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Park et al.

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(45) **Date of Patent: Aug. 12, 2025**

(54) **CAMERA MODULE**

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(73) Assignee: **Samsung Electro-Mechanics Co., Ltd.**, Suwon-si (KR)

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(30) **Foreign Application Priority Data**

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(51) **Int. Cl.**
G02B 27/64 (2006.01)
G02B 7/09 (2021.01)
G03B 5/00 (2021.01)
G03B 13/36 (2021.01)

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CPC ***G02B 27/648*** (2013.01); ***G02B 7/09*** (2013.01); ***G03B 5/00*** (2013.01); ***G03B 13/36*** (2013.01); *G03B 2205/0007* (2013.01)

(58) **Field of Classification Search**
CPC . G03B 5/00; G03B 5/04; G03B 13/36; G03B 2205/0007; G03B 2205/0053; G03B 2205/0015; G03B 2205/0069; G03B 3/02; G03B 3/10; G03B 13/34; G03B 30/00; G02B 7/021; G02B 7/04; G02B 7/08; G02B 7/09; G02B 7/10; G02B 9/62; G02B 13/001; G02B 13/0065; G02B 27/646; H04N 5/2253; H04N 5/2254;
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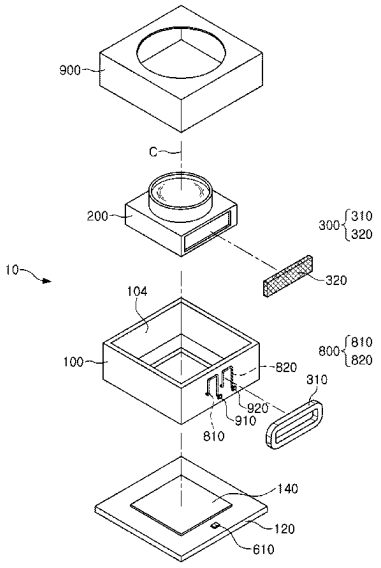
Primary Examiner — Marin Pichler
(74) *Attorney, Agent, or Firm* — NSIP Law

(57) **ABSTRACT**

A camera module includes: a housing; a lens module disposed in the housing; a driving assembly configured to move the lens module in a direction of an optical axis or a direction intersecting the optical axis; and a reinforcing structure formed integrally with the housing, and electrically connected to the driving assembly.

12 Claims, 19 Drawing Sheets



(58) **Field of Classification Search**
CPC .. H04N 5/2257; H04N 5/23287; H02K 11/33; H02K 41/0356
USPC 359/911, 554, 555, 557, 811, 813, 814, 359/824, 872, 877
See application file for complete search history.

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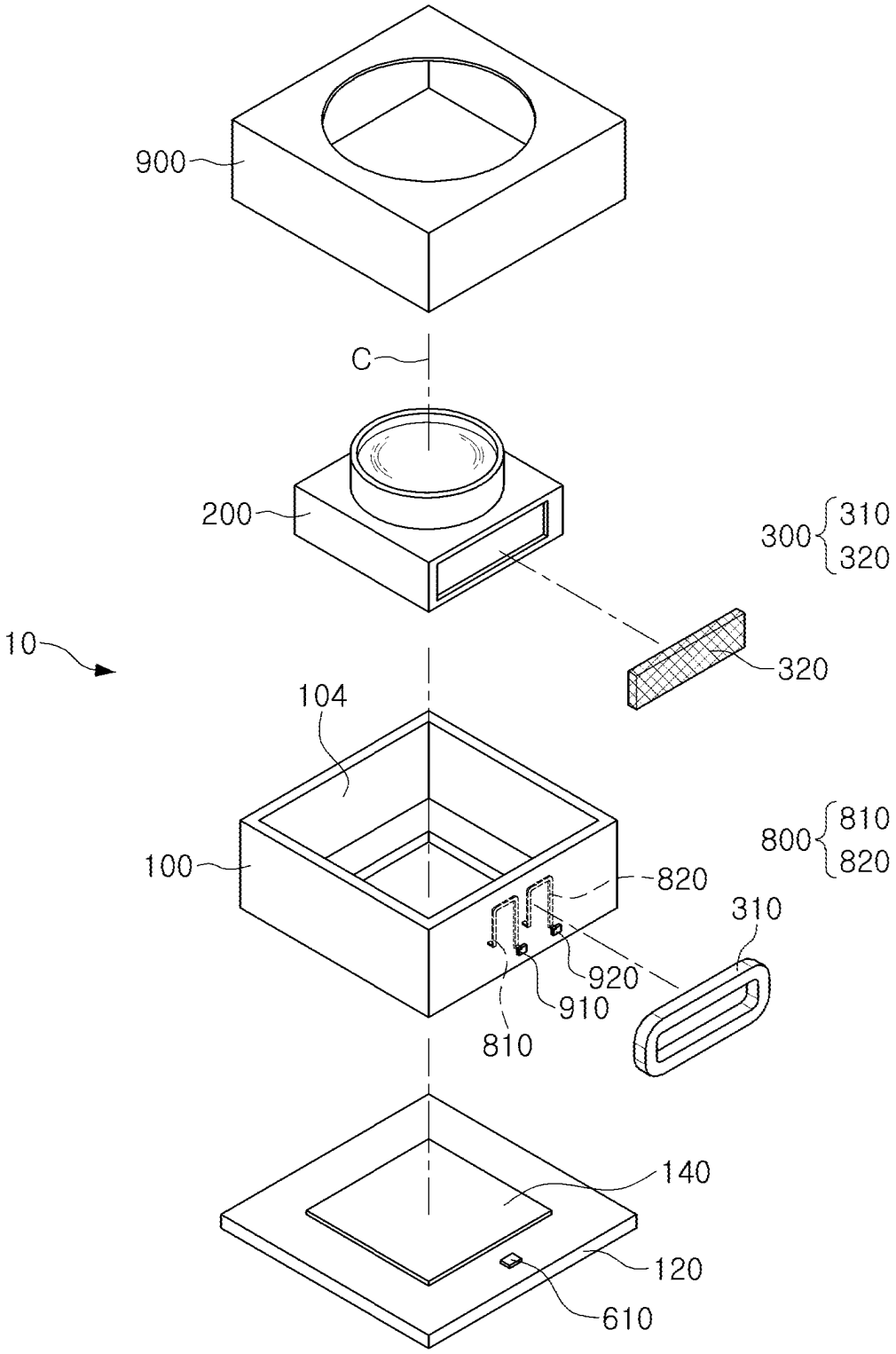
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FIG. 1

