



(11)

EP 4 773 630 A1

(12)

EUROPEAN PATENT APPLICATION
published in accordance with Art. 153(4) EPC

(43) Date of publication:
08.07.2026 Bulletin 2026/28

(51) International Patent Classification (IPC):
H04R 7/16 (2006.01) **H04R 7/06** (2006.01)
H04R 9/04 (2006.01)

(21) Application number: **25817127.1**

(86) International application number:
PCT/KR2025/019047

(22) Date of filing: **18.11.2025**

(87) International publication number:
WO 2026/106417 (21.05.2026 Gazette 2026/21)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
GE KH LA MA MD TN

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(30) Priority: **18.11.2024 KR 20240164446**
06.01.2025 KR 20250001749

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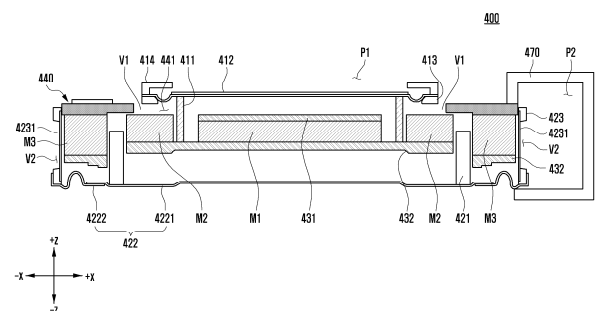
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(54) **SPEAKER MODULE AND ELECTRONIC DEVICE COMPRISING SAME**

(57) A dipole speaker module according to an embodiment of the disclosure may include a first vibration assembly that includes a first coil, a first diaphragm connected to the first coil, and a first frame on which the first diaphragm is disposed. The dipole speaker module may include a second vibration assembly that includes a second coil, and a second diaphragm connected to the second coil, positioned opposite to the first diaphragm, and larger in size than the first diaphragm. The dipole speaker module may include a magnet facing the first coil and the second coil between the first diaphragm and the second diaphragm. The dipole speaker module may include a yoke, a portion of which is disposed between the magnet and the first diaphragm, including an opening in which a portion of the first frame is accommodated. The first diaphragm of the first vibration assembly may vibrate through electromagnetic force acting between the first coil and the magnet to output a first audio signal. The second diaphragm of the second vibration assembly may vibrate through electromagnetic force acting between the second coil and the magnet to output a second audio signal. Additionally, various other embodiments are possible.

FIG. 6A



Description

[Technical Field]

[0001] Various embodiments disclosed in this document relate to a speaker module and an electronic device including the same.

[Background Art]

[0002] As electronic devices become more high-performance, electronic components are placed inside the electronic devices to perform various functions. One example of such electronic components is a speaker module for sound output. The speaker module can convert electrical signals generated by the electronic device into sound signals audible to the user by using a surround included in a diaphragm to facilitate air vibration.

[0003] The above information may be presented as background information only to assist with an understanding of the disclosure. No determination has been made, and no assertion is made, as to whether any of the above might be applicable as prior art with regard to the disclosure.

[Disclosure of Invention]

[Solution to Problem]

[0004] A dipole speaker module according to an embodiment of the disclosure may include a first vibration assembly that includes a first coil, a first diaphragm connected to the first coil, and a first frame on which the first diaphragm is disposed. The dipole speaker module may include a second vibration assembly that includes a second coil, and a second diaphragm connected to the second coil, positioned opposite to the first diaphragm, and larger in size than the first diaphragm. The dipole speaker module may include a magnet facing the first coil and the second coil between the first diaphragm and the second diaphragm. The dipole speaker module may include a yoke, a portion of which is disposed between the magnet and the first diaphragm, including an opening in which a portion of the first frame is accommodated. The first diaphragm of the first vibration assembly may vibrate through electromagnetic force acting between the first coil and the magnet to output a first audio signal. The second diaphragm of the second vibration assembly may vibrate through electromagnetic force acting between the second coil and the magnet to output a second audio signal.

[0005] An electronic device according to an embodiment of the disclosure may include a housing and a dipole speaker module disposed in the housing. The dipole speaker module may include a first vibration assembly that includes a first coil, a first diaphragm connected to the first coil, and a first frame on which the first diaphragm is disposed. The dipole speaker module may include a

second vibration assembly that includes a second coil, and a second diaphragm connected to the second coil, positioned opposite to the first diaphragm, and larger in size than the first diaphragm. The dipole speaker module may include a magnet facing the first coil and the second coil between the first diaphragm and the second diaphragm. The dipole speaker module may include a yoke, a portion of which is disposed between the magnet and the first diaphragm, including an opening in which a portion of the first frame is accommodated. The first diaphragm of the first vibration assembly may vibrate through electromagnetic force acting between the first coil and the magnet to output a first audio signal. The second diaphragm of the second vibration assembly may vibrate through electromagnetic force acting between the second coil and the magnet to output a second audio signal.

[Brief Description of Drawings]

[0006] In connection with the description of drawings, identical or similar reference numerals may be used for identical or similar components.

FIG. 1 is a block diagram of an electronic device in a network environment, according to various embodiments of the disclosure.

FIG. 2A is a perspective view of the front surface of an electronic device, according to an embodiment of the disclosure.

FIG. 2B is a perspective view of the rear surfaces of the electronic device in FIG. 2A, according to an embodiment of the disclosure.

FIG. 3 is an exploded perspective view of the electronic device in FIG. 2A, according to an embodiment of the disclosure.

FIG. 4A is an assembly view of a speaker module, according to an embodiment of the disclosure.

FIG. 4B is an assembly view of an embodiment in which a support structure is omitted from the yoke in FIG. 4A.

FIG. 5A is an assembly view of the speaker module in FIG. 4A.

FIG. 5B is a front perspective view of the speaker module in FIG. 4A.

FIG. 5C is a rear perspective view of the speaker module in FIG. 4A.

FIG. 5D is a diagram in which a magnet is disposed on one surface of a yoke, according to an embodiment of the disclosure.

FIG. 6A and FIG. 6B are cross-sectional views taken along line 6a-6a of FIG. 5B.

FIG. 6C is a cross-sectional view taken along line 6c-6c of FIG. 5B.

FIG. 7 is a cross-sectional view taken along line 7-7 of FIG. 5B.

FIG. 8 is a diagram of an embodiment in which the first frame is supported by the magnet in FIG. 4B.

FIG. 9A is a cross-sectional view taken along line 9a-9a of FIG. 8.

FIG. 9B is a cross-sectional view taken along line 9b-9b of FIG. 8.

FIG. 10 is a diagram of an embodiment in which the first diaphragm is supported by the yoke, according to an embodiment of the disclosure.

FIG. 11 is a diagram of a structure in which the first vibration assembly and the second vibration assembly share a ventilation space, according to an embodiment of the disclosure.

[Mode for the Invention]

[0007] In the following description, various embodiments of the present document are described with reference to the accompanying drawings. The various embodiments and the terms used herein are not intended to limit the technical features described in this document to specific examples, but should be understood to include various modifications, equivalents, or alternatives of the described embodiments.

[0008] With regard to the description of the drawings, similar reference numerals may be used to refer to similar or related elements. It is to be understood that a singular form of a noun corresponding to an item may include one or more of the things, unless the relevant context clearly indicates otherwise.

[0009] As used herein, each of such phrases as "A or B," "at least one of A and B," "at least one of A or B," "A, B, or C," "at least one of A, B, and C," and "at least one of A, B, or C," may include any one of, or all possible combinations of the items enumerated together in a corresponding one of the phrases. As used herein, such terms as "1st" and "2nd," or "first" and "second" may be used to simply distinguish a corresponding component from another, and does not limit the components in other aspect (e.g., importance or order). It is to be understood that if an element (e.g., a first element) is referred to, with or without the term "operatively" or "communicatively", as "coupled with," "coupled to," "connected with," or "connected to" another element (e.g., a second element), it means that the element may be coupled with the other element directly (e.g., wiredly), wirelessly, or via a third element.

[0010] Fig. 1 is a block diagram illustrating an electronic device 101 in a network environment 100 according to various embodiments. Referring to Fig. 1, the electronic device 101 in the network environment 100 may communicate with an electronic device 102 via a first network 198 (e.g., a short-range wireless communication network), or at least one of an electronic device 104 or a server 108 via a second network 199 (e.g., a long-range wireless communication network). According to an embodiment, the electronic device 101 may communicate with the electronic device 104 via the server 108. According to an embodiment, the electronic device 101 may include a processor 120, memory 130, an input module

150, a sound output module 155, a display module 160, an audio module 170, a sensor module 176, an interface 177, a connecting terminal 178, a haptic module 179, a camera module 180, a power management module 188, a battery 189, a communication module 190, a subscriber identification module (SIM) 196, or an antenna module 197. In some embodiments, at least one of the components (e.g., the connecting terminal 178) may be omitted from the electronic device 101, or one or more other components may be added in the electronic device 101. In some embodiments, some of the components (e.g., the sensor module 176, the camera module 180, or the antenna module 197) may be implemented as a single component (e.g., the display module 160).

[0011] The processor 120 may execute, for example, software (e.g., a program 140) to control at least one other component (e.g., a hardware or software component) of the electronic device 101 coupled with the processor 120, and may perform various data processing or computation. According to one embodiment, as at least part of the data processing or computation, the processor 120 may store a command or data received from another component (e.g., the sensor module 176 or the communication module 190) in volatile memory 132, process the command or the data stored in the volatile memory 132, and store resulting data in non-volatile memory 134. According to an embodiment, the processor 120 may include a main processor 121 (e.g., a central processing unit (CPU) or an application processor (AP)), or an auxiliary processor 123 (e.g., a graphics processing unit (GPU), a neural processing unit (NPU), an image signal processor (ISP), a sensor hub processor, or a communication processor (CP)) that is operable independently from, or in conjunction with, the main processor 121. For example, when the electronic device 101 includes the main processor 121 and the auxiliary processor 123, the auxiliary processor 123 may be adapted to consume less power than the main processor 121, or to be specific to a specified function. The auxiliary processor 123 may be implemented as separate from, or as part of the main processor 121.

[0012] The auxiliary processor 123 may control at least some of functions or states related to at least one component (e.g., the display module 160, the sensor module 176, or the communication module 190) among the components of the electronic device 101, instead of the main processor 121 while the main processor 121 is in an inactive (e.g., sleep) state, or together with the main processor 121 while the main processor 121 is in an active state (e.g., executing an application). According to an embodiment, the auxiliary processor 123 (e.g., an image signal processor or a communication processor) may be implemented as part of another component (e.g., the camera module 180 or the communication module 190) functionally related to the auxiliary processor 123. According to an embodiment, the auxiliary processor 123 (e.g., the neural processing unit) may include a hardware structure specified for artificial intelligence model proces-

sing. An artificial intelligence model may be generated by machine learning. Such learning may be performed, e.g., by the electronic device 101 where the artificial intelligence is performed or via a separate server (e.g., the server 108). Learning algorithms may include, but are not limited to, e.g., supervised learning, unsupervised learning, semi-supervised learning, or reinforcement learning. The artificial intelligence model may include a plurality of artificial neural network layers. The artificial neural network may be a deep neural network (DNN), a convolutional neural network (CNN), a recurrent neural network (RNN), a restricted boltzmann machine (RBM), a deep belief network (DBN), a bidirectional recurrent deep neural network (BRDNN), deep Q-network or a combination of two or more thereof but is not limited thereto. The artificial intelligence model may, additionally or alternatively, include a software structure other than the hardware structure.

[0013] The memory 130 may store various data used by at least one component (e.g., the processor 120 or the sensor module 176) of the electronic device 101. The various data may include, for example, software (e.g., the program 140) and input data or output data for a command related thereto. The memory 130 may include the volatile memory 132 or the non-volatile memory 134.

[0014] The program 140 may be stored in the memory 130 as software, and may include, for example, an operating system (OS) 142, middleware 144, or an application 146.

[0015] The input module 150 may receive a command or data to be used by another component (e.g., the processor 120) of the electronic device 101, from the outside (e.g., a user) of the electronic device 101. The input module 150 may include, for example, a microphone, a mouse, a keyboard, a key (e.g., a button), or a digital pen (e.g., a stylus pen).

[0016] The sound output module 155 may output sound signals to the outside of the electronic device 101. The sound output module 155 may include, for example, a speaker or a receiver. The speaker may be used for general purposes, such as playing multimedia or playing record. The receiver may be used for receiving incoming calls. According to an embodiment, the receiver may be implemented as separate from, or as part of the speaker.

[0017] The display module 160 may visually provide information to the outside (e.g., a user) of the electronic device 101. The display module 160 may include, for example, a display, a hologram device, or a projector and control circuitry to control a corresponding one of the display, hologram device, and projector. According to an embodiment, the display module 160 may include a touch sensor adapted to detect a touch, or a pressure sensor adapted to measure the intensity of force incurred by the touch.

[0018] The audio module 170 may convert a sound into an electrical signal and vice versa. According to an embodiment, the audio module 170 may obtain the

sound via the input module 150, or output the sound via the sound output module 155 or a headphone of an external electronic device (e.g., an electronic device 102) directly (e.g., wiredly) or wirelessly coupled with the electronic device 101.

[0019] The sensor module 176 may detect an operational state (e.g., power or temperature) of the electronic device 101 or an environmental state (e.g., a state of a user) external to the electronic device 101, and then generate an electrical signal or data value corresponding to the detected state. According to an embodiment, the sensor module 176 may include, for example, a gesture sensor, a gyro sensor, an atmospheric pressure sensor, a magnetic sensor, an acceleration sensor, a grip sensor, a proximity sensor, a color sensor, an infrared (IR) sensor, a biometric sensor, a temperature sensor, a humidity sensor, or an illuminance sensor.

[0020] The interface 177 may support one or more specified protocols to be used for the electronic device 101 to be coupled with the external electronic device (e.g., the electronic device 102) directly (e.g., wiredly) or wirelessly. According to an embodiment, the interface 177 may include, for example, a high definition multimedia interface (HDMI), a universal serial bus (USB) interface, a secure digital (SD) card interface, or an audio interface.

[0021] A connecting terminal 178 may include a connector via which the electronic device 101 may be physically connected with the external electronic device (e.g., the electronic device 102). According to an embodiment, the connecting terminal 178 may include, for example, a HDMI connector, a USB connector, a SD card connector, or an audio connector (e.g., a headphone connector).

[0022] The haptic module 179 may convert an electrical signal into a mechanical stimulus (e.g., a vibration or a movement) or electrical stimulus which may be recognized by a user via his tactile sensation or kinesthetic sensation. According to an embodiment, the haptic module 179 may include, for example, a motor, a piezoelectric element, or an electric stimulator.

[0023] The camera module 180 may capture a still image or moving images. According to an embodiment, the camera module 180 may include one or more lenses, image sensors, image signal processors, or flashes.

[0024] The power management module 188 may manage power supplied to the electronic device 101. According to one embodiment, the power management module 188 may be implemented as at least part of, for example, a power management integrated circuit (PMIC).

[0025] The battery 189 may supply power to at least one component of the electronic device 101. According to an embodiment, the battery 189 may include, for example, a primary cell which is not rechargeable, a secondary cell which is rechargeable, or a fuel cell.