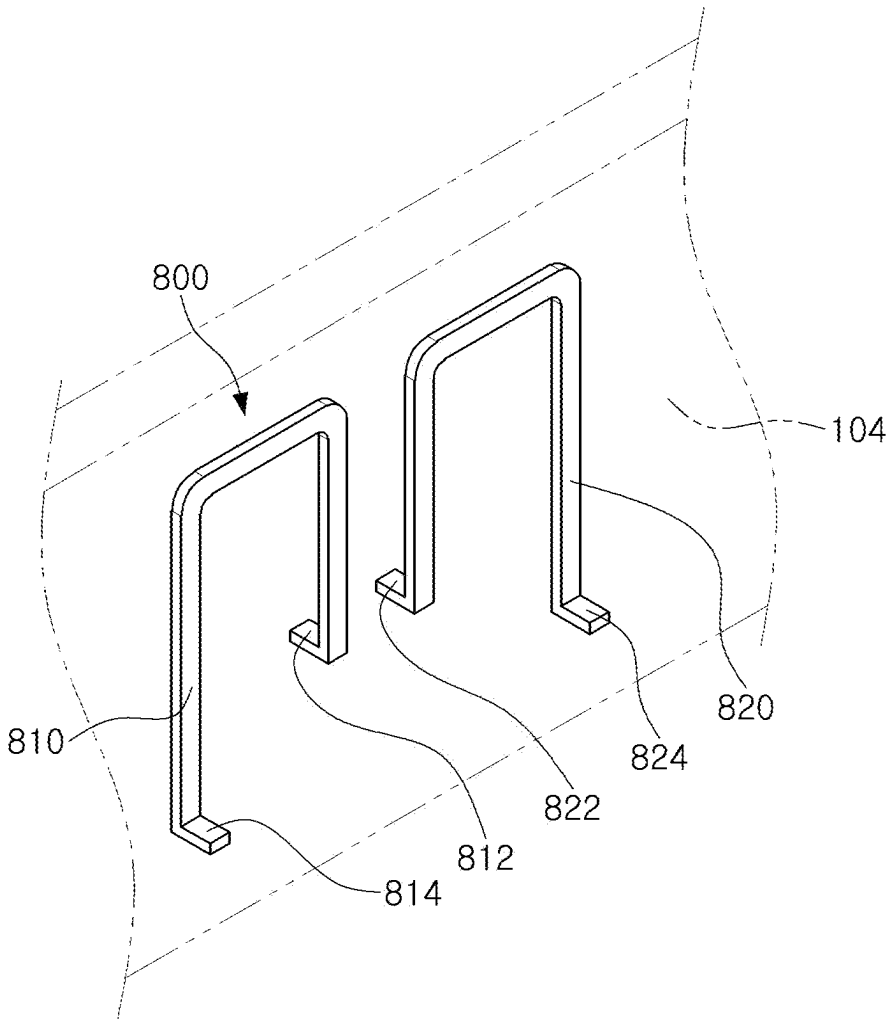


FIG. 2

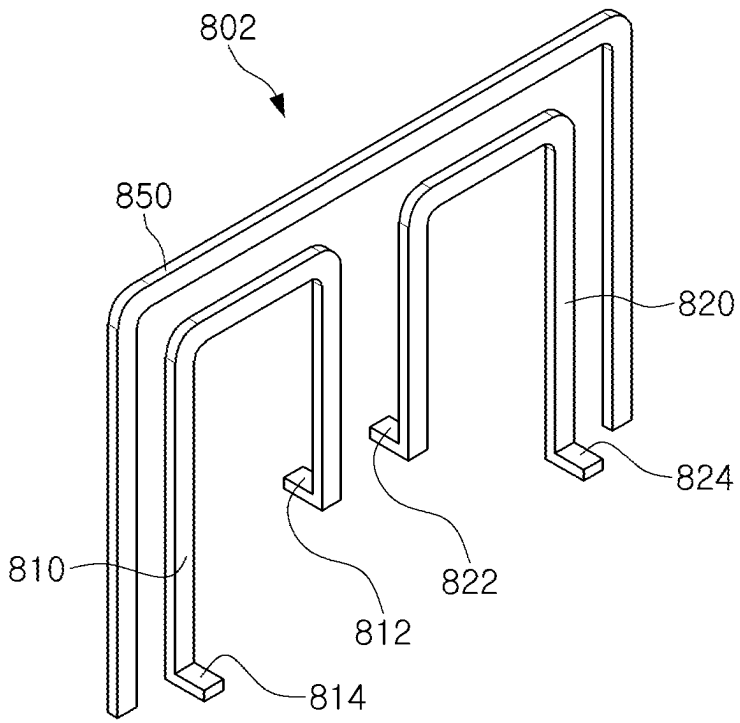


FIG. 3

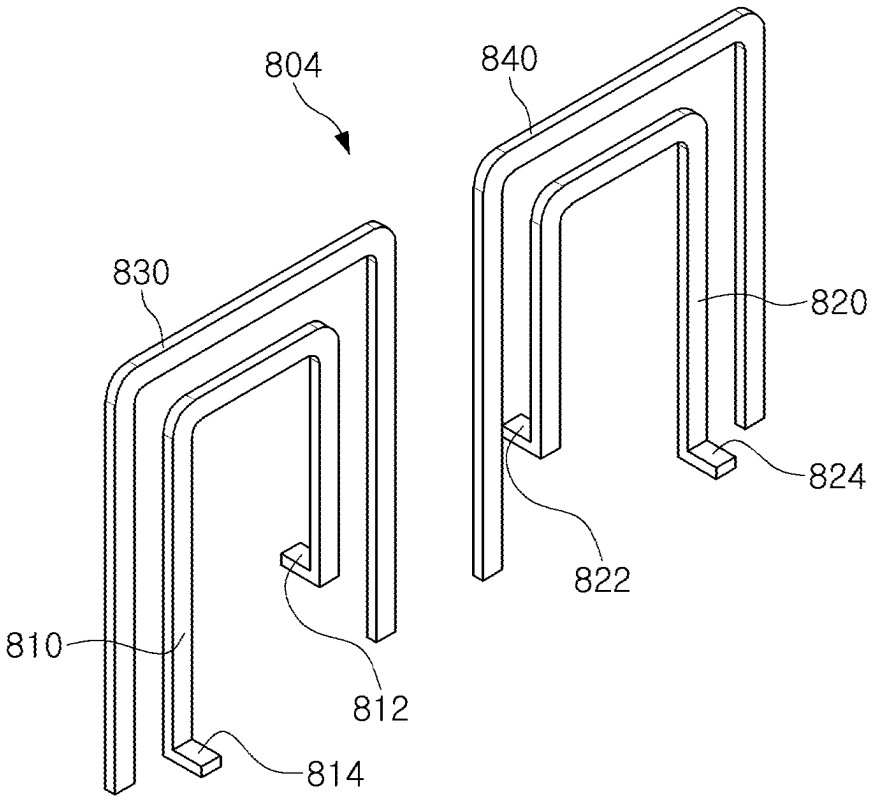


FIG. 4

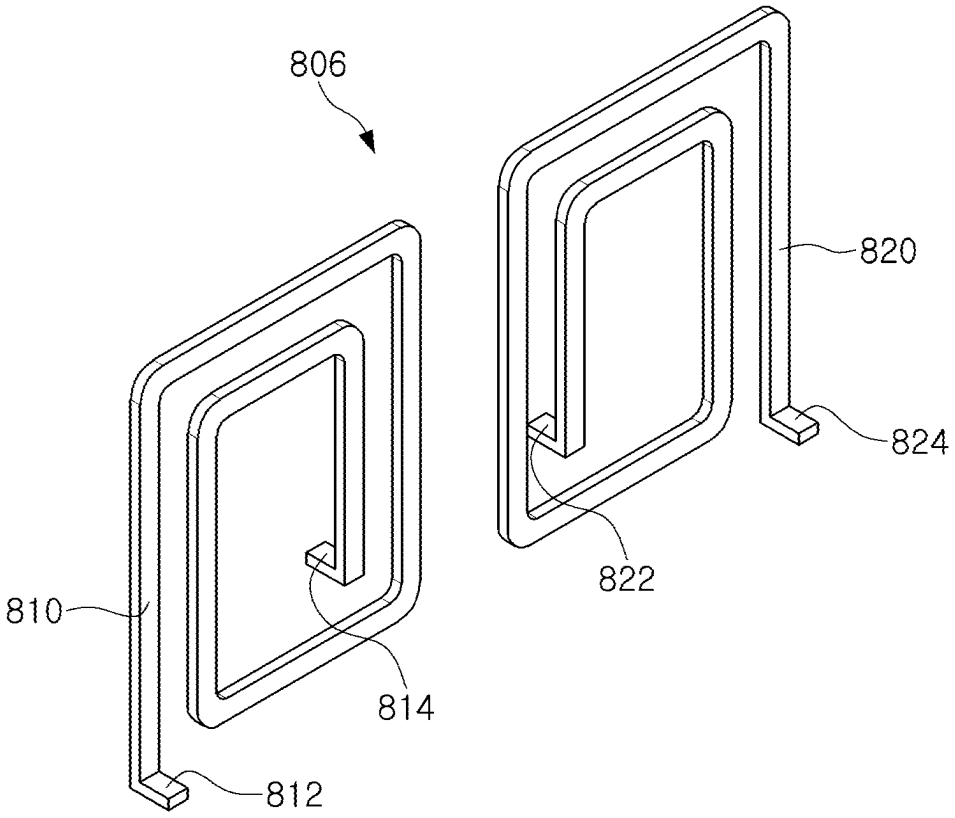


FIG. 5

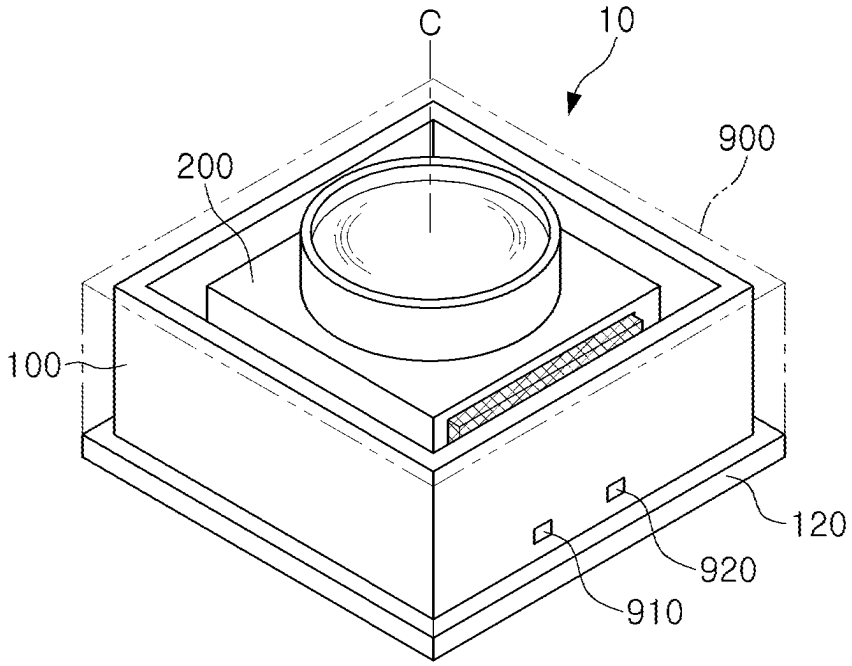


FIG. 6

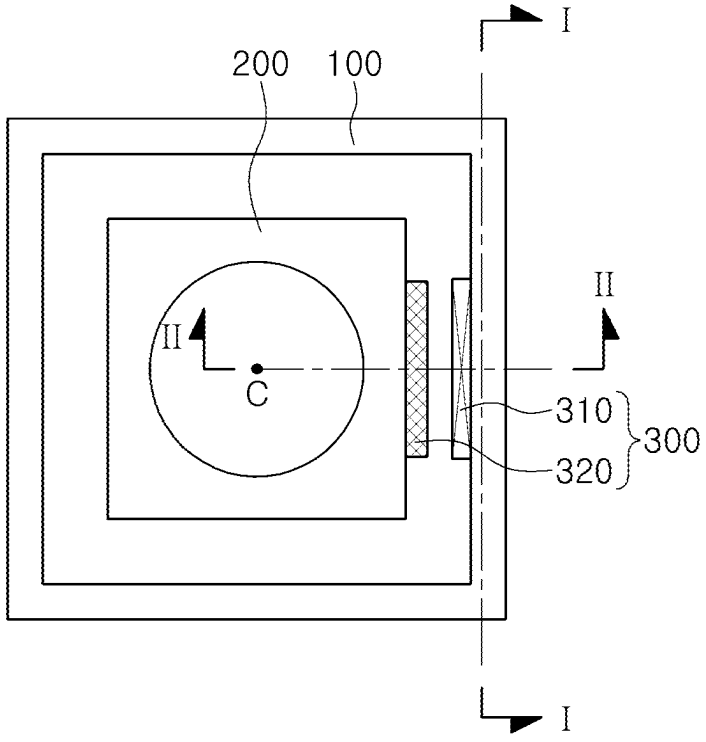
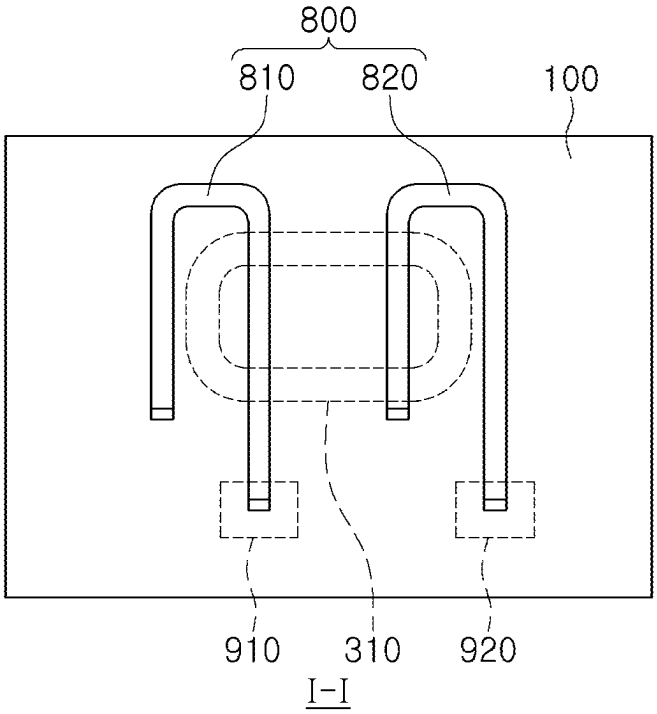


FIG. 7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I-I

FIG. 8

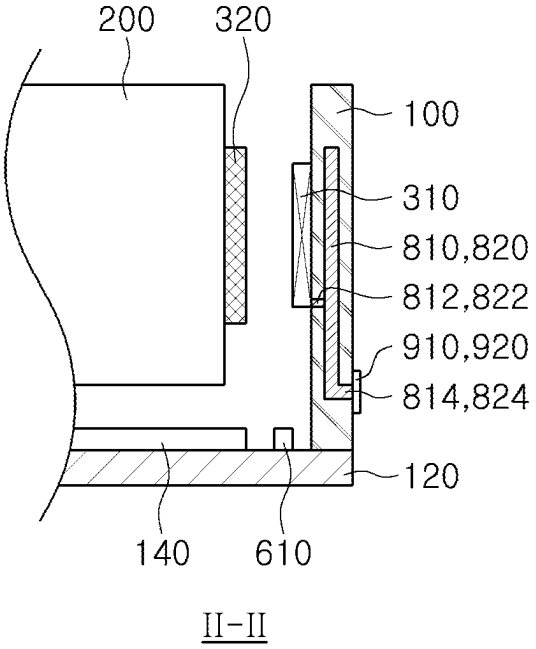
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FIG. 9

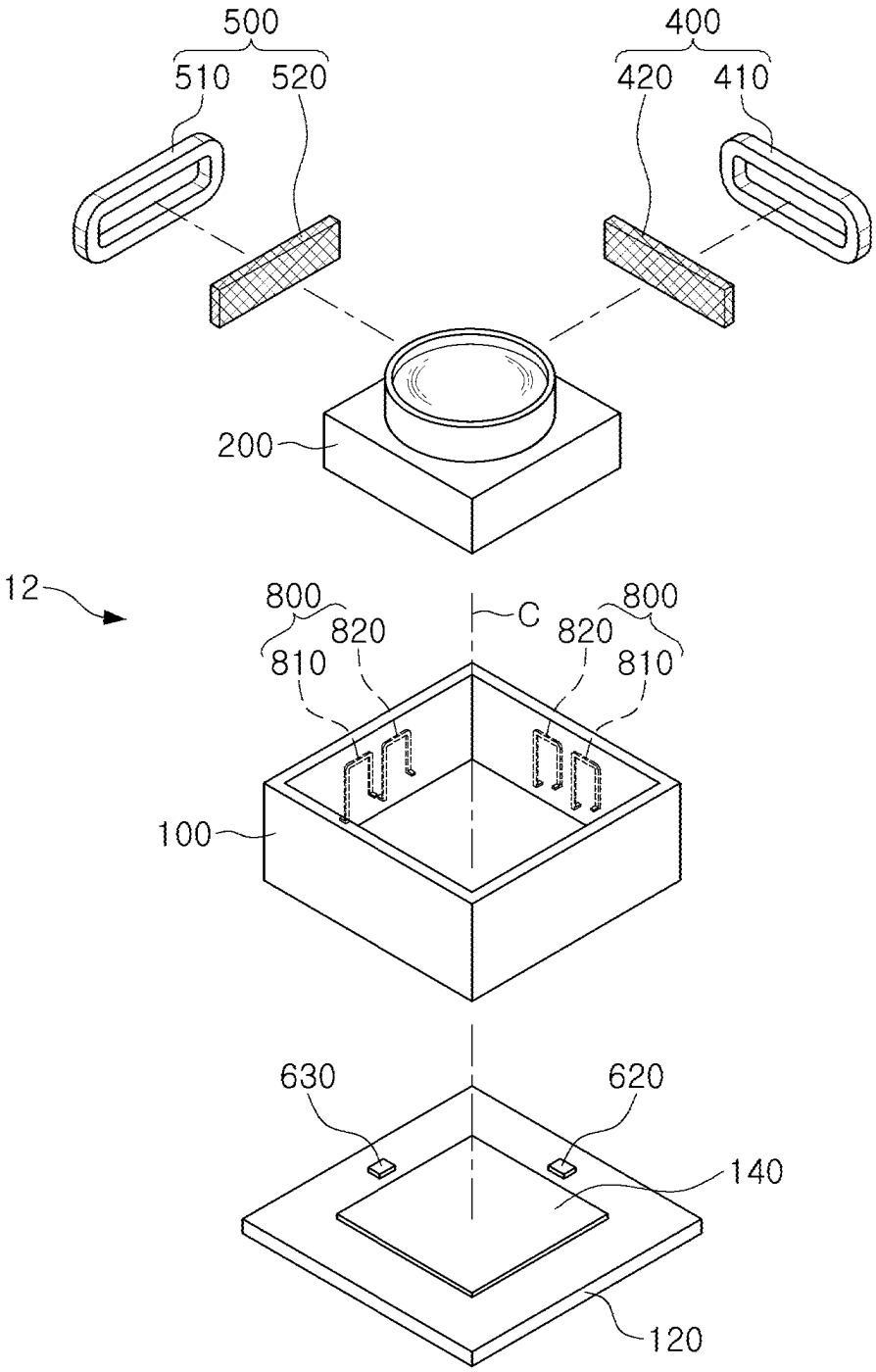
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FIG. 10

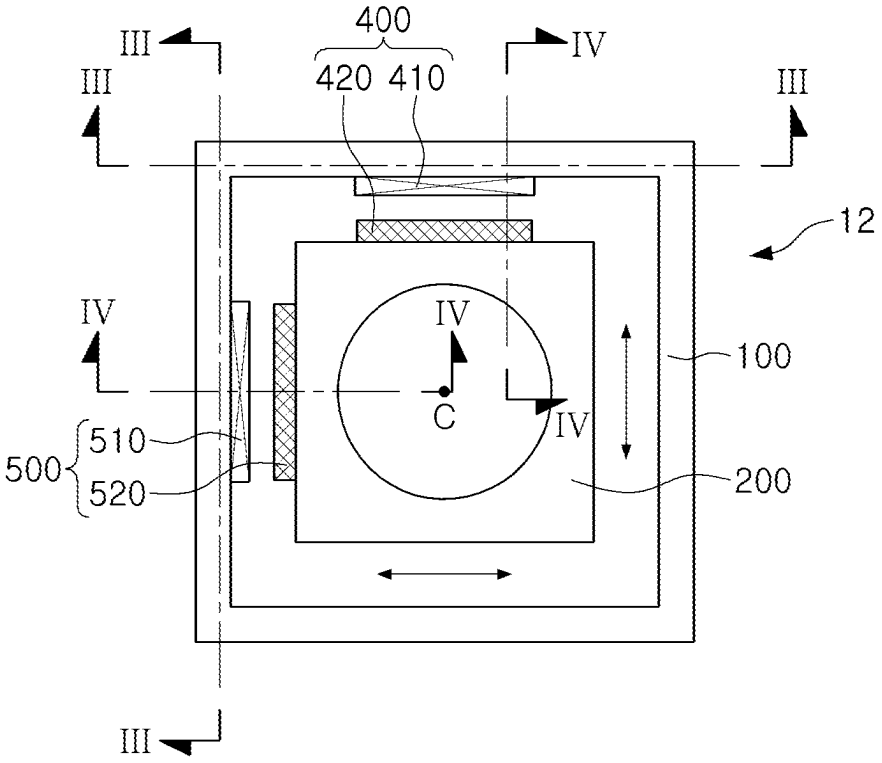
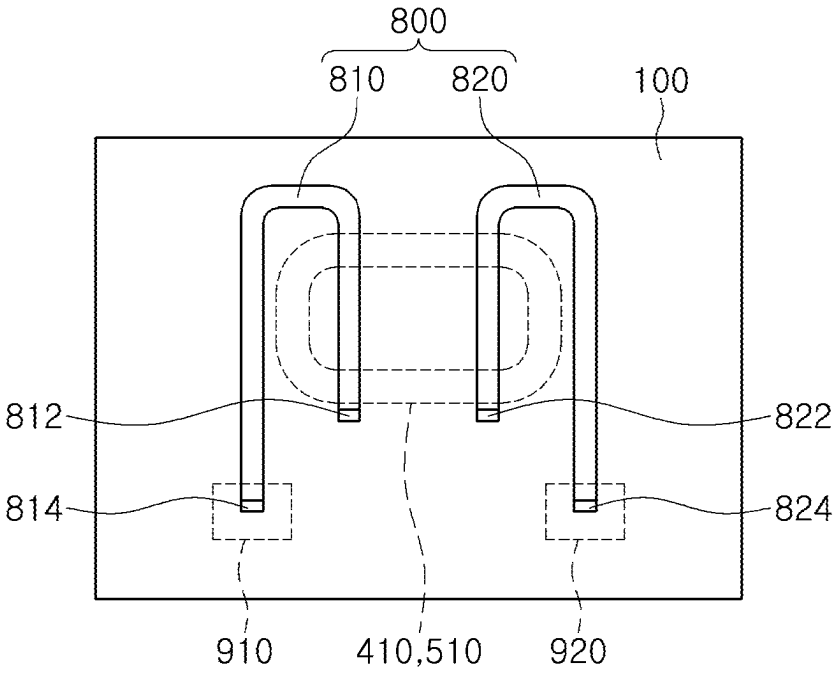
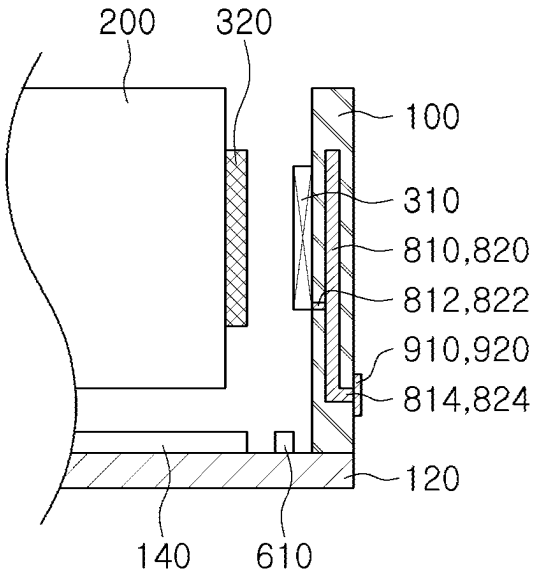


FIG. 11



III-III

FIG. 12



IV-IV

FIG. 13

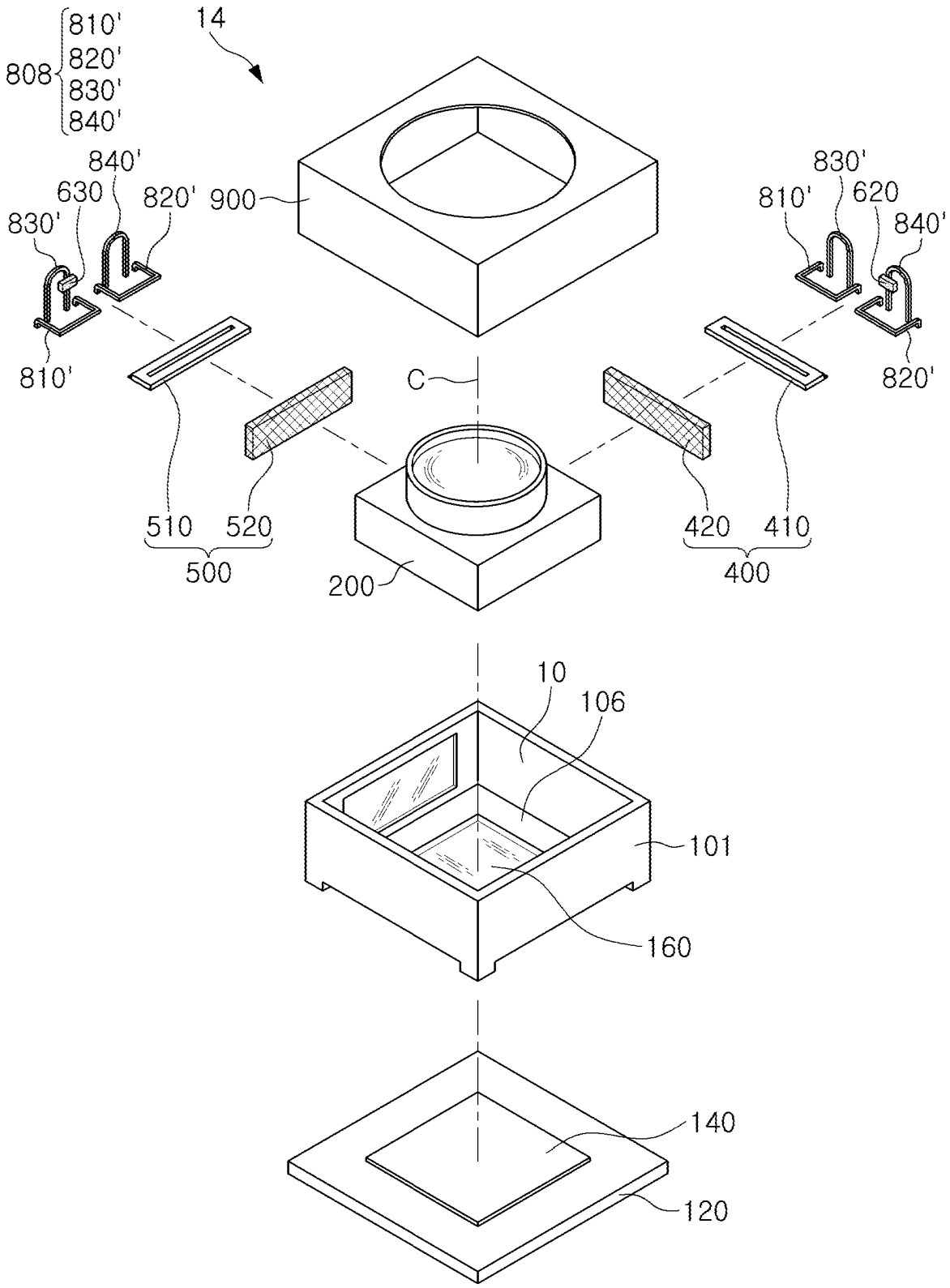

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FIG. 14

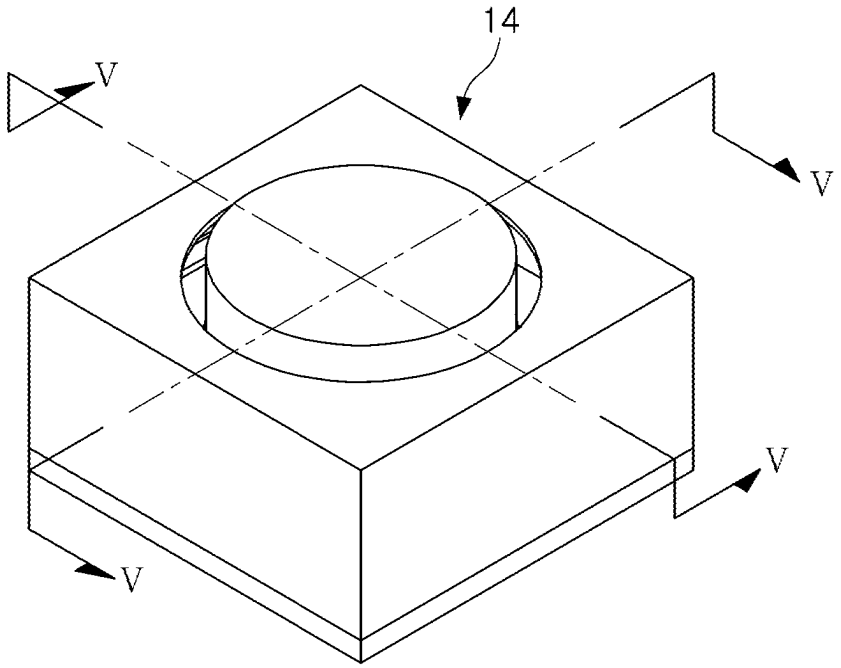
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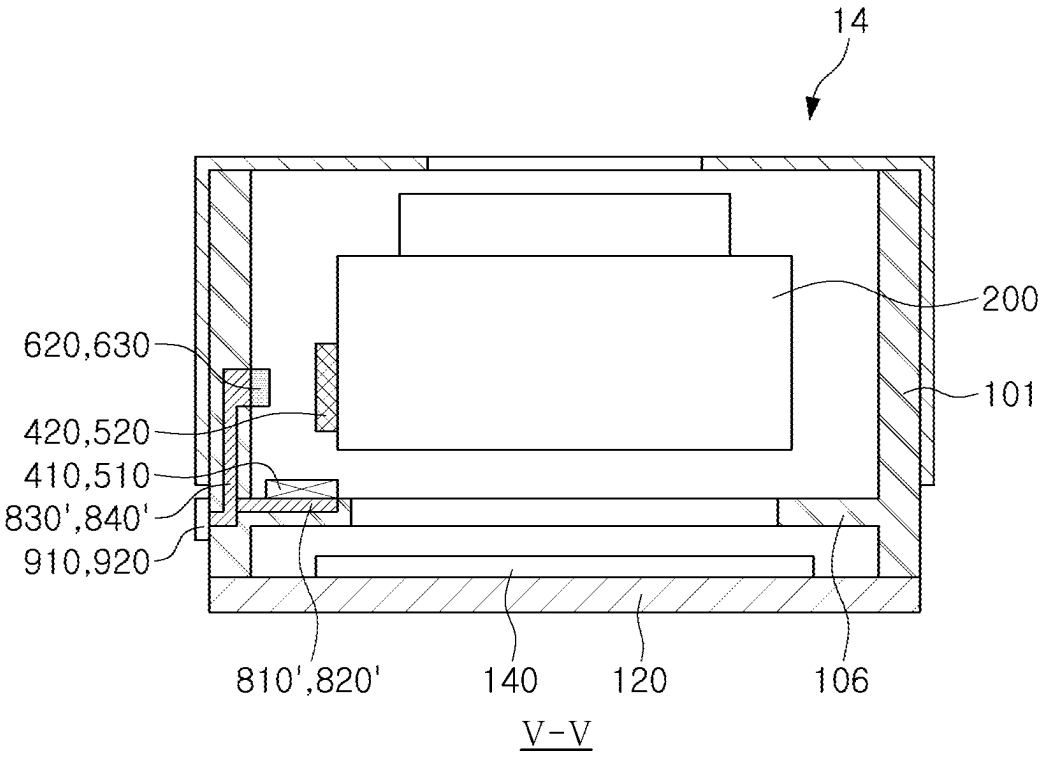
FIG. 15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V-V

FIG. 16

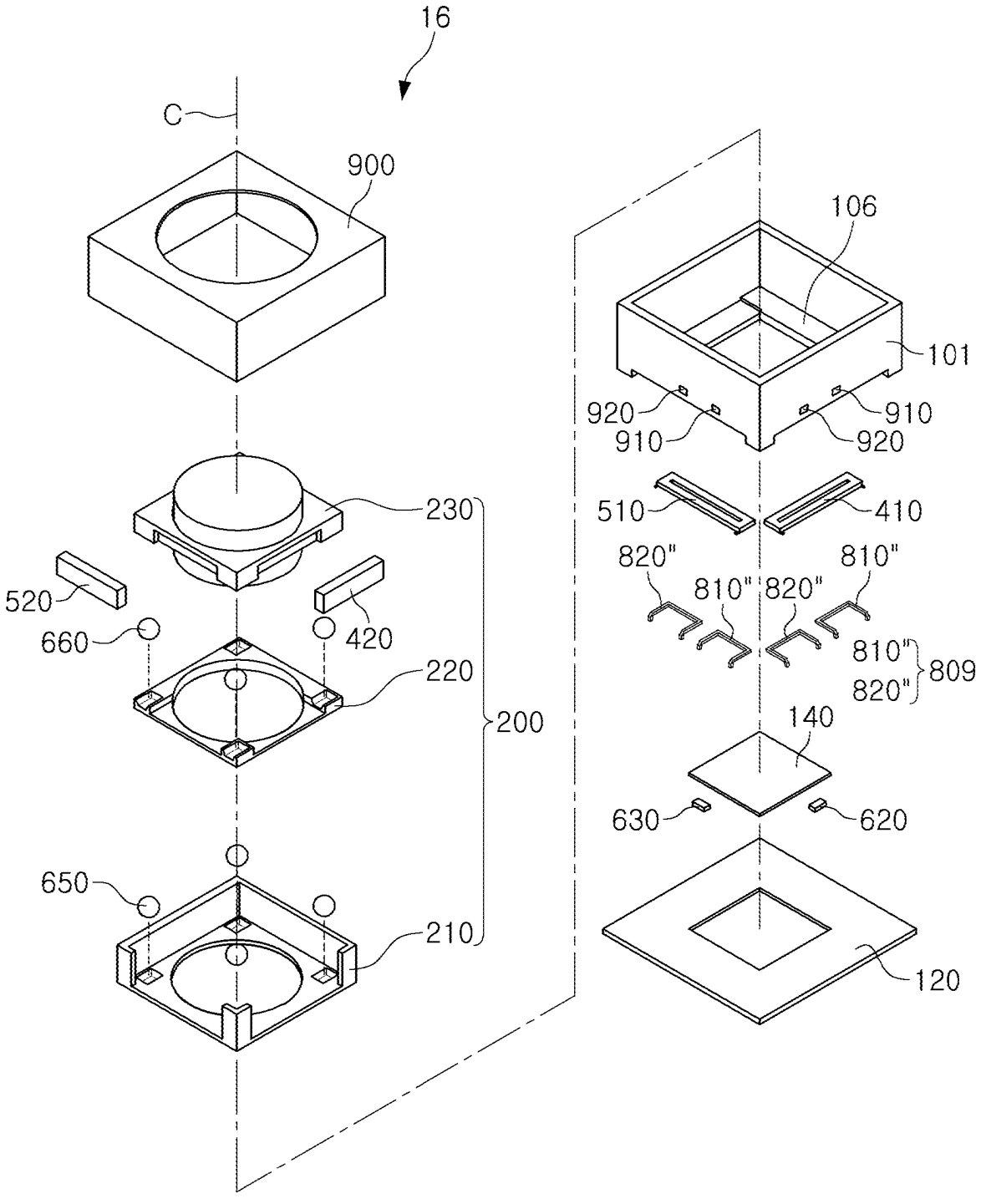
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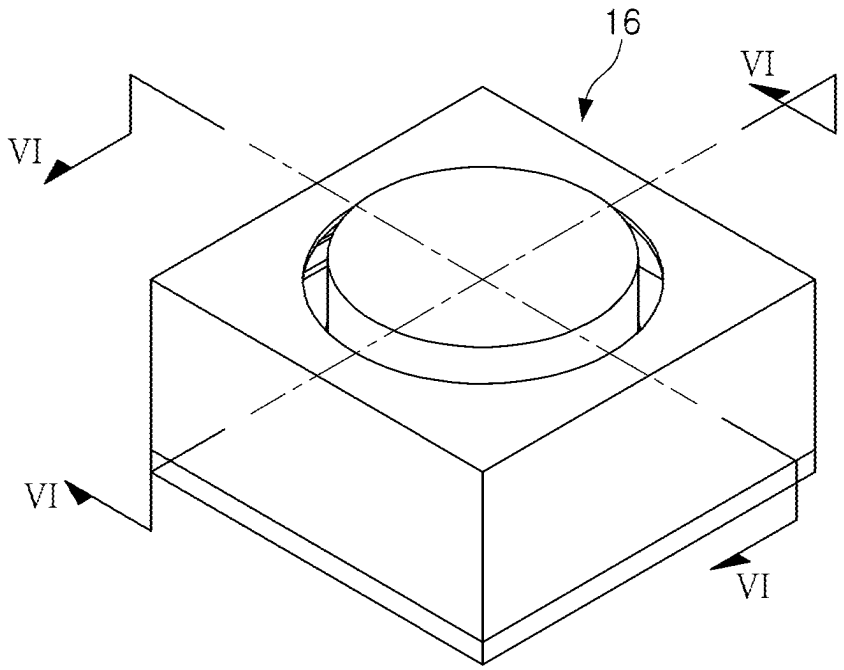
FIG. 17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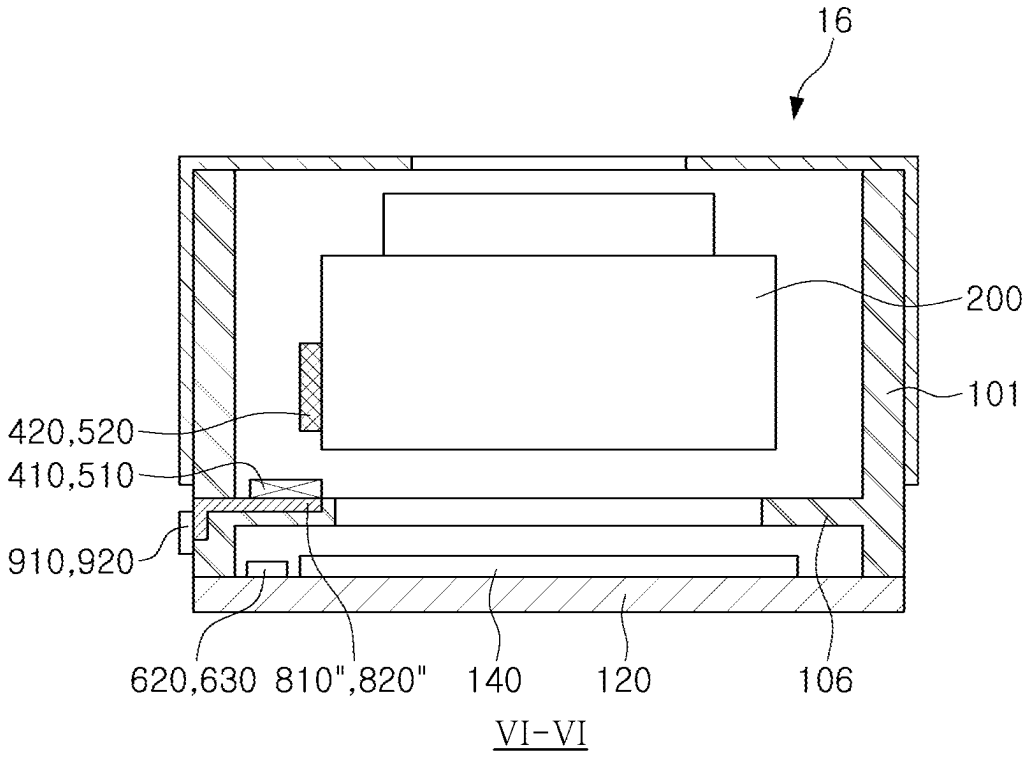
VI
VI