[0026] The communication module 190 may support establishing a direct (e.g., wired) communication channel or a wireless communication channel between the elec-

tronic device 101 and the external electronic device (e.g., the electronic device 102, the electronic device 104, or the server 108) and performing communication via the established communication channel. The communication module 190 may include one or more communication processors that are operable independently from the processor 120 (e.g., the application processor (AP)) and supports a direct (e.g., wired) communication or a wireless communication. According to an embodiment, the communication module 190 may include a wireless communication module 192 (e.g., a cellular communication module, a short-range wireless communication module, or a global navigation satellite system (GNSS) communication module) or a wired communication module 194 (e.g., a local area network (LAN) communication module or a power line communication (PLC) module). A corresponding one of these communication modules may communicate with the external electronic device via the first network 198 (e.g., a short-range communication network, such as Bluetooth™, wireless-fidelity (Wi-Fi) direct, or infrared data association (IrDA)) or the second network 199 (e.g., a long-range communication network, such as a legacy cellular network, a 5G network, a next-generation communication network, the Internet, or a computer network (e.g., LAN or wide area network (WAN))). These various types of communication modules may be implemented as a single component (e.g., a single chip), or may be implemented as multi components (e.g., multi chips) separate from each other. The wireless communication module 192 may identify and authenticate the electronic device 101 in a communication network, such as the first network 198 or the second network 199, using subscriber information (e.g., international mobile subscriber identity (IMSI)) stored in the subscriber identification module 196.

[0027] The wireless communication module 192 may support a 5G network, after a 4G network, and next-generation communication technology, e.g., new radio (NR) access technology. The NR access technology may support enhanced mobile broadband (eMBB), massive machine type communications (mMTC), or ultra-reliable and low-latency communications (URLLC). The wireless communication module 192 may support a high-frequency band (e.g., the mmWave band) to achieve, e.g., a high data transmission rate. The wireless communication module 192 may support various technologies for securing performance on a high-frequency band, such as, e.g., beamforming, massive multiple-input and multiple-output (massive MIMO), full dimensional MIMO (FD-MIMO), array antenna, analog beam-forming, or large scale antenna. The wireless communication module 192 may support various requirements specified in the electronic device 101, an external electronic device (e.g., the electronic device 104), or a network system (e.g., the second network 199). According to an embodiment, the wireless communication module 192 may support a peak data rate (e.g., 20Gbps or more) for implementing eMBB, loss coverage (e.g., 164dB or less) for

implementing mMTC, or U-plane latency (e.g., 0.5ms or less for each of downlink (DL) and uplink (UL), or a round trip of 1ms or less) for implementing URLLC.

[0028] The antenna module 197 may transmit or receive a signal or power to or from the outside (e.g., the external electronic device) of the electronic device 101. According to an embodiment, the antenna module 197 may include an antenna including a radiating element composed of a conductive material or a conductive pattern formed in or on a substrate (e.g., a printed circuit board (PCB)). According to an embodiment, the antenna module 197 may include a plurality of antennas (e.g., array antennas). In such a case, at least one antenna appropriate for a communication scheme used in the communication network, such as the first network 198 or the second network 199, may be selected, for example, by the communication module 190 (e.g., the wireless communication module 192) from the plurality of antennas. The signal or the power may then be transmitted or received between the communication module 190 and the external electronic device via the selected at least one antenna. According to an embodiment, another component (e.g., a radio frequency integrated circuit (RFIC)) other than the radiating element may be additionally formed as part of the antenna module 197.

[0029] According to various embodiments, the antenna module 197 may form a mmWave antenna module. According to an embodiment, the mmWave antenna module may include a printed circuit board, a RFIC disposed on a first surface (e.g., the bottom surface) of the printed circuit board, or adjacent to the first surface and capable of supporting a designated high-frequency band (e.g., the mmWave band), and a plurality of antennas (e.g., array antennas) disposed on a second surface (e.g., the top or a side surface) of the printed circuit board, or adjacent to the second surface and capable of transmitting or receiving signals of the designated high-frequency band.

[0030] At least some of the above-described components may be coupled mutually and communicate signals (e.g., commands or data) therebetween via an inter-peripheral communication scheme (e.g., a bus, general purpose input and output (GPIO), serial peripheral interface (SPI), or mobile industry processor interface (MIPI)).

[0031] According to an embodiment, commands or data may be transmitted or received between the electronic device 101 and the external electronic device 104 via the server 108 coupled with the second network 199. Each of the electronic devices 102 or 104 may be a device of a same type as, or a different type, from the electronic device 101. According to an embodiment, all or some of operations to be executed at the electronic device 101 may be executed at one or more of the external electronic devices 102, 104, or 108. For example, if the electronic device 101 should perform a function or a service automatically, or in response to a request from a user or another device, the electronic device 101, instead of, or in addition to, executing the function or the service,

may request the one or more external electronic devices to perform at least part of the function or the service. The one or more external electronic devices receiving the request may perform the at least part of the function or the service requested, or an additional function or an additional service related to the request, and transfer an outcome of the performing to the electronic device 101. The electronic device 101 may provide the outcome, with or without further processing of the outcome, as at least part of a reply to the request. To that end, a cloud computing, distributed computing, mobile edge computing (MEC), or client-server computing technology may be used, for example. The electronic device 101 may provide ultra low-latency services using, e.g., distributed computing or mobile edge computing. In another embodiment, the external electronic device 104 may include an internet-of-things (IoT) device. The server 108 may be an intelligent server using machine learning and/or a neural network. According to an embodiment, the external electronic device 104 or the server 108 may be included in the second network 199. The electronic device 101 may be applied to intelligent services (e.g., smart home, smart city, smart car, or healthcare) based on 5G communication technology or IoT-related technology.

[0032] FIG. 2A is a front perspective view of an electronic device according to various embodiments of the disclosure. FIG. 2B is a rear perspective view of the electronic device of FIG. 2A according to various embodiments of the disclosure.

[0033] The electronic device 200 to be described below may include at least one of the components of the electronic device 101 described above with reference to FIG. 1.

[0034] With reference to FIG. 2A and FIG. 2B, the electronic device 200 according to an embodiment may include a housing 210 that includes a first surface (or front surface) 210A, a second surface (or rear surface) 210B, and a side surface 210C surrounding a space between the first surface 210A and the second surface 210B. According to an embodiment (not shown), the housing 210 may refer to a structure forming a part of the first surface 210A, the second surface 210B, and the side surface 210C in FIG. 2A. According to an embodiment, the first surface 210A may be formed by a front plate 202 (e.g., glass plate or polymer plate including various coating layers) whose at least a portion is substantially transparent. The second surface 210B may be formed by a rear plate 211 that is substantially opaque. The rear plate 211 may be formed by, for example, coated or tinted glass, ceramic, polymer, metal (e.g., aluminum, stainless steel (STS), or magnesium), or a combination of at least two thereof. The side surface 210C may be formed by a side bezel structure (or "side member") 218 coupled to the front plate 202 and the rear plate 211 and including a metal and/or a polymer. In a certain embodiment, the rear plate 211 and side bezel structure 218 may be integrally formed and include the same material (e.g., metal material such as aluminum).

[0035] In the illustrated embodiment, the front plate 202 may include a first region 210D that is curved and seamlessly extended from the first surface 210A toward the rear plate at opposite ends of the longer edge of the front plate 202. In the illustrated embodiment (see FIG. 2B), the rear plate 211 may include a second region 210E that is curved and seamlessly extended from the second surface 210B toward the front plate 202 respectively at opposite ends of the longer edge. In a certain embodiment, the front plate 202 or the rear plate 211 may include only one of the first region 210D and the second region 210E. In a certain embodiment, the front plate 202 may not include the first region and the second region, but may include only a flat surface disposed parallel to the second surface 210B. In the above embodiments, when the electronic device is viewed from the side thereof, the side bezel structure 218 may have a first thickness (or width) on a side where the first region 210D or the second region 210E is not included, and may have a second thickness thinner than the first thickness on a side where the first region 210D or the second region 210E is included.

[0036] According to an embodiment, the electronic device 200 may include at least one or more of display 201, input device 203, sound output devices 207 and 214, sensor modules 204 and 219, camera modules 205 and 212, key input device 217, indicator (not shown), or connector 208. In a certain embodiment, at least one of the elements (e.g., key input device 217 or indicator) may be omitted from the electronic device 200, or another element may be added to the electronic device 200.

[0037] The display 201 may be exposed, for example, through a significant portion of the front plate 202. In a certain embodiment, at least a portion of the display 201 may be exposed through the front plate 202 forming the first surface 210A and the first region 210D of the side surface 210C. The display 201 may be coupled to or disposed adjacent to a touch sensing circuit, a pressure sensor capable of measuring the intensity (pressure) of a touch, and/or a digitizer that detects a magnetic field type stylus pen. In a certain embodiment, at least some of the sensor modules 204 and 219, and/or at least some of the key input devices 217 may be disposed on the first region 210D and/or the second region 210E.

[0038] The input device 203 may include a microphone 203. In a certain embodiment, the input device 203 may include a plurality of microphones 203 arranged to detect the direction of a sound. The sound output devices 207 and 214 may include speakers 207 and 214. The speakers 207 and 214 may include an external speaker 207 and a call receiver 214. In a certain embodiment, the microphone 203, the speakers 207 and 214, and the connector 208 may be at least partially disposed in the internal space of the electronic device 200, and may be exposed to the external environment through at least one hole formed in the housing 210. In a certain embodiment, the hole formed in the housing 210 may be commonly used for the microphone 203 and the speakers 207 and

214. In a certain embodiment, the sound output devices 207 and 214 may include a speaker (e.g., piezo speaker) that operates in isolation from the hole formed in the housing 210.

[0039] The sensor modules 204 and 219 may generate an electrical signal or a data value corresponding to an internal operating state of the electronic device 200 or an external environmental state. The sensor modules 204 and 219 may include, for example, a first sensor module 204 (e.g., proximity sensor) and/or a second sensor module (not shown) (e.g., fingerprint sensor) disposed on the first surface 210A of the housing 210, and/or a third sensor module 219 (e.g., HRM(heart rate monitor) sensor) disposed on the second surface 210B of the housing 210. The fingerprint sensor may be disposed on the first surface 210A (e.g., home key button) of the housing 210, on a portion of the second surface 210B, and/or under the display 201. The electronic device 200 may further include a sensor module which is not shown, for example, at least one of a gesture sensor, a gyro sensor, a barometric pressure sensor, a magnetic sensor, an acceleration sensor, a grip sensor, a color sensor, an infrared (IR) sensor, a biometric sensor, a temperature sensor, a humidity sensor, a proximity sensor, or an illuminance sensor.

[0040] The camera modules 205 and 212 may include a first camera module 205 disposed on the first surface 210A of the electronic device 200, a second camera module 212 disposed on the second surface 210B, and/or a flash 213. The camera modules 205 and 212 may include one or plural lenses, an image sensor, and/or an image signal processor. The flash 213 may include, for example, a light emitting diode or a xenon lamp. In a certain embodiment, two or more lenses (wide-angle lens, ultra-wide-angle lens, or telephoto lens) and image sensors may be arranged in one surface of the electronic device 200.

[0041] The key input devices 217 may be arranged in the side surface 210C of the housing 210. According to an embodiment, the electronic device 200 may not include some or all of the above-mentioned key input devices 217, and a key input device 217 not included may be implemented on the display 201 in a different form such as a soft key. According to an embodiment, the key input devices 217 may be implemented using a pressure sensor included in the display 201.

[0042] The indicator may be disposed on, for example, the first surface 210A of the housing 210. The indicator may provide, for example, state information of the electronic device 200 in a light form (e.g., light emitting element). According to an embodiment, the light emitting element may provide a light source interacting with, for example, the operation of the camera module 205. The indicator may include, for example, an LED(light emitting diode), an IR(infrared) LED, and/or a xenon lamp.

[0043] The connector holes 208 may include a first connector hole 208 capable of accepting a connector (e.g., universal serial bus (USB) connector) for transmit-

ting and receiving power and/or data to and from an external electronic device, and/or a second connector hole (e.g., earphone jack) (not shown) capable of accepting a connector for transmitting and receiving an audio signal to and from an external electronic device.

[0044] Some of the camera modules 205 and 212, some of the sensor modules 204 and 219, or the indicator may be disposed to be exposed through the display 201. For example, the camera module 205, the sensor module 204, or the indicator may be arranged in the internal space of the electronic device 200 so as to be in contact with the external environment through an opening of the display 201 perforated up to the front plate 202 or a transmissive region. According to an embodiment, the region in which the display 201 and the camera module 205 face each other may be formed as a transmissive region having a preset transmittance as a part of the content display area. According to an embodiment, the transmissive region may be formed to have a transmittance in a range of about 5 percent to about 20 percent. This transmissive region may include a region overlapping an effective area (e.g., angle-of-view area) of the camera module 205 through which light passes for image generation with an image formed by an image sensor. For example, the transmissive region of the display 201 may include a region having a lower pixel density than surrounding regions. For example, the transmissive region may replace the opening. For example, the camera module 205 may include an under display camera (UDC). According to an embodiment, a certain sensor module 204 may be disposed in the internal space of the electronic device so as to perform its function without being visually exposed through the front plate 202. For example, in this case, the region of the display 201 facing the sensor module may not need a perforated opening.

[0045] According to an embodiment, the electronic device 200 has a bar type or plate type appearance, but the disclosure is not limited thereto. For example, the electronic device 200 illustrated may be some of a foldable electronic device, a slidable electronic device, a stretchable electronic device, and/or a rollable electronic device. The terms "foldable electronic device", "slidable electronic device", "stretchable electronic device", and/or "rollable electronic device" may refer to an electronic device allowing bending deformation of a display (e.g., the display 330 in FIG. 3), thereby enabling at least a portion to be folded, wound or rolled, at least partially expanded in area, and/or stowed within a housing (e.g., the housing 210 in FIGS. 2A and 2B). Depending on the user's needs, the foldable electronic device, the slidable electronic device, the stretchable electronic device, and/or the rollable electronic device may expand its screen display area by unfolding the display or exposing a wider area of the display to the outside,.

[0046] FIG. 3 is an exploded perspective view of the electronic device in FIG. 2A, according to an embodiment of the disclosure.

[0047] The electronic device 300 in FIG. 3 may be

similar at least in part to the electronic device 200 in FIGS. 2A and 2B, or may include other embodiments of the electronic device.

[0048] Referring to FIG. 3, the electronic device 300 (e.g., the electronic device 200 in FIG. 2A or FIG. 2B) may include a lateral member 310 (e.g., a lateral bezel structure), a first support member 311 (e.g., a bracket or a support structure), a front plate 320 (e.g., a front cover) (e.g., the front plate 202 in FIG. 2A), a display 330 (e.g., the display 201 in FIG. 2A), a substrate 340 (e.g., a printed circuit board (PCB), a flexible PCB (FPCB), or a rigid-flexible PCB (RFPCB)), a battery 350, a second support member 360 (e.g., a rear case), an antenna 370, and a rear plate 380 (e.g., a rear cover) (e.g., the rear plate 211 in FIG. 2B). In a certain embodiment, the electronic device 300 may omit at least one (e.g., the first support member 311 or the second support member 360) of the above components or may additionally include any other component. At least one of the components of the electronic device 300 may be identical to or similar to at least one of the components of the electronic device 200 in FIG. 2A or FIG. 2B, and any redundant description will be omitted below.

[0049] The first support member 311 may be disposed inside the electronic device 300 and connected to the lateral member 310, or may be formed integrally with the lateral member 310. The first support member 311 may be formed of, for example, a metal material and/or a non-metal (e.g., polymer) material. The first support member 311 may have one surface combined with the display 330 and the other surface combined with the substrate 340. The substrate 340 may be equipped with a processor (e.g., the processor 120 in FIG. 1), a memory (e.g., the memory 130 in FIG. 1), and/or an interface (e.g., the interface 177 in FIG. 1). The processor may include, for example, one or more of a central processing unit, an application processor, a graphic processing unit, an image signal processor, a sensor hub processor, or a communication processor.

[0050] The memory may include, for example, a volatile memory or a non-volatile memory.

[0051] The interface may include, for example, a high definition multimedia interface (HDMI), a universal serial bus (USB) interface, a secure digital (SD) card interface, and/or an audio interface. The interface may electrically or physically connect the electronic device 300 to an external electronic device, and may include, for example, a USB connector, an SD card/multimedia card (MMC) connector, or an audio connector.

[0052] The battery 350 is a device for supplying power to at least one component of the electronic device 300, and may include, for example, a non-rechargeable primary battery, a rechargeable secondary battery, or a fuel cell. At least a portion of the battery 350 may be disposed substantially on the same plane as the substrate 340, for example. The battery 350 may be disposed integrally within the electronic device 300. In an embodiment, the battery 350 may also be disposed detachably from the

electronic device 300.

[0053] The antenna 370 may be disposed between the rear plate 380 and the battery 350. The antenna 370 may include, for example, a near field communication (NFC) antenna, a wireless charging antenna, and/or a magnetic secure transmission (MST) antenna. The antenna 370 may, for example, perform short-range communication with an external device or wirelessly transmit and receive power required for charging. In an embodiment, the antenna structure may be formed by a part or a combination of the lateral bezel structure 310 and/or the first support member 311.

[0054] FIG. 4A is an assembly view of a speaker module, according to an embodiment of the disclosure. FIG. 4B is an assembly view of an embodiment in which a support structure is omitted from the yoke in FIG. 4A. FIG. 5A is an assembly view of the speaker module in FIG. 4A. FIG. 5B is a front perspective view of the speaker module in FIG. 4A. FIG. 5C is a rear perspective view of the speaker module in FIG. 4A. FIG. 5D is a diagram in which a magnet is disposed on one surface of a yoke, according to an embodiment of the disclosure.

[0055] According to an embodiment, as illustrated in FIG. 4A, a speaker module 400 (e.g., the audio output module 155 in FIG. 1, or the speakers 207 and 214 in FIG. 2A) may include a first vibration assembly 410, a second vibration assembly 420, at least one magnet M (e.g., a first magnet M1, a second magnet M2, and/or a third magnet M3) disposed between a first diaphragm 412 and a second diaphragm 422, and/or a yoke 440 at least a portion of which is disposed between the first vibration assembly 410 and the second vibration assembly 420. In an embodiment, the first vibration assembly 410 may include the first diaphragm 412, a first coil 411, and a first frame 413 (e.g., a first housing, a first bracket) that supports the first diaphragm 412. The second vibration assembly 420 may include the second diaphragm 422, a second coil 421, and a second frame 423 (e.g., a second housing, a second bracket) that supports the second diaphragm 422. In an embodiment, the speaker module 400 may omit at least one of the above-described components or add at least one of any other component.

[0056] In an embodiment, the speaker module 400 may be a bidirectional speaker (e.g., a dipole speaker) that radiates sound from a front surface (e.g., a surface facing the +Z direction in FIG. 5B) and a rear surface (e.g., a surface facing the -Z direction in FIG. 5B). In an embodiment, the speaker module 400 may form sound waves in both directions through vibrations of the first diaphragm 412 facing the front surface of the speaker module 400 and the second diaphragm 422 facing the rear surface of the speaker module 400. For example, the first diaphragm 412 of the first vibration assembly 410 may vibrate through an electromagnetic force acting between the first coil 411 and the magnets M1, M2, and M3 to output a first audio signal. The second diaphragm 422 of the second vibration assembly 420 may vibrate through an electromagnetic force acting between

the second coil 421 and the magnets M1, M2, and M3 to output a second audio signal. In an embodiment, the first audio signal and the second audio signal may have the same frequency or different frequencies.

[0057] In an embodiment, the first coil 411 of the first vibration assembly 410 and the second coil 421 of the second vibration assembly 420 may form a magnetic field with magnets M (e.g., the first magnet M1, the second magnet M2, and the third magnet M3) disposed inside the speaker module 400. In an embodiment, the first coil 411 and the second coil 421 may share at least one magnet M1, M2, and/or M3. Therefore, miniaturization of the speaker module 400 may be possible through space efficiency between components included in the speaker module 400.

[0058] According to an embodiment, as illustrated in FIGS. 4A, 4B, 5A, and 5B, the first coil 411 of the first vibration assembly 410 may be connected to the first diaphragm 412 (e.g., a corn-shaped diaphragm or a dom-shaped diaphragm). In an embodiment, the first coil 411 may be disposed between the first magnet M1 and the second magnet M2. As current is applied to the first coil 411, an electromagnetic force may act between the magnets M1, M2, and M3 and the first coil 411. Referring to FIGS. 6A and 6C described below, since the first coil 411 is positioned between the first magnet M1 and the second magnet M2, an electromagnetic force may act between the first and second magnets M1 and M2 and the first coil 411. Therefore, the first diaphragm 412, connected to the first coil 411, may output a first audio signal within a first frequency range as it vibrates.

[0059] According to an embodiment, as illustrated in FIGS. 4A, 4B, 5A, and 5C, the second coil 421 of the second vibration assembly 420 may be connected to the second diaphragm 422 (e.g., a cone-shaped diaphragm or a dome-shaped diaphragm). In an embodiment, the second coil 421 may be disposed between the second magnet M2 and the third magnet M3. As current is applied to the second coil 421, an electromagnetic force may act between the magnets M1, M2, and M3 and the second coil 421. Referring to FIGS. 6A and 6C described below, since the second coil 421 is positioned between the second magnet M2 and the third magnet M3, an electromagnetic force may act between the second and third magnets M2 and M3 and the second coil 421. Therefore, the second diaphragm 422, connected to the second coil 421, may output a second audio signal within a second frequency range as it vibrates.

[0060] According to an embodiment, as illustrated in FIGS. 5A, 5B, and 5C, the first diaphragm 412 may be formed to have a smaller size than the second diaphragm 422. In an embodiment, the output intensity of an audio signal generated by the second vibration assembly 420 may be greater than the output intensity of an audio signal generated by the first vibration assembly 410. For example, the amplitude of the second audio signal generated from the second diaphragm 422 of the second vibration assembly 420 may be greater than the ampli-

tude of the first audio signal generated from the first diaphragm 412 of the first vibration assembly 410. In an embodiment, the first vibration assembly 410 may be a receiver that outputs a voice signal. The second vibration assembly 420 may output various sounds required for the operation of the electronic device 200, such as music, video sounds, notification sounds, or multimedia sounds.

[0061] According to an embodiment, as illustrated in FIGS. 4A, 4B, 5A, and 5B, the first diaphragm 412 may be disposed on the first frame 413. In an embodiment, the first diaphragm 412 may be disposed on the upper surface (e.g., the +Z direction in FIG. 4A) of the first frame 413. In an embodiment, a cover member 414 may be combined with the first frame 413 in a state where the first diaphragm 412 is disposed on the first frame 413. In an embodiment, the first coil 411 may be connected to the first diaphragm 412 and positioned inside the first frame 413.

[0062] According to an embodiment, as illustrated in FIGS. 4A, 4B, 5A, 5B, and 5C, the second diaphragm 422 may be disposed on the second frame 423. In an embodiment, the second diaphragm 422 may be disposed on the lower surface (e.g., the -Z direction in FIG. 4A) of the second frame 423. In an embodiment, the second frame 423 may be combined with the yoke 440. In an embodiment, the plurality of magnets M (e.g., the first magnet M1, the second magnet M2, and/or the third magnet M3) and the second coil 421 connected to the second diaphragm 422 may be disposed in an internal space formed by combining the second frame 423 and the yoke 440.

[0063] According to an embodiment, as illustrated in FIGS. 5A and 5B, the yoke 440 may include an opening 441. In an embodiment, at least a portion of the first frame 413 may be positioned within the opening 441 of the yoke 440. In an embodiment, referring to FIGS. 6A and 6C described below, the first frame 413 may be positioned in the opening 441 of the yoke 440 and disposed on a support structure 450 (e.g., a supporting structural member or a bridge) of the yoke 440 positioned within the opening 441. In an embodiment, referring to FIGS. 8, 9A and 9B described below, the first frame 413 may be positioned at least in part within the opening 441 of the yoke 440 and disposed on a magnet (e.g., the second magnet M2) located under (e.g., in the -Z direction of FIG. 8) the yoke 440.

[0064] In an embodiment, the first frame 413 and the second frame 423 may be formed of various materials. In an embodiment, the first frame 413 and the second frame 423 may be formed of a metal material and/or a non-metal material. For example, the metal material may include aluminum, stainless steel (STS, SUS), iron, magnesium, titanium, etc. or alloy thereof. For example, the non-metal material may include a synthetic resin, ceramic, or engineering plastic.

[0065] In an embodiment, the magnet M may include the first magnet M1, the second magnet M2, and the third magnet M3. In an embodiment, the first magnet M1, the

second magnet M2, and/or the third magnet M3 may be formed of various materials, such as a neodymium magnet, an alnico magnet, or a ferrite magnet. In an embodiment, the second magnet M2 may be arranged outside the first magnet M1. The third magnet M3 may be arranged in plural numbers outside the second magnet M2. In an embodiment, the first magnet M1 and the third magnet M3 may be formed in the form of bar magnets, and the second magnet M2 may be a closed-loop magnet that surrounds the first magnet M1. The above-described shapes of the first magnet M1, the second magnet M2, and the third magnet M3 are examples, and the shapes of the first magnet M1, the second magnet M2, and the third magnet M3 may be modified variously. In addition, the magnets M1, M2, and M3 may omit at least one of the first magnet M1, the second magnet M2, and the third magnet M3, or may additionally include at least one magnet.

[0066] According to an embodiment, at least some of the plurality of magnets M1, M2, and M3 may be fixed to the yoke 440. In an embodiment, referring to FIG. 5D, the second magnet M2 and the third magnet M3 may be fixed to a second surface 440b of the yoke 440. Thus, the first frame 413 may be disposed on a first surface 440a of the yoke 440, and the magnets (e.g., the second magnet M2 and the third magnet M3) may be disposed on the second surface 440b. In an embodiment, the yoke 440 may be formed of a material that conducts magnetic force well. For example, the yoke 440 may be formed of a highly magnetic material, such as a cobalt alloy (FeCo), iron (Fe), or iron-silicon (FeSi) alloy.

[0067] According to an embodiment, as illustrated in FIG. 5B, the yoke 440, the first frame 413, the first diaphragm 412, and/or the cover member 414 may form a front surface (e.g., a surface facing the +Z direction in FIG. 5B) of the speaker module 400. In an embodiment, the second diaphragm 422 may form a rear surface (e.g., a surface facing the -Z direction in FIG. 5B) of the speaker module 400. In an embodiment, a side surface surrounding a space between the front and rear surfaces of the speaker module 400 may be formed through the second frame 423.

[0068] FIG. 6A and FIG. 6B are cross-sectional views taken along line 6a-6a of FIG. 5B. FIG. 6C is a cross-sectional view taken along line 6c-6c of FIG. 5B.

[0069] According to an embodiment, as illustrated in FIGS. 6A and 6C, the first diaphragm 412 may be combined with the first coil 411. For example, the first coil 411 may be combined with the first diaphragm 412 and at least a portion thereof may be positioned inside the first frame 413. In an embodiment, the first coil 411 may pass through the opening 441 of the yoke 440 and face magnets (e.g., the first magnet M1 and the second magnet M2) in the internal space formed by combining the yoke 440 and the second frame 423. For example, the first coil 411 may be positioned between the first magnet M1 and the second magnet M2. The first diaphragm 412 may generate sound by vibrating together with the first coil 411. The first diaphragm 412 may be formed of a thin film.

[0070] According to an embodiment, as illustrated in FIGS. 6A and 6C, the second diaphragm 422 may be combined with the second coil 421. For example, the second coil 421 may be combined with the second diaphragm 422 and face magnets (e.g., the second magnet M2 and the third magnet M3) in the internal space formed by combining the yoke 440 and the second frame 423. For example, the second coil 421 may be positioned between the second magnet M2 and the third magnet M3. The second diaphragm 422 may generate sound by vibrating together with the second coil 421. The second diaphragm 422 may be formed of a thin film.

[0071] In an embodiment, the speaker module 400 may output audio signals of different frequency ranges through the first diaphragm 412 and the second diaphragm 422. In an embodiment, the first vibration assembly 410 may be connected to a first audio hole (e.g., a receiver hole) formed in the housing 210 (e.g., the housing 210 in FIG. 2A). Audio (e.g., sound) output from the first vibration assembly 410 may be emitted to the outside of the electronic device (e.g., the electronic device 101 in FIG. 1, the electronic device 200 in FIG. 2A, and/or the electronic device 300 in FIG. 3) through the first audio hole. In an embodiment, the second vibration assembly 420 may be connected to a second audio hole (e.g., a speaker hole) formed in the housing 210 (e.g., the housing 210 in FIG. 2A). Audio (e.g., sound) output from the second vibration assembly 420 may be emitted to the outside of the electronic device (e.g., the electronic device 101 in FIG. 1, the electronic device 200 in FIG. 2A, and/or the electronic device 300 in FIG. 3) through the second audio hole.

[0072] According to an embodiment, as illustrated in FIGS. 6A and 6B, the sound output from the first vibration assembly 410 and the sound output from the second vibration assembly 420 may be emitted to the outside of the electronic device 200 through different audio channels (e.g., audio spaces). For example, the audio output from the first vibration assembly 410 may be transmitted to the first audio hole through a first audio channel P1, connected to the first audio hole, and emitted to the outside of the electronic device 200. The audio output from the second vibration assembly 420 may be transmitted to the second audio hole through a second audio channel P2, connected to the second audio hole, and emitted to the outside of the electronic device 200. In an embodiment, the first audio channel P1 and the second audio channel P2 may be formed directly in the housing 210. In an embodiment, the first audio channel P1 and the second audio channel P2 may be formed by a mechanism disposed in the housing 210. Here, the "audio channel" or "audio space" may refer to a passage that guides the transmission of sound (sound wave, audio). For example, the audio channel or audio space may refer to a physical space. The audio channel or audio space may include a space filled with a medium (e.g., air) that can transmit sound waves. Hereinafter, the transmission of sound through the audio channel or audio space may

mean that the sound is transmitted via a specific space. In an embodiment, referring to FIG. 11 described below, the first vibration assembly 410 and the second vibration assembly 420 may share one audio channel. In this case, one audio channel may be physically connected to the first audio hole and the second audio hole.

[0073] In an embodiment, referring to FIG. 6B, a hole H may be formed in the mechanism 470 (e.g., a part of the housing 210 or a mechanism disposed in the housing 210) forming the second audio channel P2. In an embodiment, a ventilation member 460 may be disposed to cover the hole H in the mechanism formed with the second audio channel P2. In an embodiment, the ventilation member 460 may include a porous hole or a mesh structure (e.g., a lattice structure) to provide air permeability between the exterior and interior of the speaker module 400. In an embodiment, the second audio channel P2 may achieve pressure equilibrium with the first audio channel P1 through the hole H and the ventilation member 460.

[0074] In an embodiment, the ventilation member 460 may be formed of a material such as nylon, polyester, metal, and may also be formed of various other materials.