FIG. 18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VI-VI

FIG. 19

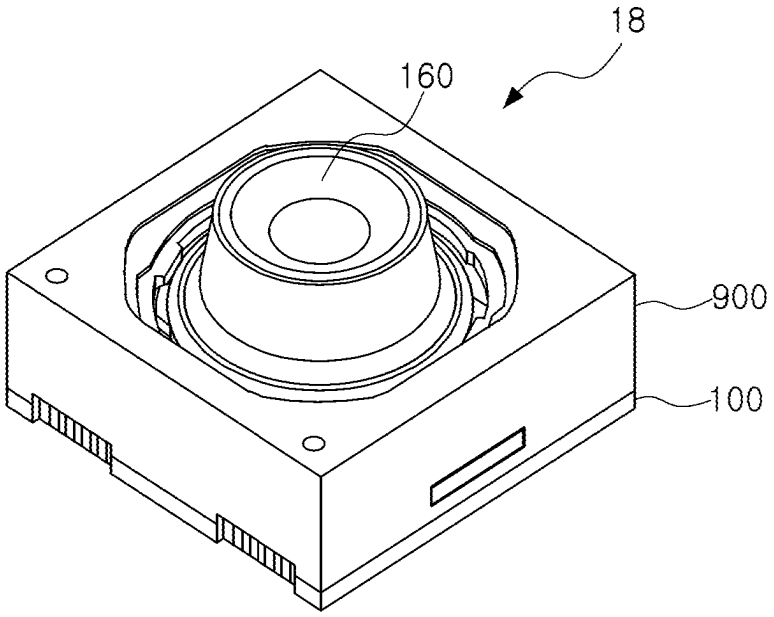

FIG. 20

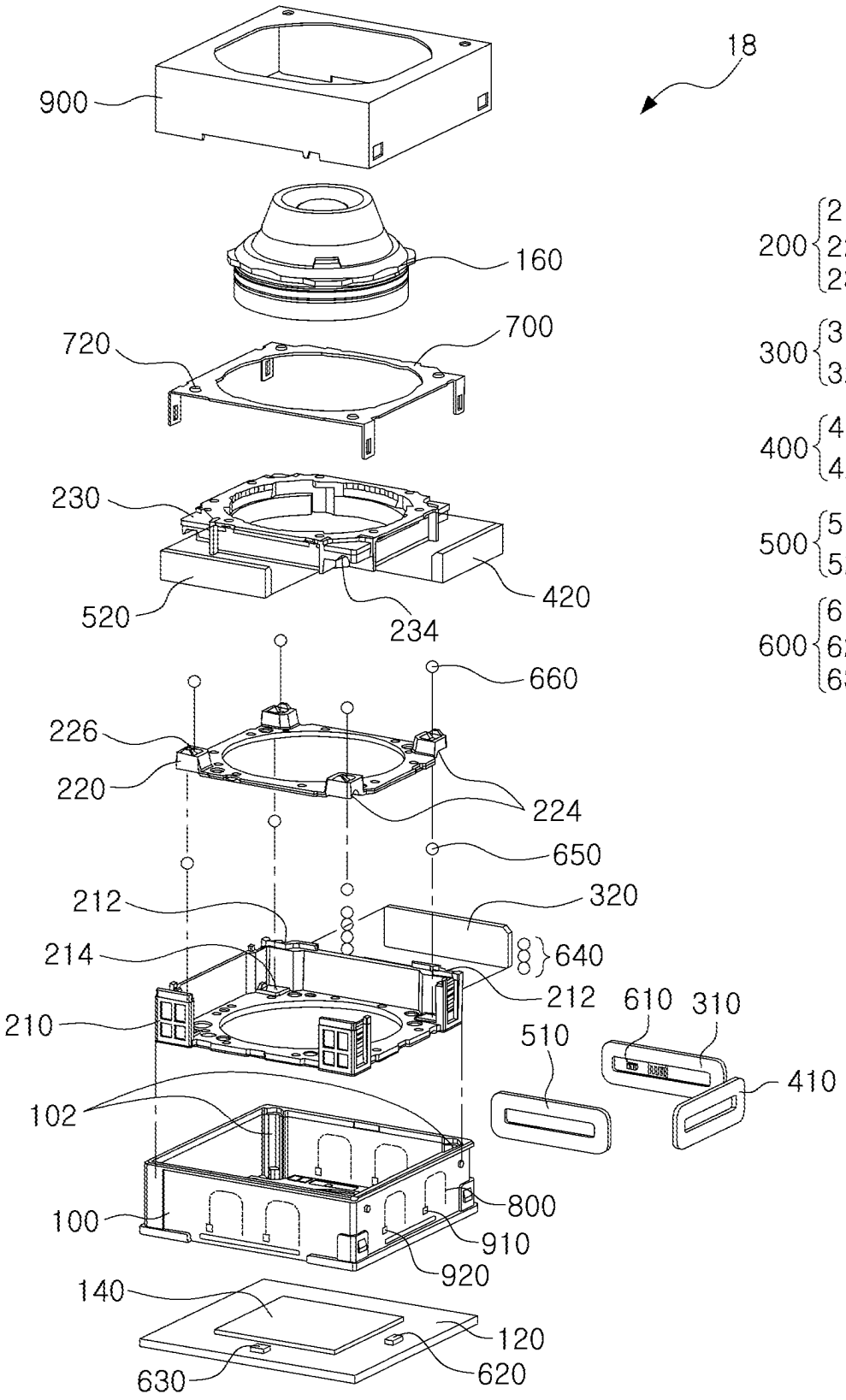
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FIG. 21

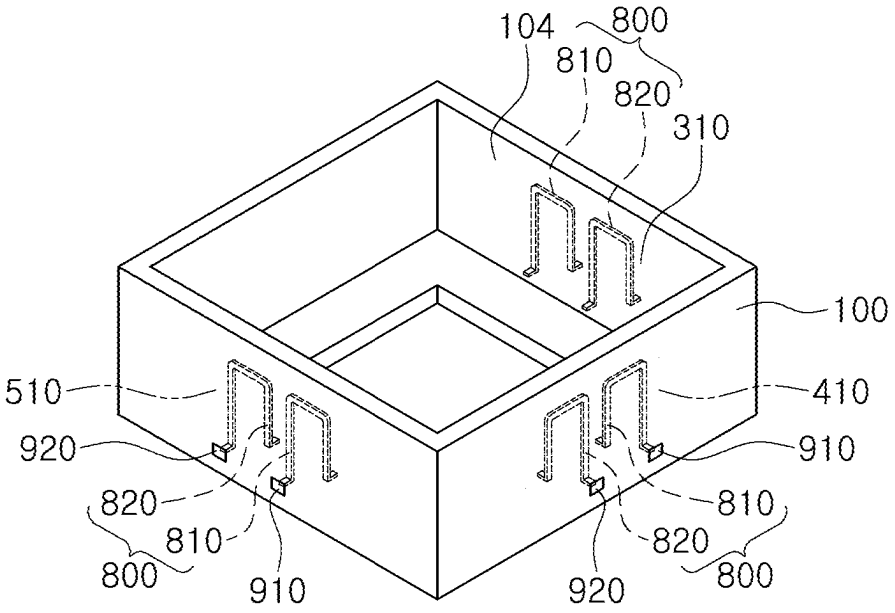
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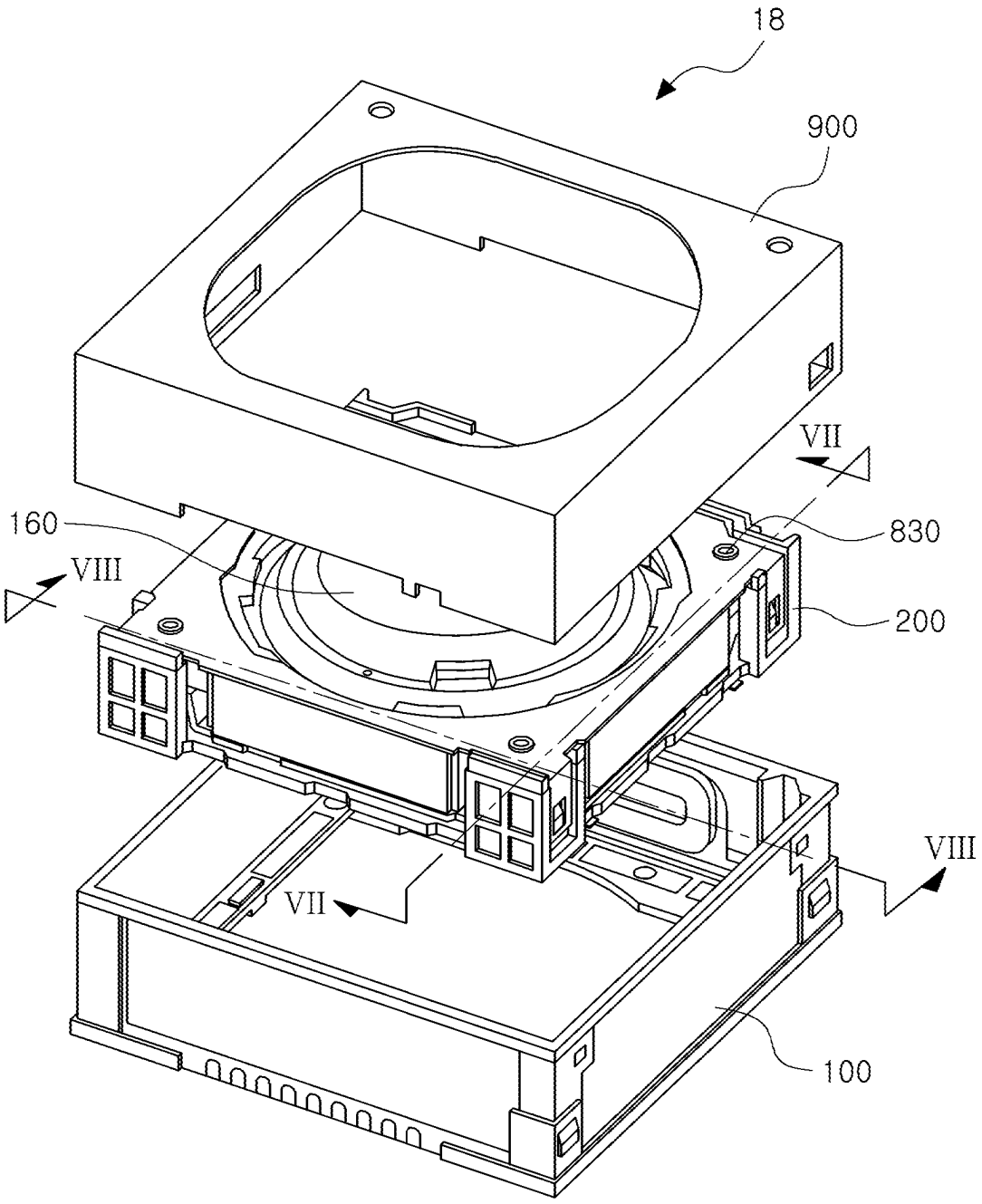
FIG. 22



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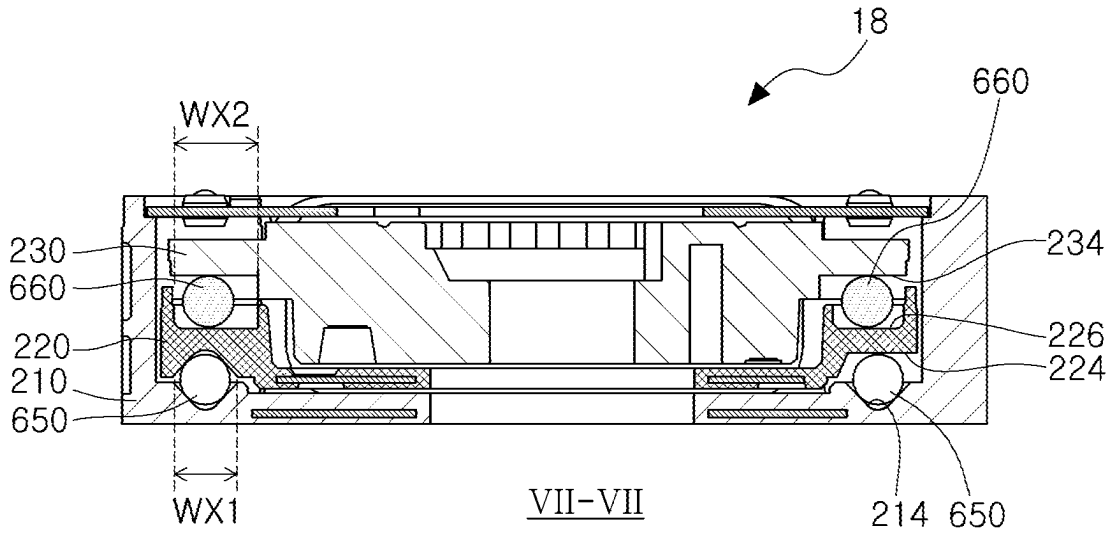
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WX1
VII-VII
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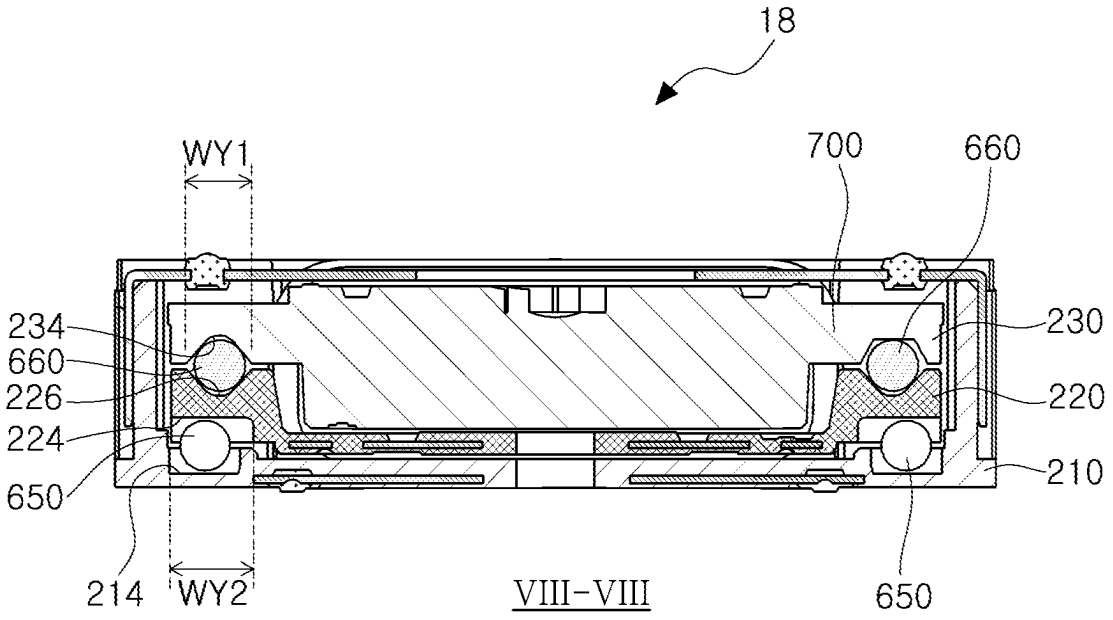
FIG. 24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WY2
VIII-VIII
650

FIG. 25

CAMERA MODULE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit under 35 U.S.C. § 119 (a) of Korean Patent Application No. 10-2020-0034079 filed on Mar. 19, 2020 in the Korean Intellectual Property Office, the entire disclosure of which is incorporated herein by reference for all purposes.

BACKGROUND

The following description relates to a camera module having a housing structure in which a driving coil is disposed.

A camera module may include a driving assembly for driving a lens module. The driving assembly may include a plurality of lens modules configured to be driven in an optical axis direction and a direction intersecting the optical axis. For example, the driving assembly may be disposed on three surfaces of a housing in which the lens module is disposed. The camera module may include a substrate for transmitting a current and a current signal to the driving assembly. The substrate may be disposed on a perimeter of the housing so as to transmit the current and the current signal to the driving assembly. The housing is configured to have predetermined rigidity to support the lens module or driving assembly. For example, the perimeter of the housing is formed with a predetermined thickness to provide a suitable rigidity. Therefore, it may be difficult to reduce a size of the camera module configured as described above due to the thickness of the housing and the substrate surrounding the perimeter of the housing.

SUMMARY

This Summary is provided to introduce a selection of concepts in simplified form that are further described below in the Detailed Description. This Summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used as an aid in determining the scope of the claimed subject matter.

In one general aspect, camera module includes: a housing; a lens module disposed in the housing; a driving assembly configured to move the lens module in a direction of an optical axis or a direction intersecting the optical axis; and a reinforcing structure formed integrally with the housing, and electrically connected to the driving assembly.

The driving assembly may include: a driving magnet disposed in the lens module; and a driving coil disposed in the housing and electrically connected to the reinforcing structure.

The camera module may further include: a detection sensor electrically connected to the reinforcing structure and configured to detect displacement of the lens module in the direction of the optical axis or the direction intersecting the optical axis.

The reinforcing structure may include a first reinforcing member and a second reinforcing member. A first end of the first reinforcing member and a first end of the second reinforcing member may be connected to the driving coil. A second end of the first reinforcing member and a second end of the second reinforcing member may be respectively connected to the connection terminals.

The first reinforcing member and the second reinforcing member may each have an inverted U shape or a spiral shape.

The camera module may further include a connection terminal formed in the housing, and electrically connected to the driving assembly by the reinforcing structure.

The reinforcing structure may be formed on a sidewall of the housing.

The camera module may further include a circuit board on which an image sensor configured to convert an optical signal incident through the lens module into an electrical signal is disposed.

The camera module may further include a detection sensor disposed on the circuit board, and configured to detect displacement of the lens module in the direction of the optical axis or the direction intersecting the optical axis.

The reinforcing structure may be formed on a flange portion of the housing.

The driving assembly may include: a driving magnet disposed in the lens module; and a driving coil disposed on the reinforcing structure.

The reinforcing structure may have a spiral shape.

The reinforcing structure may include a reinforcing member having an inverted U shape,

In another general aspect, a camera module includes: a driving assembly configured to move a lens module in a direction of an optical axis or a direction intersecting the optical axis; a housing in which the lens module is received; a first reinforcing member formed integrally with a sidewall of the housing, and increasing rigidity of the housing; and a second reinforcing member formed integrally with a flange portion of the housing. A driving coil of the driving assembly is disposed on the second reinforcing member.

The camera module may further include: a detection sensor disposed on the first reinforcing member, electrically connected to the first reinforcing member, and configured to detect displacement of the lens module in the direction of the optical axis direction or the direction intersecting the optical axis.

The detection sensor may be disposed on a circuit board on which an image sensor is mounted.

The camera module may further include: a connection terminal formed on the first reinforcing member or the second reinforcing member, and configured to electrically connect the driving coil to an external circuit.

Other features and aspects will be apparent from the following detailed description, the drawings, and the claims.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is an exploded perspective view of a camera module, according to an embodiment.

FIG. **2** is a perspective view of a reinforcing structure shown in FIG. **1**.

FIGS. **3** to **5** are perspective views of reinforcing structures, according to embodiments

FIG. **6** is a coupled perspective view of the camera module shown in FIG. **1**.

FIG. **7** is a plan view of the camera module shown in FIG. **1**.

FIGS. **8** and **9** are cross-sectional views of the camera module shown in FIG. **1**.

FIG. **10** is an exploded perspective view of a camera module, according to an embodiment.

FIG. **11** is a plan view of the camera module shown in FIG. **10**.

FIGS. **12** and **13** are cross-sectional views along lines III-III and IV-IV, respectively, of FIG. **11**.

FIG. **14** is an exploded perspective view of a camera module, according to an embodiment.

FIG. **15** is a coupled perspective view of the camera module shown in FIG. **14**.

FIG. **16** is a cross-sectional view along line V-V of FIG. **15**.

FIG. **17** is an exploded perspective view of a camera module, according to an embodiment.

FIG. **18** is a coupled perspective view of the camera module shown in FIG. **17**.

FIG. **19** is a cross-sectional view along line VI-VI of FIG. **18**.

FIG. **20** is a coupled perspective view of a camera module, according to an embodiment.

FIG. **21** is an exploded perspective view of the camera module shown in FIG. **20**.

FIG. **22** is an enlarged perspective view of a housing shown in FIG. **20**.

FIG. **23** is a partially coupled perspective view of the camera module shown in FIG.

FIGS. **24** and **25** are cross-sectional views along lines VII-VII and VIII-VIII, respectively, of FIG. **23**.

Throughout the drawings and the detailed description, the same reference numerals refer to the same elements. The drawings may not be to scale, and the relative size, proportions, and depiction of elements in the drawings may be exaggerated for clarity, illustration, and convenience.

DETAILED DESCRIPTION

The following detailed description is provided to assist the reader in gaining a comprehensive understanding of the methods, apparatuses, and/or systems described herein. However, various changes, modifications, and equivalents of the methods, apparatuses, and/or systems described herein will be apparent after an understanding of the disclosure of this application. For example, the sequences of operations described herein are merely examples, and are not limited to those set forth herein, but may be changed as will be apparent after an understanding of the disclosure of this application, with the exception of operations necessarily occurring in a certain order. Also, descriptions of features that are known in the art may be omitted for increased clarity and conciseness.

The features described herein may be embodied in different forms, and are not to be construed as being limited to the examples described herein. Rather, the examples described herein have been provided merely to illustrate some of the many possible ways of implementing the methods, apparatuses, and/or systems described herein that will be apparent after an understanding of the disclosure of this application.

Herein, it is noted that use of the term "may" with respect to an example or embodiment, e.g., as to what an example or embodiment may include or implement, means that at least one example or embodiment exists in which such a feature is included or implemented while all examples and embodiments are not limited thereto.

Throughout the specification, when an element, such as a layer, region, or substrate, is described as being "on," "connected to," or "coupled to" another element, it may be directly "on," "connected to," or "coupled to" the other element, or there may be one or more other elements intervening therebetween. In contrast, when an element is described as being "directly on," "directly connected to," or "directly coupled to" another element, there can be no other elements intervening therebetween.

As used herein, the term "and/or" includes any one and any combination of any two or more of the associated listed items.

Although terms such as "first," "second," and "third" may be used herein to describe various members, components, regions, layers, or sections, these members, components, regions, layers, or sections are not to be limited by these terms. Rather, these terms are only used to distinguish one member, component, region, layer, or section from another member, component, region, layer, or section. Thus, a first member, component, region, layer, or section referred to in examples described herein may also be referred to as a second member, component, region, layer, or section without departing from the teachings of the examples.

Spatially relative terms such as "above," "upper," "below," and "lower" may be used herein for ease of description to describe one element's relationship to another element as illustrated in the figures. Such spatially relative terms are intended to encompass different orientations of the device in use or operation in addition to the orientation depicted in the figures. For example, if the device in the figures is turned over, an element described as being "above" or "upper" relative to another element will then be "below" or "lower" relative to the other element. Thus, the term "above" encompasses both the above and below orientations depending on the spatial orientation of the device. The device may also be oriented in other ways (for example, rotated 90 degrees or at other orientations), and the spatially relative terms used herein are to be interpreted accordingly.

The terminology used herein is for describing various examples only, and is not to be used to limit the disclosure. The articles "a," "an," and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. The terms "comprises," "includes," and "has" specify the presence of stated features, numbers, operations, members, elements, and/or combinations thereof, but do not preclude the presence or addition of one or more other features, numbers, operations, members, elements, and/or combinations thereof.

Due to manufacturing techniques and/or tolerances, variations of the shapes illustrated in the drawings may occur. Thus, the examples described herein are not limited to the specific shapes illustrated in the drawings, but include changes in shape that occur during manufacturing.

The features of the examples described herein may be combined in various ways as will be apparent after an understanding of the disclosure of this application. Further, although the examples described herein have a variety of configurations, other configurations are possible as will be apparent after an understanding of the disclosure of this application.

A camera module according to the disclosure herein may be mounted in a portable electronic product. For example, the camera module may be mounted on a mobile phone, laptop, or the like. However, a usage range of the disclosed camera module is not limited to the above-described electronic products. For example, the camera module may be installed in an automated teller machine (ATM), a television for interactive broadcasting, and the like.

FIG. **1** illustrates a camera module **10**, according to an embodiment.

Referring to FIG. **1**, the camera module **10** may include, for example, a housing **100**, a circuit board **120**, an image sensor **140**, a lens module **200**, a first driving assembly **300**, and a reinforcing structure **800**. However, a configuration of

the camera module **10** is not limited to the aforementioned members. For example, the camera module **10** may further include a first detection sensor **610**, a shield can **900**, and connection terminals **910** and **920**.

The housing **100** may be made of a plastic material. For example, the housing **100** may be manufactured by injection molding. The housing **100** is configured to receive the lens module **200**. For example, a space sufficient to completely receive the lens module **200** may be formed inside the housing **100**. The housing **100** may have a form in which an upper portion and a lower portion of the housing **100** are open, so that light incident along an optical axis C can be imaged on the image sensor **140**, which is disposed below the housing **100**. The housing **100** may be generally in a form of a face having a plurality of side surfaces. For example, the housing **100** may have a shape similar to a hexahedron having four sides, as shown in FIG. **1**. However, the shape of the housing **100** is not limited to the shape shown in FIG. **1**. For example, the housing **100** may have a cylindrical shape with a curved side surface.

The circuit board **120** may be disposed in the housing **100**. For example, the circuit board **120** may be disposed below the housing **100**. The circuit board **120** may be electrically connected to the image sensor **140**. For example, the circuit board **120** may be formed with an electric circuit configured to transmit an electric signal from the image sensor **140** to an external or other electronic component. The circuit board **120** may be composed of a single-layer or multilayer substrate. For example, the circuit board **120** may be manufactured in a form in which an insulating layer and a plating layer on which an electric circuit is formed are sequentially stacked. An electronic component may be mounted on the circuit board **120**. For example, one or more electronic components required for driving the camera module **10** may be disposed above or inside the circuit board **120**.

The image sensor **400** is configured to convert an optical signal into an electrical signal. For example, the image sensor **400** may be manufactured in a CCD form. However, the image sensor **140** is not limited to the CCD form. For example, the image sensor **140** may be manufactured in a CMOS form. The image sensor **140** may be disposed on the circuit board **120**. For example, the image sensor **140** may be mounted on an upper portion of the circuit board **120**. The image sensor **140** may be electrically connected to the circuit board **120**. For example, the image sensor **140** may be connected to an electrical circuit of the circuit board **120**, and may be configured to transmit the converted electrical signal externally through the circuit board **120**.

The lens module **200** may be configured to image light reflected from an object on the image sensor **400**. For example, the lens module **200** may image light incident through one or more lenses on the image sensor **140**. The lens module **200** may be driven inside the housing **100**. For example, the lens module **200** may be moved along the optical axis C for focus adjustment.

The first driving assembly **300** is configured to drive the lens module **200**. For example, the first driving assembly **300** may drive the lens module **200** in the direction of the optical axis C (hereinafter, "optical axis direction"). The first driving assembly **300** may include a first driving coil **310** and a first driving magnet **320**. However, the configuration of the first driving assembly **300** is not limited to the above-described members.