[0075] In an embodiment, the processor 120 may apply current to the first coil 411 and the second coil 421 of the speaker module 400 to vibrate the first diaphragm 412 and the second diaphragm 422, thereby reproducing sounds such as music, video sounds, notification sounds, or multimedia sounds. In a certain embodiment, the processor 120 may apply current to the second coil 421 of the speaker module 400 to vibrate the second diaphragm 422, thereby reproducing sounds such as music, video sounds, notification sounds, or multimedia sounds. In an embodiment, the processor 120 may apply current to the first coil 421 of the speaker module 400 to vibrate the first diaphragm 412 in a call operation mode of the electronic device 200, thereby outputting call sounds.

[0076] According to an embodiment, to reproduce sounds such as music, video sounds, notification sounds, or multimedia sounds, the processor 120 may control the speaker module 400 to amplify sound waves in a specific frequency band so that the first vibration assembly 410 and the second vibration assembly 420 output sounds in the same phase within that frequency band. The processor 120 may apply current to the first coil 411 and the second coil 421 of the speaker module 400 to cancel out sound waves in a specific frequency band so that the first vibration assembly 410 and the second vibration assembly 420 output sounds in opposite phases within that frequency band.

[0077] According to an embodiment, as illustrated in FIG. 6C, the first diaphragm 412 may include a first surround 4122 (or edge, or peripheral area) that expands a vibration area and contributes to efficient air vibration. The first surround 4122 may have a shape that facilitates vibration of the first diaphragm 412. The first surround 4122 may be formed adjacent to an edge of the first diaphragm 412 and along the edge. The first diaphragm

412 may include a first center cap 4121 positioned substantially corresponding to the first coil 411. For example, the first center cap 4121 may contribute to determining the directionality of sound waves. The first center cap 4121 may serve to prevent foreign substances such as dust from flowing into the interior of the first coil 411.

[0078] According to an embodiment, as illustrated in FIG. 6C, the second diaphragm 422 may include a second surround 4222 (or edge, or peripheral area) that expands a vibration area and contributes to efficient air vibration. The second surround 4222 may have a shape that facilitates vibration of the second diaphragm 422. The second surround 4222 may be formed adjacent to an edge of the second diaphragm 422 and along the edge. The second diaphragm 422 may include a second center cap 4221 positioned substantially corresponding to the second coil 421. For example, the second center cap 4221 may contribute to determining the directionality of sound waves. The second center cap 4221 may serve to prevent foreign substances such as dust from flowing into the interior of the second coil 421.

[0079] According to an embodiment, the first diaphragm 412 may vibrate through an electromagnetic force acting between the first coil 411 and the magnets M1, M2, and M3. For example, the first coil 411 may be electrically connected to a printed circuit board (e.g., the substrate 340 in FIG. 3) through a conductive wire (e.g., a flexible circuit board). The first coil 411 may be supplied with power through the conductive wire so that an electromagnetic force may act on the magnets M1, M2, and M3. In an embodiment, referring to FIGS. 6A and 6C, the first coil 411 may vibrate in an up-and-down direction (e.g., the Z-axis direction in FIG. 6A) through an electromagnetic force acting on the first magnet M1 and the second magnet M2. The first diaphragm 412 may be connected to the first coil 411 and vibrate in the up-and-down direction (e.g., the Z-axis direction in FIG. 6A). Therefore, the first diaphragm 412, connected to the first coil 411, may output a first audio signal within a first frequency range as it vibrates.

[0080] According to an embodiment, the second diaphragm 422 may vibrate through an electromagnetic force acting between the second coil 421 and the magnets M1, M2, and M3. For example, the second coil 421 may be electrically connected to a printed circuit board (e.g., the substrate 340 in FIG. 3) through a conductive wire (e.g., a flexible circuit board). The second coil 421 may be supplied with power through the conductive wire so that an electromagnetic force may act on the magnets M1, M2, and M3. In an embodiment, referring to FIGS. 6A and 6C, the second coil 421 may vibrate in an up-and-down direction (e.g., the Z-axis direction in FIG. 6A) through an electromagnetic force acting on the second magnet M2 and the third magnet M3. The second diaphragm 422 may be connected to the second coil 421 and vibrate in the up-and-down direction (e.g., the Z-axis direction in FIG. 6A). Therefore, the second diaphragm 422, connected to the second coil 421, may output a

second audio signal within a second frequency range as it vibrates.

[0081] According to an embodiment, as illustrated in the aforementioned FIGS. 4A, 4B, 6A, and 6C, the first magnet M1 may be disposed between a first plate 431 and a second plate 432, which are disposed inside the speaker module 400. In an embodiment, the first plate 431 may be disposed on the first magnet M1 between the first magnet M1 and the first diaphragm 412. For example, the first plate 431 may be attached to one surface (e.g., a surface facing the +Z direction in FIG. 6A) of the magnet M (e.g., the first magnet M1) and may face the first diaphragm 412. The second plate 432 may be disposed on the magnets M1, M2, and M3 between the second diaphragm 422 and the magnets M1, M2, and M3. For example, the second plate 432 may be attached to the other surface (e.g., a surface facing the -Z direction in FIG. 6A) of the magnet M (e.g., the first magnet M1, the second magnet M2, and the third magnet M3) and may face the second diaphragm 422.

[0082] In an embodiment, the first plate 431 and the second plate 432 may include a magnetic material (e.g., a material that is magnetized in a magnetic field) that facilitates the passage of magnetic force. In an embodiment, the second magnet M2 and the third magnet M3 may be disposed between the yoke 440 and the second plate 432. In an embodiment, the yoke 440, the first plate 431, and the second plate 432 may contribute to forming a magnetic field distribution by collecting magnetic fields generated from the magnets M1, M2, and M3, the first coil 411, and the second coil 421. In an embodiment, at least one of the first plate 431 and the second plate 432 may be formed of a highly magnetic material, such as soft iron, silicon steel, ferrite, cast iron, an amorphous metal, a nano-crystalline alloy, a cobalt alloy (FeCo), iron (Fe), or iron-silicon (FeSi), such as the yoke 440.

[0083] According to an embodiment, as illustrated in FIG. 6A, at least a portion of the first frame 413 may be positioned within the opening 441 of the yoke 440. The first frame 413 positioned at least in part within the opening 441 may be enclosed with the yoke 440. Compared to a comparative embodiment in which the opening 441 for accommodating the first frame 413 is not formed in the yoke 440, the speaker module 400 in FIG. 6A may have a reduced thickness (e.g., the length in the Z-axis direction in FIG. 6A) as at least a portion of the first frame 413 is positioned within the opening 441 of the yoke 440.

[0084] In an embodiment, as illustrated in FIG. 6C, the yoke 440 may include a support structure 450 (e.g., a supporting structural member, a bridge) extended toward the opening 441. In an embodiment, the first frame 413 may be supported by the support structure 450 of the yoke 440. For example, the first frame 413 may be attached to the support structure 450 of the yoke 440 via bonding with an adhesive (e.g., a bond or a tape) or welding.

[0085] In an embodiment, the support structure 450 may be formed to extend inwardly from a side edge of the

yoke 440 defining the opening 441. The side edge may be a border of the yoke 440 defining the opening 441. For example, the support structure 450 may be formed to extend into the opening 441.

[0086] In an embodiment, the support structure 450 may form a stepped surface in the Z-axis direction of FIG. 6C with respect to the first surface 440a of the yoke 440. For example, the support structure 450 may be positioned in the -Z direction of FIG. 6C with respect to the first surface 440a of the yoke 440. In an embodiment, the first surface 440a of the yoke 440 may be a surface on which the opening 441 is formed or a surface on which the opening 441 is defined.

[0087] According to an embodiment, the speaker module 400 may cause a change in internal pressure by compressing or expanding internal air due to the vibration of the first diaphragm 412 and the second diaphragm 422. The change in internal pressure may create resistance to the movement of the first diaphragm 412 and the second diaphragm 422. The speaker module 400 of the disclosure may include a ventilation structure (e.g., a first vent hole V1 and a second vent hole V2) and induce equilibrium between the internal air pressure and the external air pressure through the ventilation structure. Therefore, the speaker module 400 may reduce the resistance to the movement of the first diaphragm 412 and the second diaphragm 422 caused by the change in internal pressure, thereby preventing or avoiding sound distortion.

[0088] According to an embodiment, as illustrated in FIG. 6A, the speaker module 400 may include the first vent hole V1 (e.g., a first space) and the second vent hole V2 (e.g., a second space). In an embodiment, the first vent hole V1 may be a part of the opening 441 of the yoke 440. For example, the first vent hole V1 may be a space remaining in the opening 441 of the yoke 440 except for a space occupied by the first frame 413. The first vent hole V1 may be a space between the first frame 413 and the border of the yoke 440 enclosing the first frame 413. In an embodiment, the change in internal pressure generated inside the speaker module 400 by the vibration of the first diaphragm 412 may achieve equilibrium with the external air pressure through the first vent hole V1.

[0089] In an embodiment, the second vent hole V2 may be formed in the second frame 423. In an embodiment, the second frame 423 may include a side surface substantially perpendicular to the first diaphragm 412 and the second diaphragm 422. In an embodiment, the second vent hole V2 may be formed in the side surface of the second frame 423. In an embodiment, the change in internal pressure generated inside the speaker module 400 by the vibration of the second diaphragm 422 may achieve equilibrium with the external air pressure through the second vent hole V2.

[0090] In an embodiment, a mesh member 4231 may be disposed in the second vent hole V2. In an embodiment, the mesh member 4231 may block foreign substances or moisture, etc., that may flow into the inside of

the speaker module from the outside of the speaker module 400. In an embodiment, the mesh member 4231 may include porous holes or a mesh structure (e.g., a lattice structure) to provide air permeability between the exterior and interior of the speaker module 400. In an embodiment, the mesh member 4231 may be formed of a material such as nylon, polyester, or metal, and may also be formed of various other materials.

[0091] FIG. 7 is a cross-sectional view taken along line 7-7 of FIG. 5B.

[0092] The speaker module 400 illustrated in FIG. 7 is a cross-sectional view taken along the line 7-7 of FIG. 5B, but it may include a yoke 540 having a different shape from the yoke 440 illustrated in FIG. 5B.

[0093] FIG. 7 may be an embodiment in which the thickness of the third magnet M'3 (e.g., the length in the Z-axis direction of FIG. 7) is formed greater than the thickness of the third magnet M3 illustrated in FIG. 6C. In this case, the yoke 540 in FIG. 7 (e.g., the yoke 440 in FIG. 4A) may have a first region 540a corresponding to the third magnet M'3 and a second region 540b corresponding to the first diaphragm 412, the former protruding in the +Z direction of FIG. 7 more than the latter. In an embodiment, the yoke 540 in FIG. 7 may have a step formed between the first region 540a and the second region 540b. For example, the second region 540b may be positioned in the -Z direction of FIG. 7 with respect to the first region 540a. The first frame 413 may be positioned in the stepped section formed in the yoke 540 so that at least a portion thereof may be positioned within an opening 541 of the yoke 540 (e.g., the opening 441 in FIG. 4A).

[0094] According to an embodiment, as illustrated in FIG. 7, the thickness of the third magnet M'3 may be formed greater than the thickness of the third magnet M3 in FIGS. 6A and 6C to increase the magnetic field strength of the third magnet M'3. In an embodiment, the thickness (e.g., length or height in the Z-axis direction of FIG. 7) of the third magnet M'3 may be formed greater than the thickness of the first magnet M1 and the thickness of the second magnet M2. Therefore, the intensity of the electromagnetic force acting between the third magnet M'3 of FIG. 7 and the first and second coils 411 and 421 may be increased, thereby increasing the output intensity of the audio signals that may be output through the first vibration assembly 410 and the second vibration assembly 420.

[0095] Although the above description assumes that the thickness of the third magnet M'3 in FIG. 7 is formed greater than the thickness of the third magnet M3 in FIGS. 6A and 6C, the disclosure may not be limited thereto. In an embodiment, the thickness of the first magnet M1 in FIG. 7 may be formed greater than the thickness of the first magnet M1 in FIG. 6A. In an embodiment, the thickness of the second magnet M2 in FIG. 7 may be formed greater than the thickness of the second magnet M2 in FIG. 6A.

[0096] FIG. 8 is a diagram of an embodiment in which

the first frame is supported by the magnet in FIG. 4B. FIG. 9A is a cross-sectional view taken along line 9a-9a of FIG. 8. FIG. 9B is a cross-sectional view taken along line 9b-9b of FIG. 8.

[0097] A yoke 640 in FIGS. 8 to 9B is an embodiment in which the support structure 450 of the yoke 440 described above through FIGS. 4A, 5A to 6C is omitted. In an embodiment, the embodiment of FIGS. 8 to 9B may be the speaker module 400 illustrated in FIG. 4B. The description of the components identical or similar to the above-described components will be omitted in the description below.

[0098] According to an embodiment, as illustrated in FIGS. 8, 9A, and 9B, the first frame 413 may be positioned at least in part in an opening 641 of the yoke 640 (e.g., the yoke 440 in FIG. 4A, the yoke 640 in FIG. 4B) and attached to a magnet M (e.g., the second magnet M2) located under (e.g., the -Z direction of FIG. 9A) of the yoke 640. For example, the first frame 413 may be attached to the magnet M (e.g., the second magnet M2) via an adhesive (e.g., a bond or a tape). In comparison with a comparative embodiment in which the opening 641 for accommodating the first frame 413 is not formed in the yoke 640, the speaker module 400 in FIGS. 8 to 9B may have a reduced thickness (e.g., the length in the Z-axis direction of FIG. 9A) as at least a portion of the first frame 413 is positioned in the opening 641 of the yoke 640.

[0099] In the above description, the first frame 413 is described as being disposed on the second magnet M2, but the disclosure may not be limited thereto. In an embodiment, the first frame 413 may be disposed on the first magnet M1 and/or the third magnet M3 depending on the shape of the opening 641 of the yoke 640.

[0100] FIG. 10 is a diagram of an embodiment in which the first diaphragm is supported by the yoke, according to an embodiment of the disclosure.

[0101] FIG. 10 may be an embodiment in which the first frame 413 described through FIGS. 4A to 9 is omitted and a separate support member 742 on which the first diaphragm 412 is placed is formed on a yoke 740 (e.g., the yoke 440 in FIG. 4A or the yoke 640 in FIG. 9A).

[0102] According to an embodiment, the yoke 740 may include the support member 742 (e.g., a mounting member or a support structure) on which the first diaphragm 412 is disposed, and an opening 741 (e.g., the opening 441 in FIG. 4A, the opening 641 in FIG. 9A) in which the first coil 411 is accommodated. In an embodiment, the first diaphragm 412 may be fixed to the support member 742 of the yoke 740. For example, the first surround 4122 of the first diaphragm 412 may be fixed to the support member 742. Thereafter, the cover member 414 may be disposed on the support member 742 to cover a portion of the first surround 4122 of the first diaphragm 412.

[0103] In an embodiment, the support member 742 may be formed integrally with the yoke 740. For example, the support member 742 may be a portion formed by bending a certain region of the yoke 740 adjacent to the

opening 741 in a direction (e.g., the +Z direction in FIG. 10) substantially perpendicular to one surface of the yoke 740. In a certain embodiment, the support member 742 may be formed separately from the yoke 740 and then combined with the yoke 740 via welding or bonding. Therefore, the first frame 413 supporting the first diaphragm 412 may be omitted, and the production cost of the speaker module 400 may be reduced by supporting the first diaphragm 412 through a portion of the yoke 740 (e.g., the support member 742).