As shown in FIG. **7**, the first driving coil **310** may be disposed in the housing **100**. For example, the first driving coil **310** may be disposed on an inner side surface of the housing **100** to face one surface of the lens module **200**. Further, as shown in FIG. **7**, the first driving magnet **320** may be disposed in the lens module **200**. For example, the first driving magnet **320** may be disposed on one side of the lens module **200** so as to face the first driving coil **310**. The first driving coil **310** and the first driving magnet **320** may provide driving force required for driving the lens module **200**. For example, the magnetic force generated between the first driving coil **310** and the first driving magnet **320** may move the lens module **200** upwardly or downwardly (e.g., in the optical axis direction).

A reinforcing structure **800** is formed in the housing **100**. For example, the reinforcing structure **800** may be formed on one sidewall **104** or two or more sidewalls **104** of the housing **100**. The reinforcing structure **800** may be made of a material different from a material of the housing **100**. For example, the reinforcing structure **800** may be made of a metal material. However, the material of the reinforcing structure **800** is not limited to metal. The reinforcing structure **800** may be configured to increase rigidity of the housing **100**. For example, the reinforcing structure **800** may be integrally formed with the housing **100** by an insert injection method to improve the rigidity of the housing **100**. The reinforcing structure **800** may be electrically connected to the first driving coil **310**. For example, first ends **812** and **822** (FIG. **2**) of the reinforcing structure **800** may be connected to the first driving coil **310**, which is disposed inside the housing **100**, to enable supply of current to the first driving coil **310**. The reinforcing structure **800** may be electrically connected to connection terminals **910** and **920**. For example, second ends **814** and **824** (FIG. **2**) of the reinforcing structure **800** may be connected to the connection terminals **910** and **920** disposed outside the housing **100**, to enable electrical connection to be formed between the first driving coil **310** and the connection terminals **910** and **920**. For reference, although not illustrated in the accompanying drawings, the connection terminals **910** and **920** may be electrically connected to the circuit board **120** through a separate element or component.

The first detection sensor **610** is configured to detect the position of the lens module **200**. For example, the first detection sensor **610** may be configured to transmit different electrical signals according to the position of the lens module **200** in the optical axis direction. The first detection sensor **610** may be directly or indirectly connected to the first driving assembly **300**. For example, the first detection sensor **610** may transmit a reference value required for calculating a driving size of the first driving assembly **300** to a control unit, or controller, of the first driving assembly **300**. The first detection sensor **610** is formed on the circuit board **120**. However, a formation position of the first detection sensor **610** is not limited to the circuit board **120**. For example, the first detection sensor **610** may also be disposed inside the housing **100**.

Next, a more detailed description of the reinforcing structure **800** will be described with reference to FIG. **2**.

A reinforcing structure **800** may be configured to contact an external member. For example, the first ends **812** and **822** of the reinforcing structure **800** may be formed to extend inside the housing **100** to be connected to the first coil member **310**, and the second ends **814** and **824** of the reinforcing structure **800** may be formed to extend outside the housing **100** to be connected to connection terminals **910** and **920**, respectively.

The reinforcing structure **800** may be configured to extend along a sidewall of the housing **100**. For example, a portion of the reinforcing structure **800** may be formed to extend along a height direction of the sidewall of the housing **100**,

and a portion of the reinforcing structure **800** may be formed to extend along a width direction of the sidewall of the housing **100**.

The reinforcing structure **800** may include multiple members. For example, the reinforcing structure **800** may be composed of a first reinforcing member **810** and a second reinforcing member **820**. However, the reinforcing structure **800** is not necessarily composed of two members. For example, the reinforcing structure **800** may be composed of three or more separated members.

The first reinforcing member **810** and the second reinforcing member **820** may be configured in a symmetrical shape. However, the first reinforcing member **810** and the second reinforcing member **820** are not necessarily configured in a symmetrical shape. For example, the first reinforcing member **810** and the second reinforcing member **820** may be configured in the same form or may be configured in different forms.

For example, the first reinforcing member **810** and the second reinforcing member **820** may each have an approximate overall shape of an inverted U. The first reinforcing member **810** may include the first end **812** and the second end **814**, which extend in opposite directions. The second reinforcing member **820** may include the first end **822** and the second end **824**, which extend in opposite directions.

The reinforcing structure **800** configured as described above may be integrally formed with the housing **100** to increase the rigidity of the housing **100**. Therefore, the camera module **10** may not need to unnecessarily increase the size of the housing **100** or increase the sidewall thickness of the housing **100** in order to reinforce rigidity of the housing **100**.

The reinforcing member **800** may be modified in various forms.

FIGS. **3** to **5** illustrate reinforcing structures **802**, **804**, and **806**, respectively, according to embodiments.

Referring to FIG. **3**, as an example, the reinforcing structure **802** may be composed of the first reinforcing member **810**, the second reinforcing member **820**, and a third reinforcing member **850**. The first reinforcing member **810** and the second reinforcing member **820** may have the forms described above with respect to FIG. **2**. However, the shapes of the first reinforcing member **810** and the second reinforcing member **820** are not limited to those shown in FIG. **2**. The third reinforcing member **850** may be formed in a form surrounding the perimeter of the first reinforcing member **810** and the second reinforcing member **820**. A distance between the third reinforcing member **850** and the first reinforcing member **810**, and a distance between the third reinforcing member **850** and the second reinforcing member **820** may be substantially the same.

Referring to FIG. **4**, as another example, the reinforcing structure **804** may be composed of the first reinforcing member **810**, the second reinforcing member **820**, a third reinforcing member **830**, and a fourth reinforcing member **840**. The first reinforcing member **810** and the second reinforcing member **820** may have the same forms described above with respect to FIG. **2**. However, the shapes of the first reinforcing member **810** and the second reinforcing member **820** are not limited to those shown in FIG. **2**. The third reinforcing member **830** and the fourth reinforcing member **840** may be formed in forms surrounding each of the perimeters of the first reinforcing member **810** and the second reinforcing member **820**. For example, the third reinforcing member **830** may be formed in a form surrounding the perimeter of the first reinforcing member **810**, and the fourth reinforcing member **840** may be formed in a form surrounding the perimeter of the second reinforcing member **820**.

Referring to FIG. **5**, as another example, the reinforcing structure **806** may be composed of a first reinforcing member **810'** and a second reinforcing member **820'** formed to have a spiral shape.

The reinforcing structures **802**, **804**, and **806** shown in FIGS. **3** to **5** may electrically connect the first driving coil **310** to the connection terminals **910** and **920** through the reinforcing members **810** and **820**, and may improve the rigidity of the housing **100** through the respective reinforcing members **810**, **820**, **830**, **840**, and **850**. For reference, a reinforcing structure may be provided in forms other than those shown in FIGS. **3** to **5**. For example, a reinforcing structure may have a mixture of two or more of the shapes shown in FIGS. **3** to **5**.

A coupling form of the camera module **10** will be described with reference to FIGS. **6** to **9**.

Referring to FIGS. **6** and **7**, the camera module **10** may be manufactured in a compact size to be mounted on a portable terminal. The camera module **10** may be configured to enable focus adjustment. For example, the lens module **200** may move along an optical axis C, and may thereby adjust a focus of the camera module **10**. The movement of the lens module **200** may be performed by the first driving assembly **300**. For example, the lens module **200** may be moved in the optical axis C direction by a magnetic force generated between the first driving coil **310** and the first driving magnet **320**.

The camera module **10** may be connected to an external electronic device. For example, the connection terminals **910** and **920** of the camera module **10** may be electrically connected to a control unit, or controller, of a portable terminal or other electronic devices.

Referring to FIGS. **6** to **9**, the camera module **10** may enable a connection to be easily made between the first driving coil **310** and the connection terminals **910** and **920**. For example, the first driving coil **310** and the connection terminals **910** and **920** may be electrically connected by the reinforcing structure **800** (e.g., the first reinforcing member **810** and the second reinforcing member **820**), which may be integrally formed in the housing **100**, as shown in FIGS. **8** and **9**.

The camera module **10** may include a first detection sensor **610** for detecting the position or displacement of the lens module **200**, as shown in FIG. **1**. The first detection sensor **610** may detect the position of the lens module **200** through a magnetic field generated from the first driving magnet **320** disposed in the lens module **200**. The first detection sensor **610** may be disposed at a position capable of detecting the magnetic field of the first driving magnet **320** while being less affected by the first driving coil **310**. For example, the first detection sensor **610** may be disposed on the circuit board **120** on which the image sensor **140** is mounted. However, the position of the first detection sensor **610** is not limited to the circuit board **120**.

FIGS. **10** to **12** illustrate a camera module **12**, according to an embodiment.

Referring to FIG. **10**, the camera module **12** may include, for example, the housing **100**, the circuit board **120**, the image sensor **140**, the lens module **200**, second driving assemblies **400** and **500**, and the reinforcing structure **800**. However, the configuration of the camera module **12** is not limited to the aforementioned members. For example, the

camera module **12** may further include second detection sensors **620** and **630** and the connection terminals **910** and **920**.

The housing **100** may be made of a plastic material. For example, the housing **100** may be manufactured by injection molding. The housing **100** is configured to receive the lens module **200**. For example, a space sufficient to completely receive the lens module **200** may be formed inside the housing **100**. The housing **100** may have a form in which an upper portion and a lower portion of the housing **100** are open, so that light incident along the optical axis C can be imaged on the image sensor **140**, which is disposed below the housing **100**. The housing **100** may be generally in a form of a face having a plurality of side surfaces. For example, the housing **100** may have a shape similar to a hexahedron having four sides, as shown in FIG. **10**. However, the shape of the housing **100** is not limited to the shape shown in FIG. **10**. For example, the housing **100** may have a cylindrical shape with a curved side surface.

The circuit board **120** may be disposed in the housing **100**. For example, the circuit board **120** may be disposed below the housing **100**. The circuit board **120** may be electrically connected to the image sensor **140**. For example, the circuit board **120** may be formed with an electric circuit configured to transmit an electric signal from the image sensor **140** to external or other electronic components. The circuit board **120** may be composed of a single-layer or multilayer substrate. For example, the circuit board **120** may be manufactured in a form in which an insulating layer and a plating layer on which an electric circuit is formed are sequentially stacked. An electronic component may be mounted on the circuit board **120**. For example, one or more electronic components required for driving the camera module **12** may be disposed above or inside the circuit board **120**.

The image sensor **140** is configured to convert an optical signal into an electrical signal. For example, the image sensor **140** may be manufactured in a CCD form. However, the image sensor **140** is not limited to the CCD form. For example, the image sensor **140** may be manufactured in a CMOS form. The image sensor **140** may be disposed on the circuit board **120**. For example, the image sensor **140** may be mounted on an upper portion of the circuit board **120**. The image sensor **140** may be electrically connected to the circuit board **120**. For example, the image sensor **140** may be connected to an electrical circuit of the circuit board **120**, and may be configured to transmit the converted electrical signal externally through the circuit board **120**.

The lens module **200** may be configured to image light reflected from an object on the image sensor **140**. For example, the lens module **200** may image light incident through one or more lenses on the image sensor **140**. The lens module **200** may be driven inside the housing **100**. For example, the lens module **200** may be moved along the optical axis C for focus adjustment.

The second driving assemblies **400** and **500** may perform image stabilization of the camera module **12**. For example, the second driving assemblies **400** and **500** may drive the lens module **200** in a direction intersecting the optical axis C as shown in FIG. **11**. The second driving assemblies **400** and **500** may include second driving coils **410** and **510**, respectively, and second driving magnets **420** and **520**, respectively. However, the configuration of the second driving assemblies **400** and **500** is not limited to the above-described members. The second driving coils **410** and **510** may be disposed in the housing **100**. For example, the second driving coils **410** and **510** may be disposed on two side surfaces of the housing **100**, respectively, so as to face two respective side surfaces of the lens module **200**. The second driving magnets **420** and **520** may be disposed on the lens module **200**. For example, the second driving magnets **420** and **520** may be disposed on two side surfaces of the lens module **200** so as to face the second driving coils **410** and **520**, respectively. The second driving coils **410** and **510** and the second driving magnets **420** and **520** may provide driving force required for driving the lens module **200**. For example, the magnetic force generated between the second driving coils **410** and **510** and the second driving magnets **420** and **520**, respectively, may move the lens module **200** in a first direction or a second direction intersecting the optical axis C.

The reinforcing structure **800** is formed in the housing **100**. For example, the reinforcing structure **800** may be formed on one side surface of the housing **100**, or two or more reinforcing structures **800** may be respectively formed on two or more side surfaces of the housing **100**. The reinforcing structure **800** may be made of a material different from a material of the housing **100**. For example, the reinforcing structure **800** may be made of a metal material. However, the material of the reinforcing structure **800** is not limited to metal. The reinforcing structure **800** may be configured to increase the rigidity of the housing **100**. For example, the reinforcing structure **800** may be integrally formed with the housing **100** by an insert injection method to improve the rigidity of the housing **100**.

FIGS. **10** to **12** illustrate an example including two reinforcing structures **800**. The reinforcing structures **800** may be electrically connected to the second driving coils **410** and **510**, respectively. For example, first ends **812** and **822** of the each of the reinforcing structures **800** may be respectively connected to the second driving coils **410** and **510**, which are disposed inside the housing **100**, to enable supply of current to the second driving coils **410** and **510**. The reinforcing structures **800** may be electrically connected to the respective connection terminals **910** and **920** disposed outside the housing **100**. For example, the second ends **814** and **824** of each of the reinforcing structures **800** may be connected to the respective connection terminals **910** and **920** to enable electrical connection between the second driving coils **410** and **510** and the respective connection terminals **910** and **920**. For reference, in the embodiment illustrated in FIGS. **10** to **12**, the reinforcing structures **800** are shown in one form, but may be modified to the form according to any one of FIGS. **3** to **5**, as desired.

The second detection sensors **620** and **630** are configured to detect the position of the lens module **200**. For example, the second detection sensors **620** and **630** may be configured to detect the displacement of the lens module **200** when the lens module **200** is shaken in a direction intersecting the optical axis. The second sensing sensors **620** and **630** may be disposed at a position that can easily detect the magnetic field of the second driving magnets **420** and **520**, respectively. For example, the second detection sensors **620** and **630** may be disposed on the circuit board **120** on which the image sensor **140** is mounted. However, the positions of the second detection sensors **620** and **630** are not limited to the circuit board **120**.

The camera module **12** configured as described above enable a connection to be easily made between the second driving coils **410** and **510** and the respective connection terminals **910** and **920**. For example, the second driving coils **410** and **510** and the respective connection terminals **910** and **920** may be electrically connected by the respective reinforcing structures **800** (the first reinforcing member **810** and the second reinforcing member **820**), which are inte-

grally formed in the housing **100** as illustrated in FIGS. **12** and **13**. Further, the camera module **12** may improve the rigidity of two side surfaces of the housing **100** through the reinforcing structures **800**.

FIGS. **14** to **16** illustrate a camera module **14**, according to an embodiment.