[0104] FIG. 11 is a diagram of a structure in which the first vibration assembly and the second vibration assembly share a ventilation space, according to an embodiment of the disclosure.

[0105] According to an embodiment, as illustrated in FIG. 11, a yoke 840 (e.g., the yoke 440 in FIG. 4A, the yoke 540 in FIG. 7, the yoke 640 in FIG. 9A, or the yoke 740 in FIG. 10) may include an opening 841. In an embodiment, the yoke 840 may include a support structure (e.g., the support structure 450 in FIG. 6A). In an embodiment, the support structure (e.g., the support structure 450 in FIG. 6A) may form a stepped surface with one surface of the yoke 840 where the opening 841 is formed. For example, the support structure may be positioned in the -Z direction of FIG. 11 with respect to one surface of the yoke 840 where the opening 841 is formed. In an embodiment, the first frame 413 of the first vibration assembly 410 may be attached to the support structure of the yoke 840. The first frame 413 may be disposed on the support structure to cover the opening 841 of the yoke 840, as illustrated in FIG. 11. In this case, the thickness (e.g., the length in the Z-axis direction in FIG. 11) of the speaker module 400 (e.g., the audio output module 155 in FIG. 1 or the speakers 207 and 214 in FIG. 2A) may be reduced as the first frame 413 is positioned in a space formed by the stepped surface formed by the support structure and the yoke 840.

[0106] In an embodiment, the yoke 840 may not include the support structure 450 of FIG. 4A. In this case, the first frame 413 may be disposed on one surface of the yoke 840 where the opening 841 is formed, and may cover the opening 841 as illustrated in FIG. 11.

[0107] According to an embodiment, as illustrated in FIG. 11, a third vent hole V3 (e.g., a third space) formed through the magnet M (e.g., the first magnet M1, the second magnet M2, and/or the third magnet M3) may be connected to the second vent hole V2 formed in the second frame 423. In an embodiment, the third vent hole V3 may be a space between the first magnet M1, the second magnet M2, and the third magnet M3. In a certain embodiment, when one magnet M is disposed in the space formed by the yoke 840 and the second frame 423, the third vent hole V3 may be a hole formed in the magnet M.

[0108] In an embodiment, the second plate 432 may be disposed on the magnets M1, M2, and M3 between the second diaphragm 422 and the magnets M1, M2, and M3. For example, the second plate 432 may be attached

to the other surface (e.g., the surface facing the -Z direction in FIG. 11) of the magnet M (e.g., the first magnet M1, the second magnet M2, and the third magnet M3) so as to face the second diaphragm 422. In an embodiment, the second plate 432 may include an opening corresponding to the third vent hole V3 formed through the magnet M. In an embodiment, a ventilation member 460 (e.g., the ventilation member 460 in FIG. 6B) may be disposed in the opening of the second plate 432.

[0109] In an embodiment, the internal pressure change caused by the vibration of the first diaphragm 412 may achieve pressure equilibrium through the third vent hole V3, the space between the second plate 432 and the second diaphragm 422, and the second vent hole V2. In an embodiment, the space between the first plate 431 and the first diaphragm 412 may be ventilated to the outside of the speaker module 400 through the third vent hole V3, the ventilation member 460, the space between the second plate 432 and the second diaphragm 422, and the second vent hole V2, thereby achieving pressure equilibrium. In an embodiment, the internal pressure change caused by the vibration of the second diaphragm 422 may achieve pressure equilibrium through the second vent hole V2. Therefore, the resistance to the movement of the first diaphragm 412 and the second diaphragm 422 due to the change in internal pressure of the speaker module 400 is reduced, so that sound distortion may be prevented or avoided.

[0110] According to an embodiment, the processor 120 may apply current to the first coil 411 of the speaker module 400 in a call operation mode of the electronic device 200 to vibrate the first diaphragm 412 and thereby output a call sound. The processor 120 may apply current to the second coil 421 to vibrate the second diaphragm 422 and thereby control a media operation (e.g., music, video sound, notification sound, or multimedia sound output). Therefore, in an embodiment in which the first vibration assembly 410 and the second vibration assembly 420 share one audio channel, such as the speaker module 400 in FIG. 11, the first vibration assembly 410 and the second vibration assembly 420 may operate individually according to an operation scenario (e.g., a call operation or a media operation).

[0111] The speaker module 400 may be a bidirectional speaker (e.g., a dipole speaker) that radiates sound from the front and rear surfaces thereof. In the bidirectional speaker, the first vibration assembly 410 and the second vibration assembly 420 may be disposed above and below the magnets M1, M2, and M3, respectively. The bidirectional speaker may have a structure in which the first vibration assembly 410, the magnets M1, M2, and M3, and the second vibration assembly 420 are stacked in the thickness direction of the speaker module 400. This stack structure may increase the thickness of the speaker module 400. Therefore, the electronic device 101, 200, or 300 may have an increased thickness (e.g., in the Z-axis direction in FIG. 2A) to accommodate the speaker module 400.

[0112] Meanwhile, in the case of reducing the thicknesses of the magnets M1, M2, and M3 or reducing the vibration widths of the first diaphragm 412 of the first vibration assembly 410 and the second diaphragm 422 of the second vibration assembly 420 so as to reduce the thickness of the speaker module 400, the audio performance of the speaker module 400 may deteriorate.

[0113] The technical problems to be solved by the disclosure are not limited to those mentioned above, and other technical problems not mentioned can be clearly understood from the description herein by a person having ordinary knowledge in the technical field to which the disclosure belongs.

[0114] A dipole speaker module 155, 207, 214, or 400 according to an embodiment of the disclosure may include a first vibration assembly 410 including a first coil 411, a first diaphragm 412 connected to the first coil, and a first frame 413 on which the first diaphragm is disposed. The dipole speaker module may include a second vibration assembly 420 including a second coil 421 and a second diaphragm 422, the second diaphragm connected to the second coil, positioned opposite to the first diaphragm, and larger in size than the first diaphragm. The dipole speaker module may include a magnet M1, M2, or M3 facing the first coil and the second coil between the first diaphragm and the second diaphragm. The dipole speaker module may include a yoke, a portion of which is disposed between the magnet and the first diaphragm, including an opening in which a portion of the first frame is accommodated. The first diaphragm of the first vibration assembly may vibrate through an electromagnetic force acting between the first coil and the magnet to output a first audio signal. The second diaphragm of the second vibration assembly may vibrate through an electromagnetic force acting between the second coil and the magnet to output a second audio signal.

[0115] In an embodiment, the yoke may include a support structure 450 extending inwardly from a side edge defining the opening. The first frame may be attached to the support structure of the yoke.

[0116] In an embodiment, the support structure may form a stepped surface with a surface defining the opening of the yoke.

[0117] In an embodiment, an interior and an exterior of the speaker module may be connected through a space V1 between the opening and the first frame.

[0118] In an embodiment, the second vibration assembly may include a second frame 423 supporting the second diaphragm. The second frame may include a vent hole V2 connecting an interior and an exterior of the speaker module.

[0119] In an embodiment, the second frame may include a side surface substantially perpendicular to the first and second diaphragms. The vent hole may be formed on the side surface of the second frame.

[0120] In an embodiment, the dipole speaker module may further include a mesh member 4231 disposed in the

vent hole.

[0121] In an embodiment, the first frame may be accommodated in the opening of the yoke and be attached to the magnet.

[0122] In an embodiment, the magnet may include a first magnet M1, a second magnet M2 disposed outside the first magnet, and a third magnet M3 disposed outside the second magnet. The first coil of the first vibration assembly may be disposed between the first and second magnets. The second coil of the second vibration assembly may be disposed between the second and third magnets.

[0123] In an embodiment, a thickness of the third magnet may be greater than thicknesses of the first and second magnets.

[0124] In an embodiment, an output intensity of the second audio signal generated by the second vibration assembly may be greater than an output intensity of the first audio signal generated by the first vibration assembly.

[0125] In an embodiment, the yoke, the first frame, and the first diaphragm may form one surface of the speaker module. The second diaphragm may form the opposite surface of the speaker module.

[0126] In an embodiment, the dipole speaker module may further include a first plate 431 attached to one surface of the magnet, facing the first diaphragm, and including a magnetic material, and a second plate 432 attached to other surface opposite to the one surface of the magnet, facing the second diaphragm, and including the magnetic material.

[0127] In an embodiment, the second magnet may be formed in a closed-loop shape.

[0128] An electronic device according to an embodiment of the disclosure may include a housing 210 and a dipole speaker module 155, 207, 214, or 400 disposed in the housing. The dipole speaker module may include a first vibration assembly 410 including a first coil 411, a first diaphragm 412 connected to the first coil, and a first frame 413 on which the first diaphragm is disposed. The dipole speaker module may include a second vibration assembly 420 including a second coil 421 and a second diaphragm 422, the second diaphragm connected to the second coil, positioned opposite to the first diaphragm, and larger in size than the first diaphragm. The dipole speaker module may include a magnet M1, M2, or M3 facing the first coil and the second coil between the first diaphragm and the second diaphragm. The dipole speaker module may include a yoke, a portion of which is disposed between the magnet and the first diaphragm, including an opening in which a portion of the first frame is accommodated. The first diaphragm of the first vibration assembly may vibrate through an electromagnetic force acting between the first coil and the magnet to output a first audio signal. The second diaphragm of the second vibration assembly may vibrate through an electromagnetic force acting between the second coil and the magnet to output a second audio

signal.

[0129] In an embodiment, the housing may include a first audio hole connected to the first vibration assembly to emit the first audio signal generated from the first vibration assembly, and a second audio hole connected to the second vibration assembly to emit the second audio signal generated from the second vibration assembly.

[0130] In an embodiment, the yoke may include a support structure 450 extending inwardly from a side edge defining the opening. The first frame may be attached to the support structure of the yoke.

[0131] In an embodiment, the support structure may form a stepped surface with a surface defining the opening of the yoke.

[0132] In an embodiment, an interior and an exterior of the speaker module may be connected through a space V1 between the opening and the first frame.

[0133] In an embodiment, the second vibration assembly may include a second frame 423 supporting the second diaphragm. The second frame may include a vent hole V2 connecting an interior and an exterior of the speaker module.

[0134] According to an embodiment of the disclosure, at least a portion of the frame 413 supporting the diaphragm 412 of the vibration assembly 410 may be accommodated in the opening 441 formed in the yoke 440 of the speaker module 400. Accordingly, compared to an embodiment in which the opening 441 is not formed in the yoke 440, the speaker module 400 may have a reduced thickness as a stacked section of components constituting the speaker module 400 is reduced.

[0135] The effects obtainable from the disclosure are not limited to those mentioned above, and other effects not mentioned will be clearly understood from the description herein by a person having ordinary skill in the art to which the disclosure belongs.

[0136] Various embodiments of the disclosure and the terms used herein are not intended to limit the technological features set forth herein to particular embodiments and should be understood as including various changes, equivalents, or replacements for a corresponding embodiment. In relation to the description of the drawings, similar reference numerals may be used to refer to similar or related elements. A singular form of a noun corresponding to an item may include one or more of the things, unless the relevant context clearly indicates otherwise. As used herein, each of such phrases as "A or B", "at least one of A and B", "at least one of A or B", "A, B, or C", "at least one of A, B, and C", and "at least one of A, B, or C" may include any one of, or all possible combinations of the items enumerated together in a corresponding one of the phrases. As used herein, such terms as "1st" and "2nd", or "first" and "second" may be used to simply distinguish a corresponding component from another, and does not limit the components in other aspect (e.g., importance or order). If a particular (e.g., first) element is referred to, with or without the term

"operatively" or "communicatively", as "coupled" or "connected" to another (e.g., second) element, it means that the particular element may be connected to another element directly (e.g., wiredly), wirelessly, or via a third element.

[0137] According to various embodiments, each component (e.g., a module or a program) of the above-described components may include a single entity or multiple entities. According to various embodiments, one or more of the above-described components may be omitted, or one or more other components may be added. Alternatively or additionally, a plurality of components (e.g., modules or programs) may be integrated into a single component. In such a case, the integrated component may still perform one or more functions of each of the plurality of components in the same or similar manner as they are performed by a corresponding one of the plurality of components before the integration. According to various embodiments, operations performed by the module, the program, or another component may be carried out sequentially, in parallel, repeatedly, or heuristically, or one or more of the operations may be executed in a different order or omitted, or one or more other operations may be added.

[0138] It will be understood that the disclosure contemplates and includes, in addition to the embodiments disclosed above, embodiments based on any combination of two or more of the above embodiments, and embodiments including any combination of the above features. That is, the absence of an explicit indication that two features may be combined or that two embodiments may be combined does not mean that such a combination is not envisioned, but rather that such a combination is intended to be included herein.

Claims

1. A dipole speaker module comprising:

a first vibration assembly including a first coil, a first diaphragm connected to the first coil, and a first frame on which the first diaphragm is disposed;

a second vibration assembly including a second coil and a second diaphragm, the second diaphragm connected to the second coil, positioned opposite to the first diaphragm, and larger in size than the first diaphragm;

a magnet facing the first coil and the second coil between the first diaphragm and the second diaphragm; and

a yoke, a portion of which is disposed between the magnet and the first diaphragm, including an opening in which a portion of the first frame is accommodated,

wherein the first diaphragm of the first vibration assembly vibrates through an electromagnetic

- force acting between the first coil and the magnet to output a first audio signal, and wherein the second diaphragm of the second vibration assembly vibrates through an electromagnetic force acting between the second coil and the magnet to output a second audio signal.
2. The dipole speaker module of claim 1, wherein the yoke comprises a support structure extending inwardly from a side edge defining the opening, and wherein the first frame is attached to the support structure of the yoke.
 3. The dipole speaker module of claim 2, wherein the support structure forms a stepped surface with a surface defining the opening of the yoke.
 4. The dipole speaker module of claim 1, wherein an interior and an exterior of the speaker module are connected through a space between the opening and the first frame.
 5. The dipole speaker module of claim 1, wherein the second vibration assembly includes a second frame supporting the second diaphragm, and wherein the second frame includes a vent hole connecting an interior and an exterior of the speaker module.
 6. The dipole speaker module of claim 5, wherein the second frame includes a side surface substantially perpendicular to the first and second diaphragms, and wherein the vent hole is formed on the side surface of the second frame.
 7. The dipole speaker module of claim 5, further comprising: a mesh member disposed in the vent hole.
 8. The dipole speaker module of claim 1, wherein the first frame is accommodated in the opening of the yoke and is attached to the magnet.
 9. The dipole speaker module of claim 1, wherein the magnet comprises a first magnet, a second magnet disposed outside the first magnet, and a third magnet disposed outside the second magnet,

wherein the first coil of the first vibration assembly is disposed between the first and second magnets, and

wherein the second coil of the second vibration assembly is disposed between the second and third magnets.
 10. The dipole speaker module of claim 9, wherein a thickness of the third magnet is greater than thick-
- nesses of the first and second magnets.
11. The dipole speaker module of claim 1, wherein an output intensity of the second audio signal generated by the second vibration assembly is greater than an output intensity of the first audio signal generated by the first vibration assembly.
 12. The dipole speaker module of claim 1, wherein the yoke, the first frame, and the first diaphragm form one surface of the speaker module, and wherein the second diaphragm forms the opposite surface of the speaker module.
 13. The dipole speaker module of claim 5, further comprising:

a first plate attached to one surface of the magnet, facing the first diaphragm, and including a magnetic material; and

a second plate attached to other surface opposite to the one surface of the magnet, facing the second diaphragm, and including the magnetic material.
 14. The dipole speaker module of claim 9, wherein the second magnet is formed in a closed-loop shape.
 15. An electronic device comprising:

a housing; and

a dipole speaker module disposed in the housing,

the dipole speaker module comprising:

a first vibration assembly including a first coil, a first diaphragm connected to the first coil, and a first frame on which the first diaphragm is disposed,

a second vibration assembly including a second coil and a second diaphragm, the second diaphragm connected to the second coil, positioned opposite to the first diaphragm, and larger in size than the first diaphragm,

a magnet facing the first coil and the second coil between the first diaphragm and the second diaphragm, and

a yoke, a portion of which is disposed between the magnet and the first diaphragm, including an opening in which a portion of the first frame is accommodated,

wherein the first diaphragm of the first vibration assembly vibrates through an electromagnetic force acting between the first coil and the magnet to output a first audio signal, and

wherein the second diaphragm of the sec-

ond vibration assembly vibrates through an electromagnetic force acting between the second coil and the magnet to output a second audio signal.

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FIG. 1

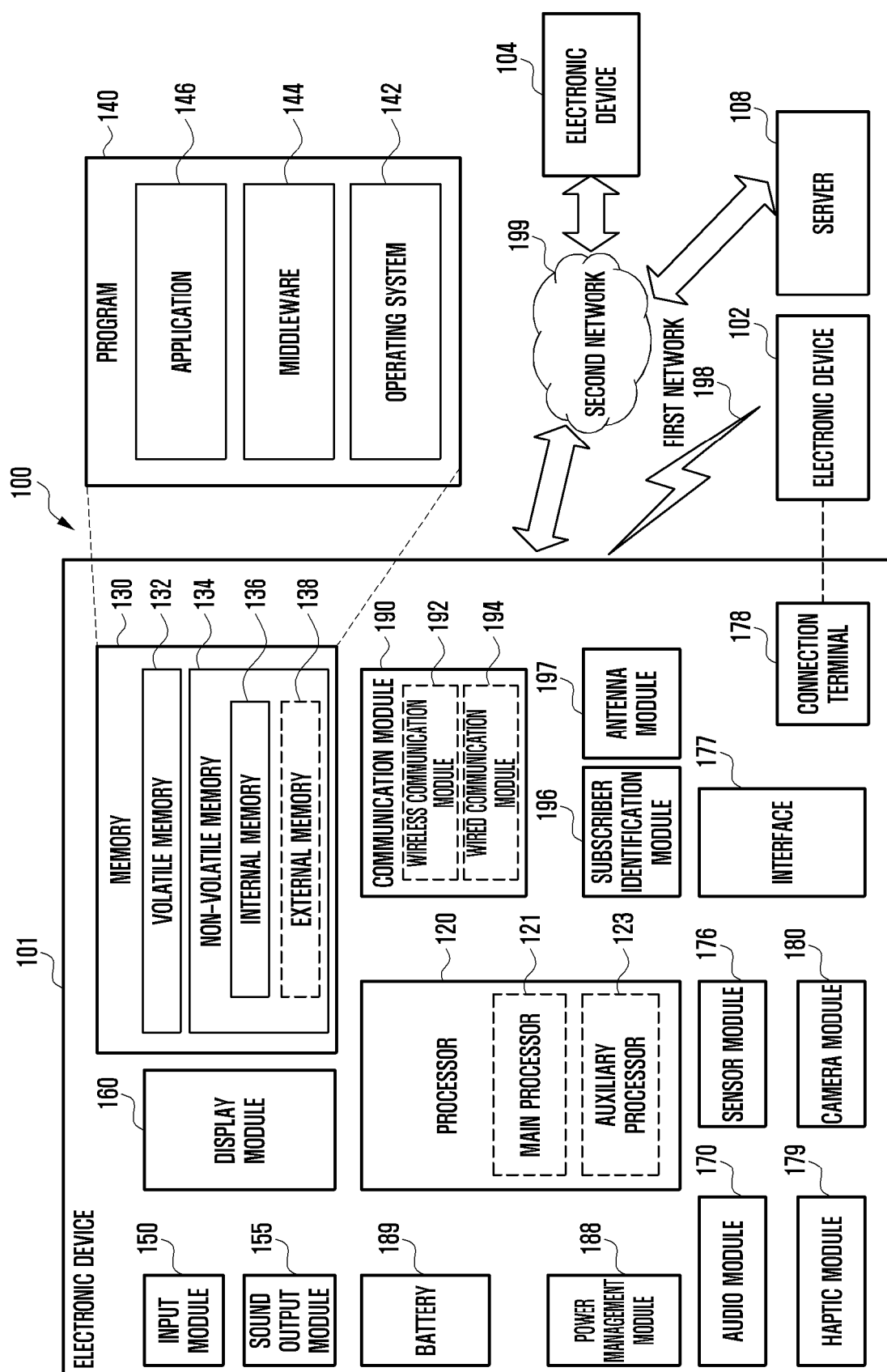


FIG. 2A

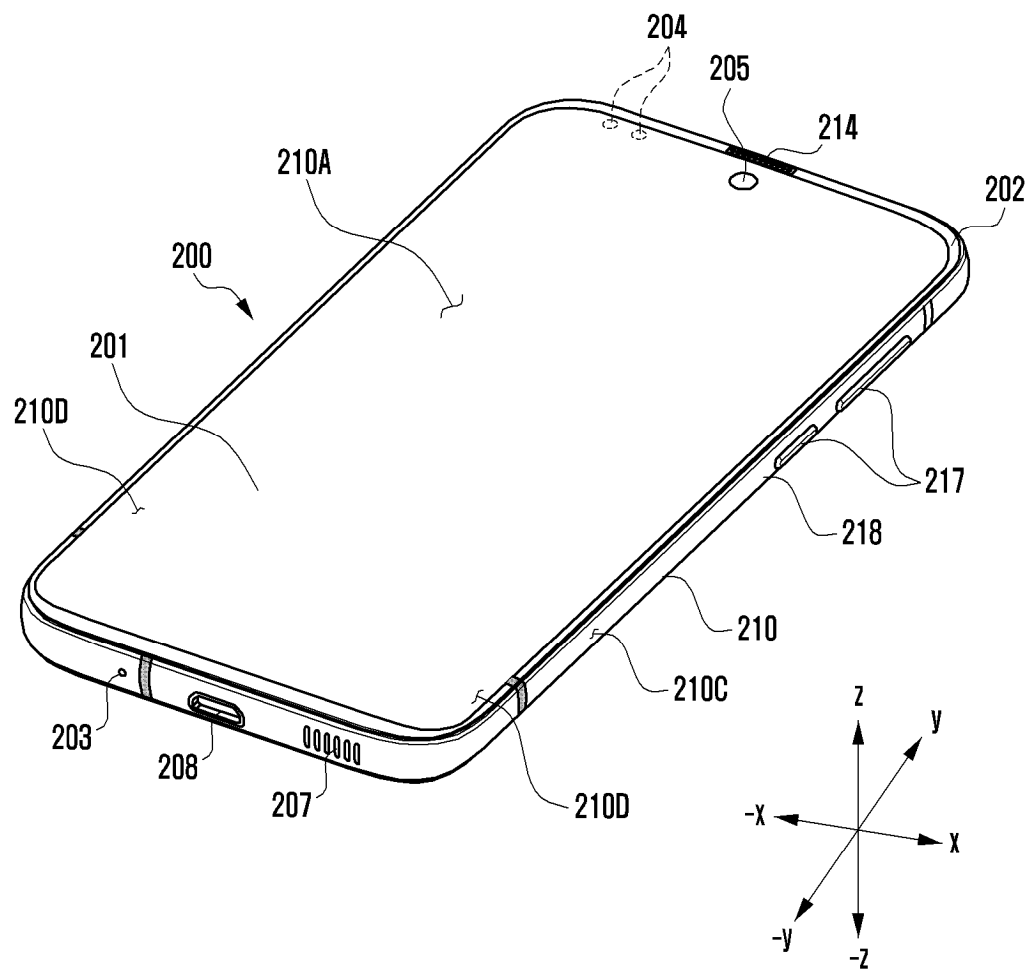


FIG. 2B

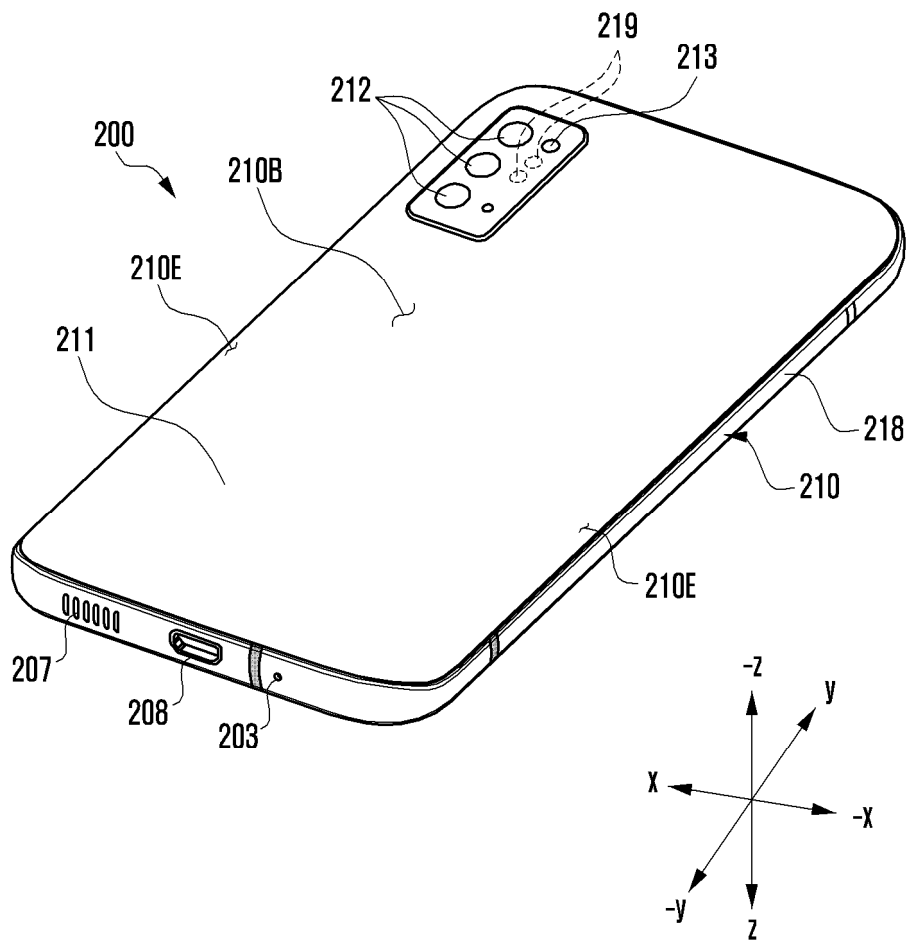


FIG. 3

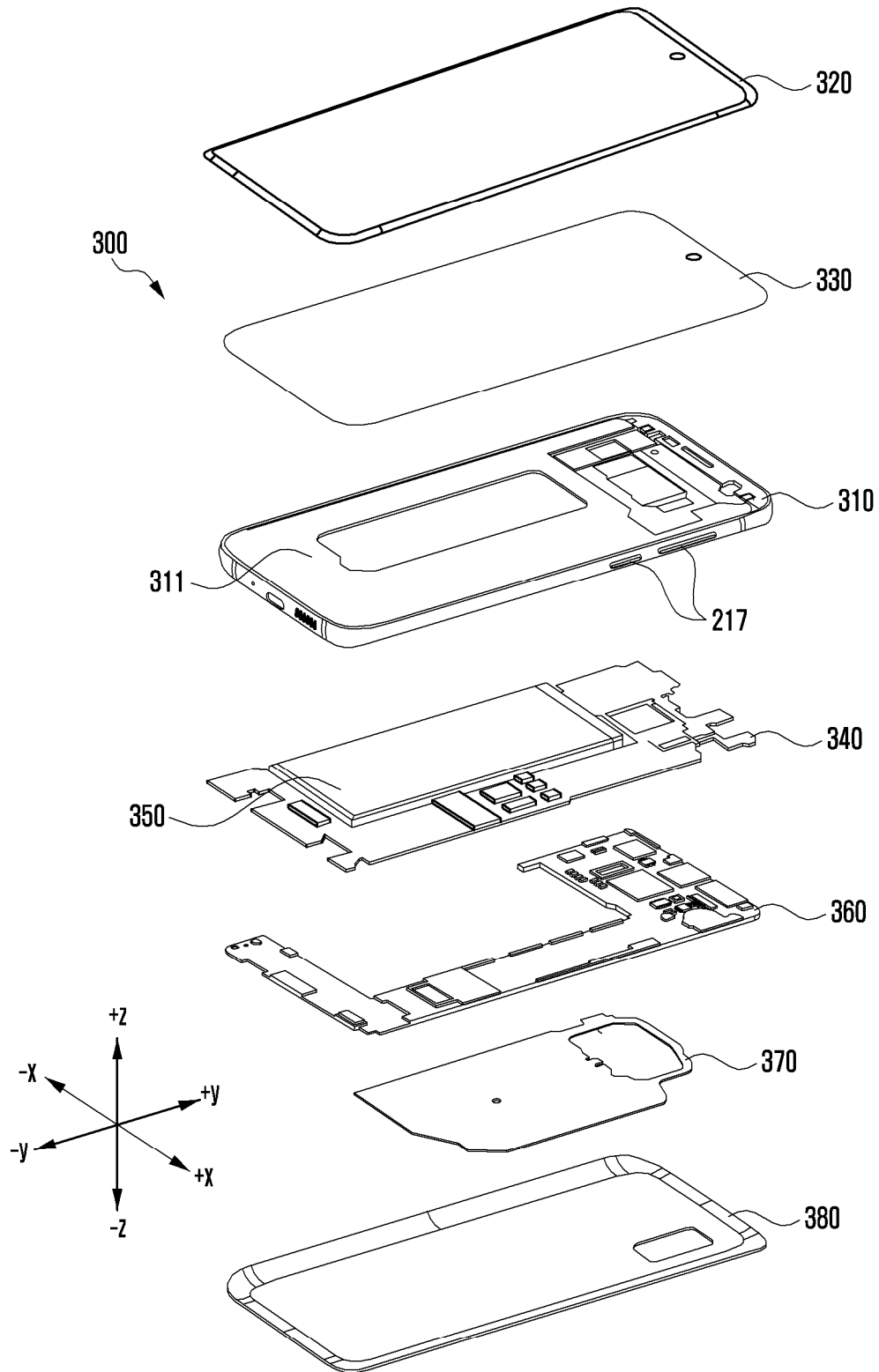