Referring to FIGS. **14** to **16**, the camera module **14** may include, for example, a housing **101**, the circuit board **120**, the image sensor **140**, the lens module **200**, the second driving assemblies **400** and **500**, and reinforcing structures **808**. However, the configuration of the camera module **14** is not limited to these members. For example, the camera module **14** may further include the second detection sensors **620** and **630** and the connection terminals **910** and **920**.

The housing **101** may be made of a plastic material. For example, the housing **101** may be manufactured by injection molding. The housing **101** is configured to receive the lens module **200**. For example, a space sufficient to completely receive the lens module **200** may be formed inside the housing **101**. The housing **101** may have a form in which an upper portion and a lower portion of the housing **101** are open, so that light incident along the optical axis C can be imaged on the image sensor **140**, which is disposed below the housing **101**. The housing **101** may be generally in a form of a surface having a plurality of side surfaces. For example, the housing **101** may have a shape similar to a hexahedron having four sides, as shown in FIG. **14**. However, the shape of the housing **101** is not limited to the shape shown in FIG. **10**. For example, the housing **101** may have a cylindrical shape with a curved side surface. A space for a filter member **160** to be disposed may be formed in the housing **101**. For example, a flange portion **106** forming a predetermined size of transparent window may be formed in a lower portion of the housing **101**.

The circuit board **120** may be disposed in the housing **101**. For example, the circuit board **120** may be disposed below the housing **101**. The circuit board **120** may be electrically connected to the image sensor **140**. For example, the circuit board **120** may be formed with an electric circuit for transmitting an electric signal from the image sensor **140** to external or other electronic components. The circuit board **120** may be composed of a single-layer or multilayer substrate. For example, the circuit board **120** may be manufactured in a form in which an insulating layer and a plating layer on which an electric circuit is formed are sequentially stacked. An electronic component may be mounted on the circuit board **120**. For example, one or more electronic components required for driving the camera module **14** may be disposed above or inside the circuit board **120**.

The image sensor **140** is configured to convert an optical signal into an electrical signal. For example, the image sensor **140** may be manufactured in a CCD form. However, the image sensor **140** is not limited to the CCD form. For example, the image sensor **140** may also be manufactured in a CMOS form. The image sensor **140** may be disposed on the circuit board **120**. For example, the image sensor **140** may be mounted on an upper portion of the circuit board **120**. The image sensor **140** may be electrically connected to the circuit board **120**. For example, the image sensor **140** may be connected to an electrical circuit of the circuit board **120**, and may be configured to transmit the converted electrical signal externally through the circuit board **120**.

The lens module **200** may be configured to image light reflected from an object on the image sensor **140**. For example, the lens module **200** may image light incident through one or more lenses on the image sensor **140**. The lens module **200** may be driven inside the housing **101**. For example, the lens module **200** may be moved in the direction intersecting the optical axis by the second driving assemblies **400** and **500**.

The second driving assemblies **400** and **500** are configured to perform image stabilization correction of the camera module **14**. For example, the second driving assemblies **400** and **500** may drive the lens module **200** in a first direction or a second direction intersecting the optical axis C. The second driving assemblies **400** and **500** may include the second driving coils **410** and **510**, respectively, and the second driving magnets **420** and **520**, respectively. However, the configuration of the second driving assemblies **400** and **500** is not limited to the above-described members.

The second driving magnets **420** and **520** may be disposed on the lens module **200**. For example, the second driving magnets **420** and **520** may be respectively disposed on two side surfaces of the lens module **200**. The second driving coils **410** and **510** may be disposed in the housing **101**. For example, the second driving coils **410** and **510** may be disposed on the flange portion **106** of the housing **101** so as to be disposed close to the second driving magnets **420** and **520**, respectively.

The second driving coils **410** and **510** and the second driving magnets **420** and **520** may provide driving force required for driving the lens module **200**. For example, magnetic force generated between the second driving coils **410** and **510** and the second driving magnets **420** and **520**, respectively, may move the lens module **200** in a first direction or a second direction intersecting the optical axis C.

The reinforcing structures **808** are formed in the housing **101**. For example, the reinforcing structures **808** may be formed on the sidewall **104** and the flange portion **106** of the housing **101**. In other words, third and fourth reinforcing members **830'** and **840'** may be formed on the sidewall **104** of the housing **101**, and first and second reinforcing members **810'** and **820'** may be formed on the flange portion **106** of the housing **106**. The reinforcing structures **808** may be made of a material different from a material of the housing **101**. For example, the reinforcing structure **808** may be made of a metal material. However, the material of the reinforcing structures **808** is not limited to metal. The reinforcing structures **808** may be configured to increase the rigidity of the housing **101**. For example, the reinforcing structures **808** may be integrally formed with the housing **101** by an insert injection method to improve the rigidity of the sidewall **104** and the flange portion **106** of the housing **101**.

The reinforcing structures **808** may be electrically connected to the second detection sensors **620** and **630**, respectively, and the second driving coils **410** and **510**, respectively. For example, the first reinforcing member **810'** and the second reinforcing member **820'** of one reinforcing structure **808** may be connected to the second driving coil **410**, and the first reinforcing member **810'** and the second reinforcing member **820'** of the other reinforcing structure **808** may be connected to the second driving coil **510**. For example, the third reinforcing member **830** and the fourth reinforcing member **840** of the one reinforcing structure **808** may be connected to the second detection sensor **620**, and the third reinforcing member **830** and the fourth reinforcing member **840** of the other reinforcing structure **808** may be connected to the second detection sensor **630**. The reinforcing structures **808** may respectively connect the second driving coils **410** and **510** to the connection terminals **910** and **920**. For example, the respective first reinforcing members **810'** and second reinforcing members **820'** may connect

the second driving coils **410** and **510** to the connection terminals **910** and **920**. Similarly thereto, the respective reinforcing structures **808** may connect the second detection sensors **620** and **630** to the connection terminals **910** and **920**. For example, the respective third reinforcing member **830** and fourth reinforcing member **840** may connect the second detection sensors **630** and **620** and the connection terminals **910** and **920**. For reference, the reinforcing structures **808** are shown in one form, but may be modified to the form according to FIGS. **3** to **5**, as desired.

The second detection sensors **620** and **630** are configured to detect the position of the lens module **200**. For example, the second detection sensors **620** and **630** may be configured to detect the displacement of the lens module **200** when the lens module **200** is shaken in a direction intersecting the optical axis. The second sensing sensors **620** and **630** may be disposed at positions that can easily detect a magnetic field of the second driving magnets **420** and **520**. For example, the second detection sensors **620** and **630** may be disposed on the sidewall **104** of the housing **101**. However, the positions of the second detection sensors **620** and **630** are not limited to the sidewall **104** of the housing **101**.

In the camera module **14** configured as described above, an electrical connection between the second driving coils **410** and **510** and the connection terminals **910** and **920**, and an electrical connection between the second detection sensors **620** and **630** and the connection terminals **910** and **920** may be easily formed. Further, the camera module **14** may improve the rigidity of the sidewall **104** and the flange portion **106** of the housing **101** by including a plurality of reinforcing structures **808**. Therefore, the camera module **14** may not only enable thinning and miniaturization of the housing **101**, but may also improve the impact resistance of the housing **101** to external impacts.

FIGS. **17** to **19** illustrate a camera module **16**, according to another embodiment.

Referring to FIGS. **17** to **19**, the camera module **16** may include, for example, the housing **101**, the circuit board **120**, the image sensor **140**, the lens module **200**, the second driving assemblies **400** and **500**, and reinforcing members **809**. However, the configuration of the camera module **16** is not limited to these members. For example, the camera module **16** may further include the second detection sensors **620** and **630** and the connection terminals **910** and **920**.

The housing **101** may be made of a plastic material. For example, the housing **101** may be manufactured by injection molding. The housing **101** is configured to receive the lens module **200**. For example, a space sufficient to completely receive the lens module **200** may be formed inside the housing **101**. The housing **101** may have a form in which an upper portion and a lower portion thereof are open, so that light incident along the optical axis C can be imaged on the image sensor **140** disposed below the housing **101**. The housing **101** may be generally in a form of a face having a plurality of side surfaces. For example, the housing **101** may have a shape similar to a hexahedron having four side surfaces as shown in FIG. **17**. However, the shape of the housing **101** is not limited to the shape shown in FIG. **17**. For example, the housing **101** may have a cylindrical shape with a curved side surface. A space for the filter member **160** (FIG. **14**) to be disposed may be formed in the housing **101**. For example, the flange portion **106** forming a transparent window of a predetermined size may be formed below the housing **101**.

The circuit board **120** may be disposed in the housing **101**. For example, the circuit board **120** may be disposed below the housing **101**. The circuit board **120** may be electrically connected to the image sensor **140**. For example, the circuit board **120** may be formed with an electric circuit for transmitting an electric signal from the image sensor **140** to external or other electronic components. The circuit board **120** may be composed of a single-layer or multilayer substrate. For example, the circuit board **120** may be manufactured in a form in which an insulating layer and a plating layer on which an electric circuit is formed are sequentially stacked. An electronic component may be mounted on the circuit board **120**. For example, one or more electronic components required for driving the camera module **16** may be disposed above or inside the circuit board **120**.

The image sensor **140** is configured to convert an optical signal into an electrical signal. For example, the image sensor **140** may be manufactured in a CCD form. However, the image sensor **140** is not limited to the CCD form. For example, the image sensor **140** may be manufactured in a CMOS form. The image sensor **140** may be disposed on the circuit board **120**. For example, the image sensor **140** may be mounted on an upper portion of the circuit board **120**. The image sensor **140** may be electrically connected to the circuit board **120**. For example, the image sensor **140** may be connected to an electrical circuit of the circuit board **120** and transmit the converted electrical signal externally through the circuit board **120**.

The lens module **200** may be configured to image light reflected from an object on the image sensor **140**. For example, the lens module **200** may image light incident through one or more lenses on the image sensor **140**.

The lens module **200** may be configured to be easily moved in a direction intersecting the optical axis C. For example, the lens module **200** may include a first frame **210**, a second frame **220**, and a third frame **230**. The second frame **220** may be configured to move in a first direction intersecting the optical axis with respect to the first frame **210**, and the third frame **230** may be configured to be moved in a second direction intersecting the optical axis with respect to the second frame **220**. Ball bearings **650** may be disposed between the first frame **210** and the second frame **220**, and ball bearings **660** may be disposed between the second frame **220** and the third frame **230**.

The second driving assemblies **400** and **500** are configured to perform image stabilization correction of the camera module **16**. For example, the second driving assemblies **400** and **500** may drive the lens module **200** in the first direction or the second direction intersecting the optical axis C. The second driving assemblies **400** and **500** may include the second driving coils **410** and **510**, respectively, and the second driving magnets **420** and **520**, respectively. However, the configuration of the second driving assemblies **400** and **500** is not limited to the above-described members.

The second driving magnets **420** and **520** may be disposed on the lens module **200**. For example, the second driving magnets **420** and **520** may be respectively disposed on two side surfaces of the lens module **200**. The second driving coils **410** and **510** may be disposed in the housing **101**. For example, the second driving coils **410** and **510** may be disposed on the flange portion **106** of the housing **101** so as to be disposed close to the second driving magnets **420** and **520**, respectively.

The second driving coils **410** and **510** and the second driving magnets **420** and **520** may provide driving force required for driving the lens module **200**. For example, the magnetic force generated between the second driving coils **410** and **510** and the second driving magnets **420** and **520**,

respectively, may move the lens module **200** in the first direction or the second direction intersecting the optical axis C.

The reinforcing structures **809** are formed in the housing **101**. For example, the reinforcing structures **809** may be formed on the flange portion **106** of the housing **101**. The reinforcing structures **809** may be made of a material different from a material of the housing **101**. For example, the reinforcing structures **809** may be made of a metal material. However, a material of the reinforcing structures **809** is not limited to metal. The reinforcing structures **809** may be configured to increase the rigidity of the housing **101**. For example, the reinforcing structures **809** may be integrally formed with the housing **101** by an insert injection method to improve the rigidity of the sidewall **104** and the flange portion **106** of the housing **101**.

The reinforcing structures **809** may be electrically connected to the second driving coils **410** and **510**, respectively. For example, a first reinforcing member **810"** and a second reinforcing member **820"** of one reinforcing structure **809** may be connected to the second driving coil **410**, and a reinforcing member **810"** and a second reinforcing member **820"** of the other reinforcing structure **809** may be connected to the second driving coil **510**. The respective reinforcing structures **809** may connect the second driving coils **410** and **510** to the connection terminals **910** and **920**. For example, the respective first reinforcing members **810"** and second reinforcing members **820"** may connect the second driving coils **410** and **510** to the connection terminals **910** and **920**. For reference, in the embodiment illustrated in FIGS. **17** to **19**, the reinforcing structure **809** is shown in one form, but may be modified to the form according to FIGS. **3** to **5**, as desired.

The second detection sensors **620** and **630** are configured to detect the position of the lens module **200**. For example, the second detection sensors **620** and **630** may be configured to detect the displacement of the lens module **200** when the lens module **200** is shaken in a direction intersecting the optical axis. The second detection sensors **620** and **630** may be disposed at positions that can easily detect the magnetic field of the second driving magnets **420** and **520**, respectively. For example, the second detection sensors **620** and **630** may be disposed on the circuit board **120** on which the image sensor **140** is mounted.

The camera module **16** configured as described above enables easy electrical connection between the second driving coils **410** and **510** and the connection terminals **910** and **920**. Further, the camera module **16** may improve the rigidity of the flange portion **106** by including the reinforcing structures **809**.

FIGS. **20** to **25** illustrate a camera module **18**, according to an embodiment.

The camera module **18** may include, for example, the housing **100**, a lens barrel **250**, the lens module **200**, the first driving assembly **300**, and the second driving assemblies **400** and **500**, as shown in FIGS. **20** and **21**. However, the configuration of the camera module **18** is not limited to above-described members. For example, the camera module **18** may further include the circuit board **120**, the image sensor **140**, the detection sensors **610**, **620**, and **630**, first, second, and third ball bearings **640**, **650**, and **660**, a cover member **700**, reinforcing structures **800**, and the shield can **900**.

Referring to FIGS. **21** and **22**, the housing **100** may be formed in a form of a face having upper and lower surfaces open. For example, the housing **100** may be configured to have a substantially hexahedral shape. Three side surfaces of the housing **100** may have partially incised shapes. The driving forces of the first driving assembly **300** and the second driving assemblies **400** and **500** may be transmitted to the lens module **200** through the incised side surfaces. A pair of first guide grooves **102** may be formed inside the first surface of the housing **100**. The first guide groove **102** may be formed long along the height direction of the housing **100**. A first ball bearing **640** may be disposed in the first guide groove **102**.

The lens module **200** is disposed inside the housing **100**. The lens module **200** may be configured to move in a direction of the optical axis and in a direction intersecting the optical axis, inside the housing **100**. The lens module **200** may be composed of a plurality of members. For example, the lens module **200** may be composed of the first frame **210**, the second frame **220**, and the third frame **230**.