FIG. 4B

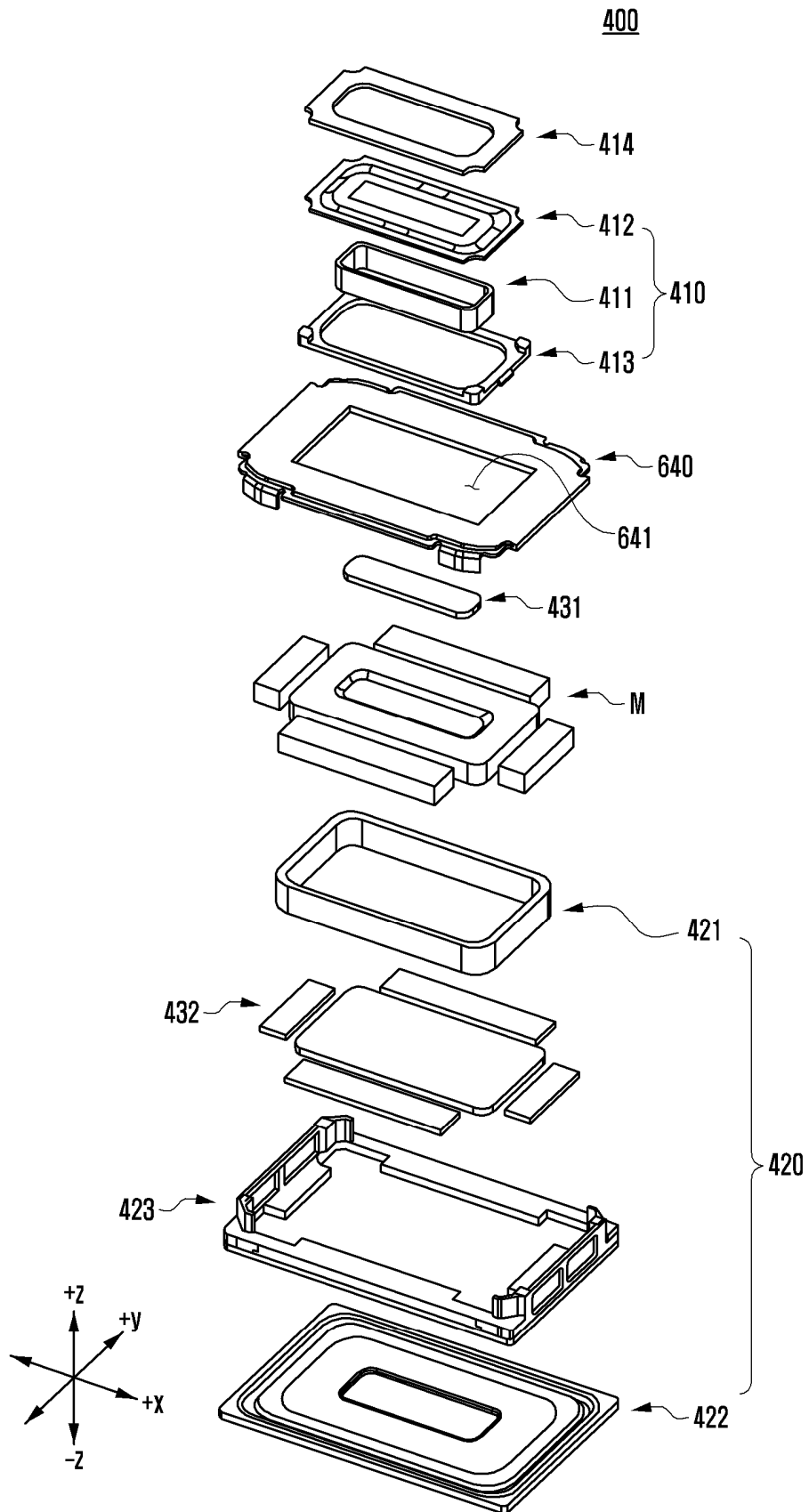


FIG. 5A

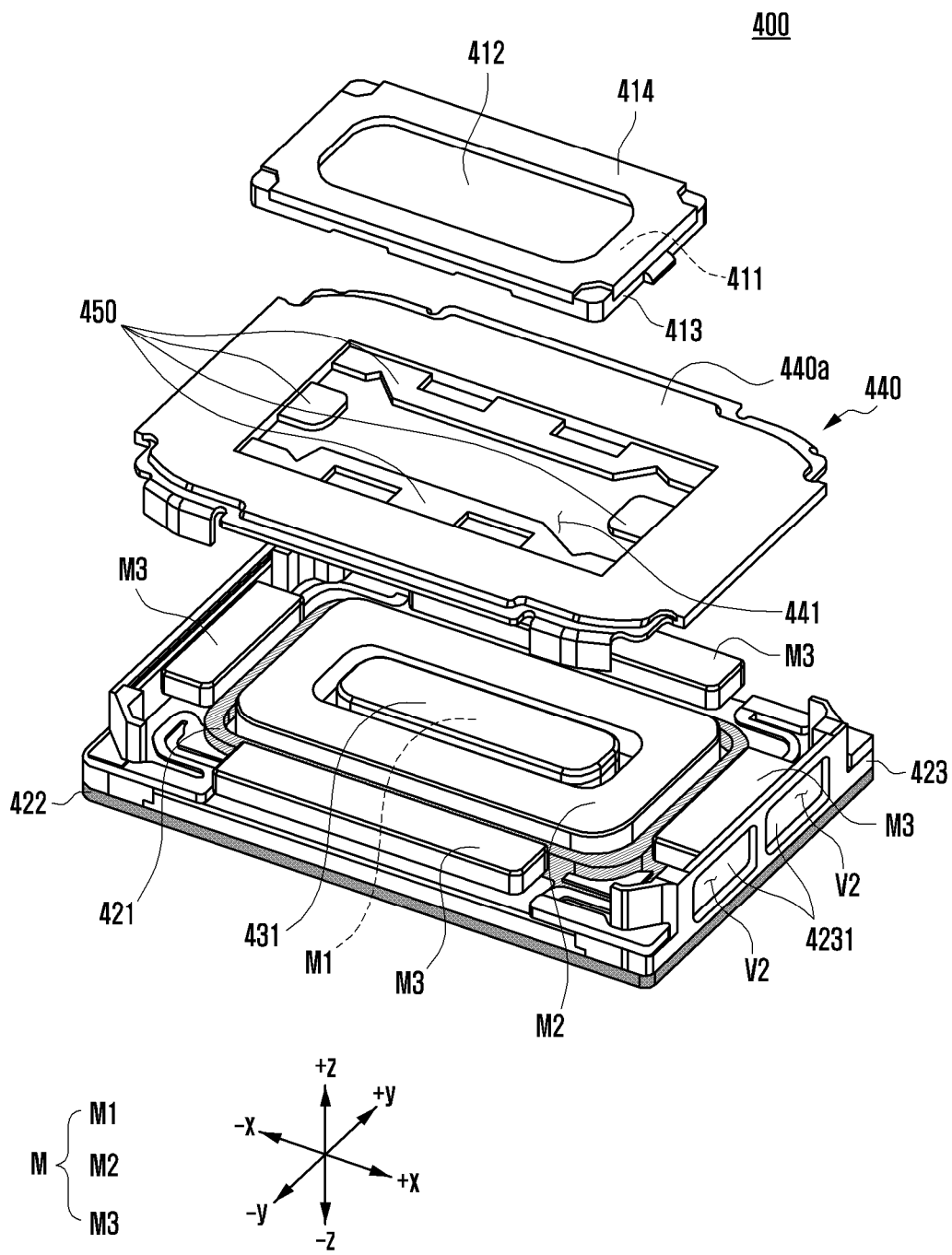


FIG. 5B

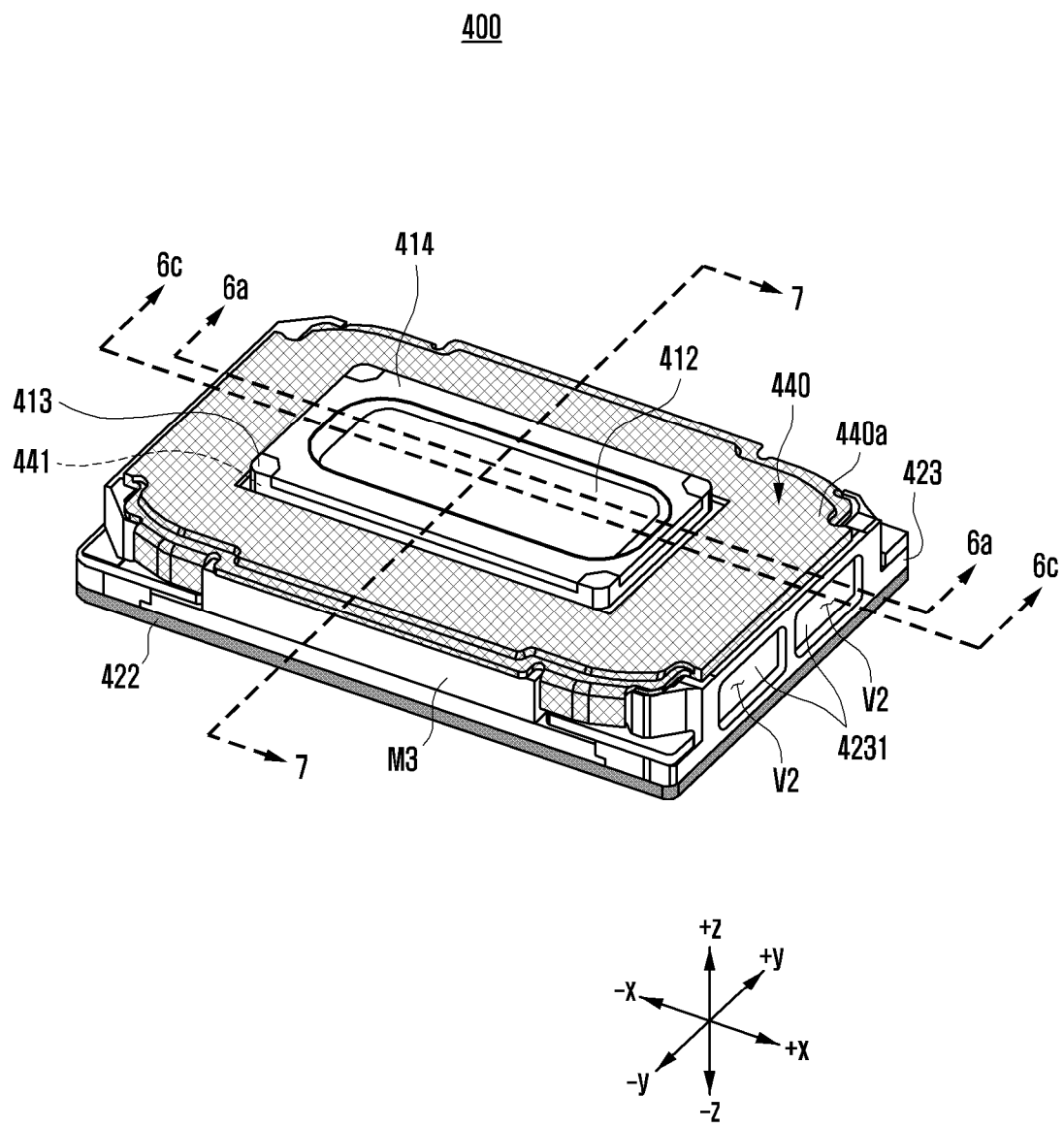


FIG. 5C

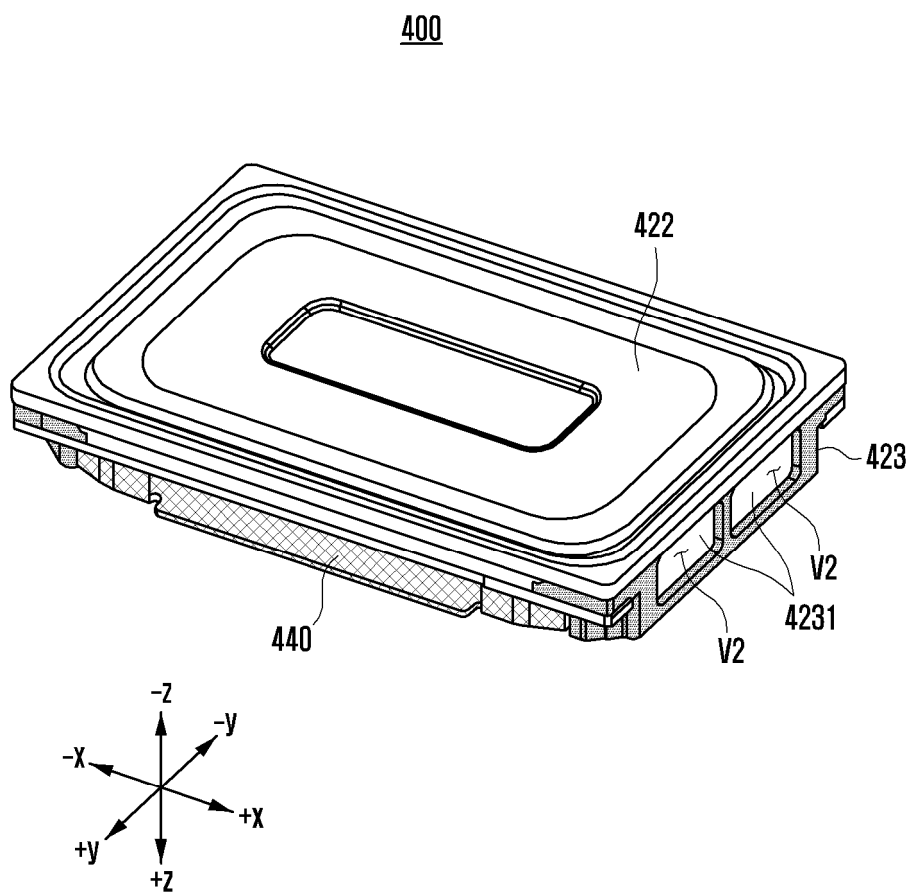


FIG. 5D