The first frame **210** may have a form in which the vertical direction is open, and the frame **210** has two closed sides and two open sides. A pair of second guide grooves **212** may be formed on the first surface of the first frame **210**. The first ball bearing **640** may be disposed in the second guide groove **212**. The first frame **210** is disposed inside the housing **100**. The first frame **210** may be configured to move in the optical axis direction with respect to the housing **100**. For example, the first frame **210** may move in the optical axis direction in a state of a point contact or line contact with the first ball bearing **640**. The driving force required for driving the first frame **210** may be provided by the first driving assembly **300**. A first groove **214** may be formed in four inner corners of the first frame **210**. The first groove **214** may have a shape elongated in a longitudinal direction. For example, the first groove **214** may be formed long along a first direction intersecting the optical axis. The second ball bearing **650** may be disposed in the first groove **214**.

The second frame **220** may have a generally thin plate shape that is open in the vertical direction. The second frame **220** is disposed on the first frame **210**, and may be configured to be moved in the first direction intersecting the optical axis. For example, the second frame **220** may be enabled to move in the first direction intersecting the optical axis by the second ball bearing **650** being disposed between the first frame **210** and the second frame **220**. The driving force required for driving the second frame **220** may be provided by the second driving assembly **400**. A second groove **224** and a third groove **226** may be formed in the second frame **220**. The second groove **224** may be formed below the second frame **220**, and the third groove **226** may be formed above the second frame **220**. The second groove **224** may be elongated in the first direction intersecting the optical axis. The second groove **224** may form a space for receiving the second ball bearing **650** together with the first groove **214**. The third groove **226** may be elongated in a second direction intersecting the optical axis and the first direction.

The third frame **230** may have a shape that is open in the vertical direction and has a predetermined height. The third frame **230** may be disposed on the second frame **220** and may be configured to move in a second direction intersecting the optical axis. For example, the third frame **230** may be enabled move in the second direction intersecting the optical axis by the third ball bearing **660** being disposed between the second frame **220** and the third frame **230**. The driving force required for driving the third frame **230** may be provided by the second driving assembly **400**. A fourth groove **234** may be formed below the third frame **230**. The fourth groove **234** may be elongated in the second direction intersecting the

optical axis. The fourth groove **234** may form a space for accommodating the third ball bearing **660** together with the third groove **226**.

The lens barrel **250** may be coupled to the third frame **230**. The lens barrel **250** may be moved by the lens module **200** in an optical axis direction and a direction intersecting the optical axis. For example, the lens barrel **250** may be moved by the first frame **210** in the optical axis direction. As another example, the lens barrel **250** may be moved by the second frame **220** and the third frame **230** in the first direction intersecting the optical axis and the second direction intersecting the optical axis. The movement of the lens barrel **250** in the optical axis direction may enable focus adjustment of the camera module **18**, and the movement of the lens barrel **250** in the first and second directions intersecting the optical axis of the lens module **250** may enable an image stabilization correction function of the camera module **18** to be performed.

The first driving assembly **300** may be configured to move the lens module **200** in the optical axis direction. For example, the first driving assembly **300** may provide driving force required to move the first frame **210** in the optical axis direction. The first driving assembly **300** may include the first driving coil **310** and the first driving magnet **320**. The first driving coil **310** may be disposed on the first surface of the housing **100**, and the first driving magnet **320** may be disposed on the first surface of the first frame **210**. The first surface of the housing **100** and the first surface of the first frame **210** may be disposed to face each other.

The second driving assemblies **400** and **500** may be configured to move the lens module **200** in the first direction intersecting the optical axis and the second direction intersecting the optical axis. For example, the second driving assemblies **400** and **500** may provide driving force required for the movement of the second frame **220** and the third frame **230**. The second driving assemblies **400** and **500** may include second driving coils **410** and **510**, respectively, and second driving magnets **420** and **520**, respectively. The second driving coils **410** and **510** may be disposed on the second and third surfaces of the housing **100**, respectively, and the second driving magnets **420** and **520** may be disposed on the second and third surfaces of the third frame **230**, respectively. For example, the second surface of the housing **100** may be a surface facing the second surface of the third frame **230**, and the third surface of the housing **100** may be a surface facing the third surface of the third frame **230**.

The camera module **18** may include a device for supplying current to driving assemblies **300**, **400**, and **500**. For example, the camera module **18** may include the circuit board **120**. The circuit board **120** may be configured to supply current required for driving the first driving assembly **300** and the second driving assemblies **400** and **500**. For example, the circuit board **120** may supply current to the first driving coil **310** and the second driving coil **410**, **510**. The circuit board **120** may be configured to provide a space in which the first driving coil **320** and the second driving coils **410** and **510** can be disposed. For example, the circuit board **120** may be disposed in a form surrounding the first surface, the second surface, and the third surface of the housing **100**, to provide a space in which the first driving coil **320** and the second driving coils **410** and **510** may be disposed in the housing **100**. The image sensor **140** may be mounted on the circuit board **120**.

The camera module **18** may include elements for detecting the position of the lens module **200**. For example, the camera module **18** may include of the first detection sensor **610** and the second detection sensors **620** and **630**. The first detection sensor **610** may detect moving displacement of the lens module **200** in the optical axis direction, and the second detection sensors **620** and **630** may detect the moving displacement of the lens module **200** in the first and second directions intersecting the optical axis. The first, second, and third detection sensors **610**, **620**, and **630** may each be in a form of a hall sensor configured to detect a magnitude of the magnetic field generated from the driving assemblies **300**, **400**, and **500**, respectively. However, the shape of the first, second, and third detection sensors **610**, **620**, and **630** is not limited to the hall sensor. The first detection sensor **610** may be disposed in a space surrounded by the driving coil **310**. For example, the first detection sensor **610** may be disposed inside the first driving coil **310**. The second detection sensors **620** and **630** may be disposed on the circuit board **120** on which the image sensor **140** is mounted.

The camera module **18** may include a component for binding the first frame **210** to the third frame **230**. For example, the camera module **18** may include the cover member **700** for binding the second frame **220** and the third frame **230** to the first frame **210**. The cover member **700** may be coupled to the first frame **210** in a state in which the first frame **210** to the third frame **230** are stacked, so that it is possible to prevent separation of the second frame **220** and the third frame **230** from the first frame **210**. A buffer member **720** may be formed on the cover member **700**. For example, a plurality of buffer members **720** protruding upwardly may be formed on an upper portion of the cover member **700**. The buffer member **720** formed as described above may reduce impacts due to collision between the lens module **200** and the shield can **900**.

The camera module **18** may include a component for shielding electromagnetic waves. For example, the camera module **18** may include the shield can **900**. The shield can **900** may be formed in a form surrounding the housing **100**, the lens module **200**, and the cover member **700**. Therefore, harmful electromagnetic waves generated inside or outside the camera module **18** may be blocked or impeded by the shield can **900**.

The camera module **18** includes the reinforcing structures **800** that may reinforce rigidity of the housing **100**. For example, the reinforcing structures **800** may be formed inside a sidewall **104** of the housing **100** as shown in FIG. **22**. The reinforcing structures **800** may be made of a material different from a material of the housing **100**. For example, the reinforcing structures **800** may be made of a metal material. The reinforcing structures **800** may be integrally formed with the housing **100**. For example, the reinforcing structures **800** formed of the metal material and the housing **100** formed of the plastic material may be integrally formed by double injection molding or insert injection molding. For example, the reinforcing structures **800** may each be composed of the first reinforcing member **810** and the second reinforcing member **820**. The reinforcing structures **800** may be respectively connected to driving coils **310**, **410**, and **510**. For example, the first end of the first reinforcing member **810** and the first end of the second reinforcing member **820** may be connected to a first terminal and a second terminal of the driving coils **310**, **410**, and **510**, respectively. The reinforcing structures **800** may be connected to the respective connection terminals **910** and **920**. For example, the second end of the first reinforcing member **810** and the second end of the second reinforcing member **820** may be connected to the connection terminals **910** and **920**, respectively. Therefore, the driving coils **310**, **410**, and **510**, which are located inside the housing **100**, and the connection

terminals **910** and **920**, which are located outside the housing **100**, may be electrically connected by the respective reinforcing structure **800**. For example, in the embodiment illustrated in FIGS. **20-25**, the reinforcing structures **800** are shown in one form, but may be modified to the form according to FIGS. **3** to **5**, as desired.

A moving structure of the second frame **220** and the third frame **230** will be described below with reference to FIGS. **24** and **25**.

Referring to FIGS. **24** and **25**, the first frame **210**, the second frame **220**, and the third frame **230** constituting the lens module **200** may be stacked and coupled along the optical axis direction. The first frame **210** may be configured to receive the second frame **220** and the third frame **230**. For example, the second frame **220** and the third frame **230** may be configured to be moved in a direction intersecting the optical axis in a state in which the second frame **220** and the third frame **230** are received inside the first frame **210**.

The second and third ball bearings **650** and **660** may be disposed between the first frame **210** and the third frame **230**. For example, the second ball bearing **650** may be disposed between the first frame **210** and the second frame **220**, and the third ball bearing **660** may be disposed between the second frame **220** and the third frame **230**.

A space for the second and third ball bearings **650** and **660** to be disposed may be formed in the first frame **210** to the third frame **230**. For example, the first groove **214** may be formed on an upper portion of the first frame **210**, the second and third grooves **224** and **226** may be formed on upper and lower portions of the second frame **220**, and the fourth groove **234** may be formed on a lower portion of the third frame **230**.

Lengths of the second and fourth grooves **224** and **234** may be formed differently according to a moving direction of the second frame **220** and the third frame **230**. For example, a length WY**2** of the second groove **224** in a first direction may be greater than a length WX**1** of the second groove **224** in a second direction, and a length WX**2** of the fourth groove **234** in the second direction may be greater than a length WY**1** of the fourth groove **234** in the first direction. Further, the length WY**2** of the second groove **224** in the first direction may be greater than the length WY**1** of the third and fourth grooves **226** and **234** in the first direction, and the length WX**2** of the fourth groove **234** may be greater than the length WX**1** of the first and second grooves **214** and **224** in the second direction.

Since the length of the second groove **224** of the second frame **220**, configured as described above, in the first direction is greater than the length of the first groove **214** of the first frame **210** in the first direction, a relative movement of the second frame **220** with respect to the first frame **210** may be possible. In addition, since the length of the fourth groove **234** of the third frame **230** in the second direction is greater than the length of the third groove **226** of the second frame **220** in the second direction, a relative movement of the third frame **230** with respect to the second frame **220** may be possible.

Since, in the camera module **18**, an electrical connection between the driving coils **310**, **410**, and **510** and the connection terminals **910**, **920** is made by the reinforcing structures **800**, there is no need to attach a flexible substrate for supplying current to the driving coils **310**, **410**, and **510** to the housing **100**. In addition, since the camera module **18** may omit an attachment process of the flexible substrate, a manufacturing process of the camera module **18** may be simplified. In addition, since the camera module **18** may secure the rigidity of the housing **100** through the reinforcing structure **800**, it is possible to make the housing **100** lightweight and miniaturized.

As set forth above, according to the disclosure herein, miniaturization of a camera module may be achieved while securing the rigidity of a housing of the camera module.

While this disclosure includes specific examples, it will be apparent after an understanding of the disclosure of this application that various changes in form and details may be made in these examples without departing from the spirit and scope of the claims and their equivalents. The examples described herein are to be considered in a descriptive sense only, and not for purposes of limitation. Descriptions of features or aspects in each example are to be considered as being applicable to similar features or aspects in other examples. Suitable results may be achieved if the described techniques are performed in a different order, and/or if components in a described system, architecture, device, or circuit are combined in a different manner, and/or replaced or supplemented by other components or their equivalents. In addition, respective embodiments may be combined with each other. Therefore, the scope of the disclosure is defined not by the detailed description, but by the claims and their equivalents, and all variations within the scope of the claims and their equivalents are to be construed as being included in the disclosure.

What is claimed is:

1. A camera module, comprising:

a housing;

a lens module disposed in the housing;

a driving assembly configured to move the lens module in a direction of an optical axis or a direction intersecting the optical axis; and

a reinforcing structure that is embedded within an inner side and an outer side of at least one sidewall of the housing, and is electrically connected to the driving assembly,

wherein the driving assembly comprises a driving magnet disposed in the lens module and a driving coil disposed in the housing and electrically connected to the reinforcing structure,

wherein the reinforcing structure includes a first end that is exposed on an inner surface of the housing, and is bent perpendicular to a surface of the housing and faces toward an inside of the housing,

wherein the reinforcing structure includes a second end that is exposed on an outer surface of the housing, and is bent perpendicular to the surface of the housing and faces toward an outside of the housing,

wherein the first end is connected to the driving coil, and

wherein the reinforcing structure passes through the at least one sidewall.

2. The camera module of claim **1**, further comprising:

a detection sensor that is electrically connected to the reinforcing structure, and configured to detect a displacement of the lens module in the direction of the optical axis or the direction intersecting the optical axis.

3. The camera module of claim **2**, wherein the reinforcing structure comprises a first reinforcing member and a second reinforcing member,

wherein the first end comprises a first end of the first reinforcing member and a first end of the second reinforcing member and the first end of the first reinforcing member and the first end of the second reinforcing member are connected to the driving coil, and

wherein the second end comprises a second end of the first reinforcing member and a second end of the second reinforcing member and the second end of the first reinforcing member and the second end of the second reinforcing member are respectively connected to connection terminals.

4. The camera module of claim **3**, wherein the first reinforcing member and the second reinforcing member each have an inverted U shape or a spiral shape.

5. The camera module of claim **1**, further comprising:

a connection terminal formed in the housing, and electrically connected to the driving assembly by the reinforcing structure.

6. The camera module of claim **1**, further comprising:

a circuit board on which an image sensor configured to convert an optical signal incident through the lens module into an electrical signal is disposed.

7. The camera module of claim **6**, further comprising:

a detection sensor disposed on the circuit board, and configured to detect displacement of the lens module in the direction of the optical axis or the direction intersecting the optical axis.

8. The camera module of claim **1**, wherein the reinforcing structure is formed on a flange portion of the housing.

9. The camera module of claim **8**, wherein the driving assembly comprises:

a driving magnet disposed in the lens module; and

a driving coil disposed on the reinforcing structure.

10. The camera module of claim **1**, wherein the reinforcing structure has a spiral shape.

11. The camera module of claim **1**, wherein the reinforcing structure includes a reinforcing member having an inverted U shape.

12. A camera module, comprising:

a housing;

a lens module disposed in the housing;

a driving assembly configured to move the lens module in a direction of an optical axis or a direction intersecting the optical axis; and

a reinforcing structure encapsulated within an inner side and an outer side of the housing, and electrically connected to the driving assembly,

wherein the driving assembly comprises a driving magnet disposed in the lens module and a driving coil disposed in the housing and electrically connected to the reinforcing structure,

wherein the reinforcing structure includes a first end that is exposed on an inner surface of the housing, and is bent perpendicular to a surface of the housing and faces toward an inside of the housing,

wherein the reinforcing structure includes a second end that is exposed on an outer surface of the housing, and is bent toward an outside of the housing,

wherein the first end is connected to the driving coil, and

wherein the reinforcing structure passes through a sidewall of the housing.

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