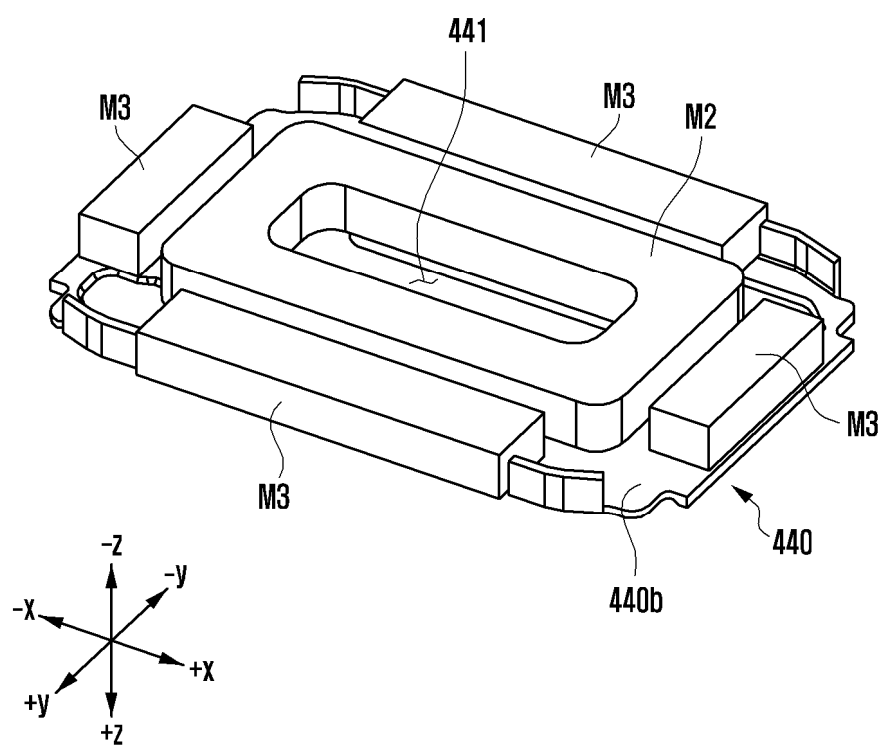


FIG. 6A

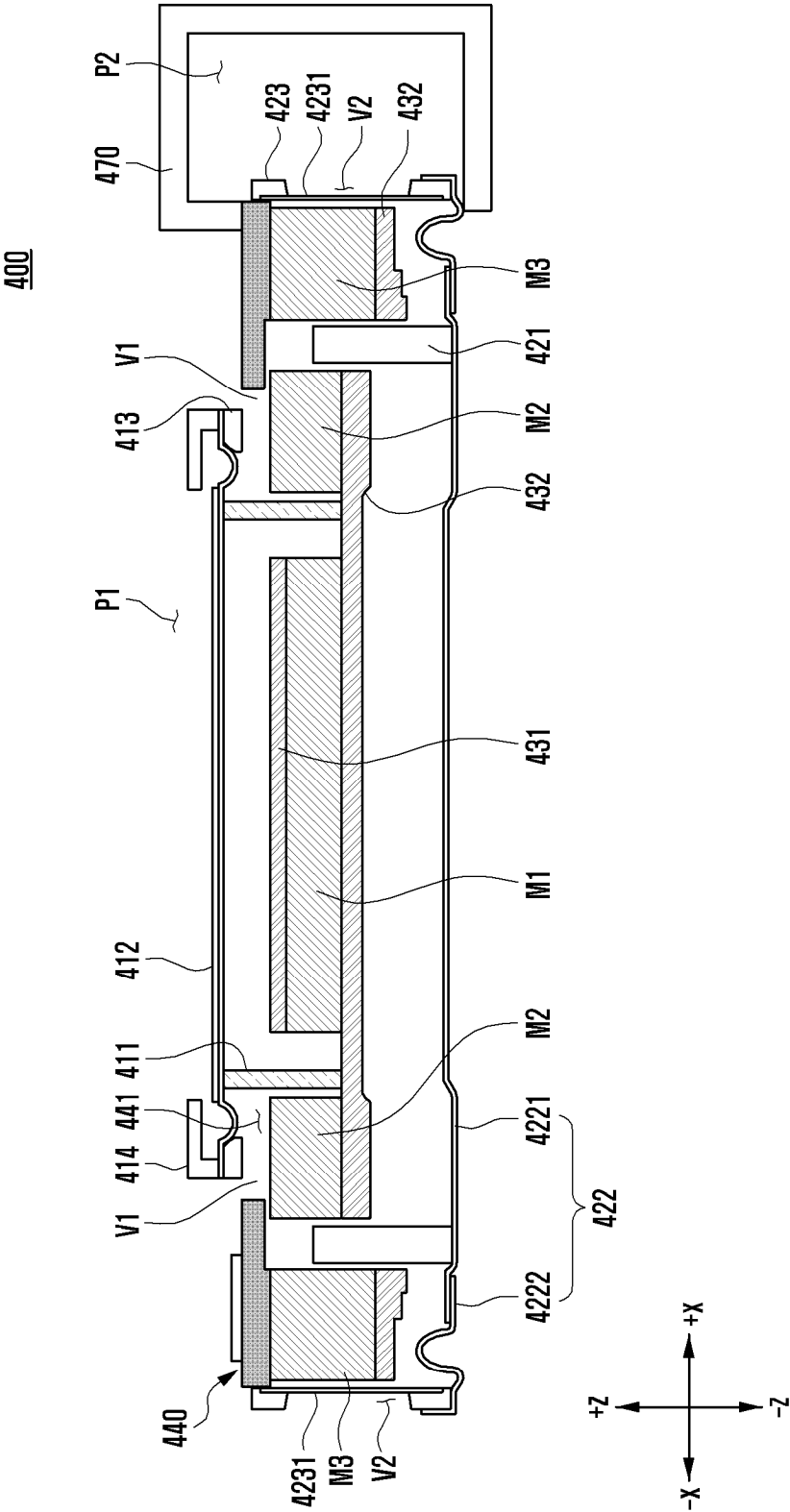


FIG. 6B

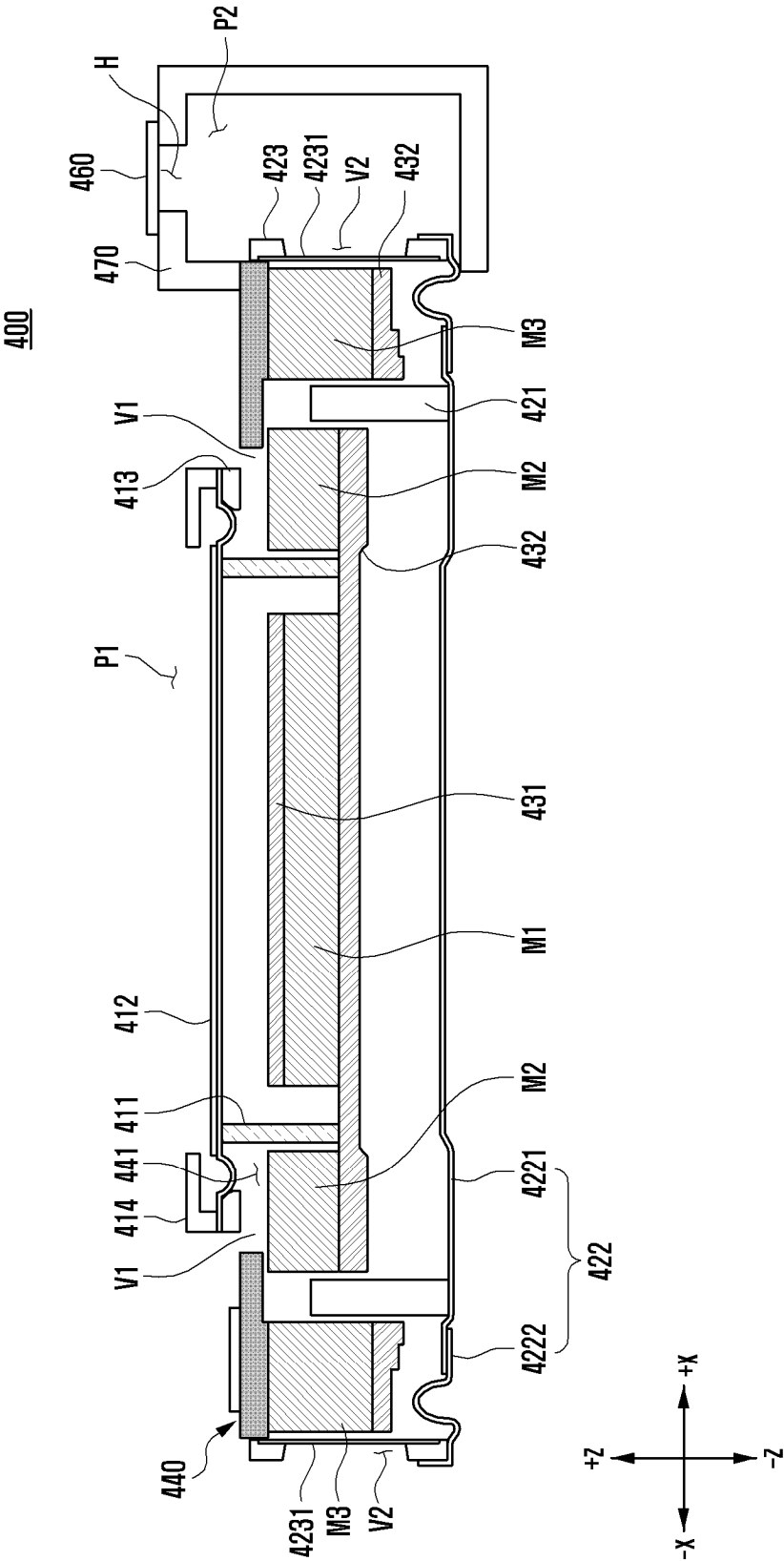


FIG. 6C

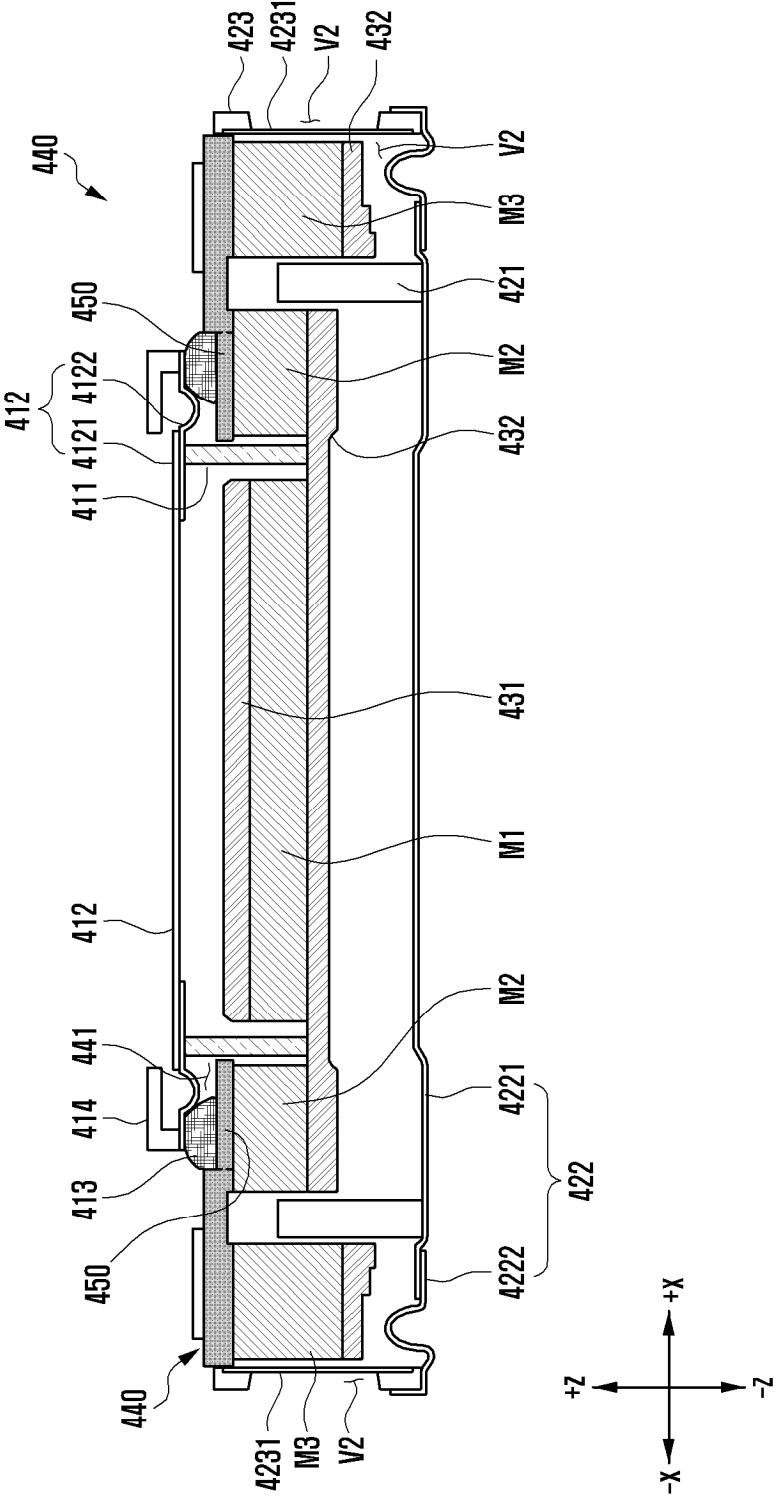


FIG. 7

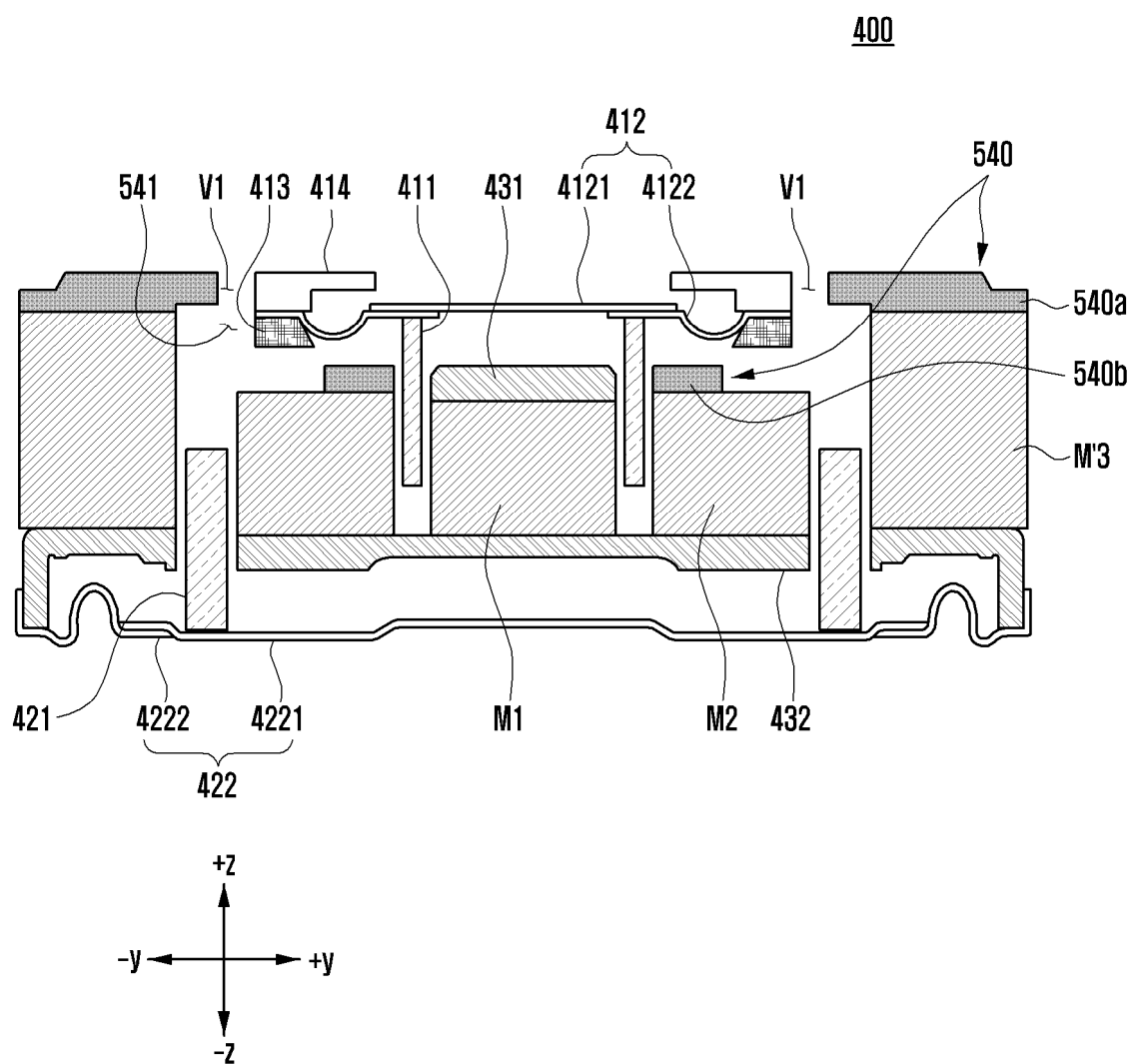


FIG. 8

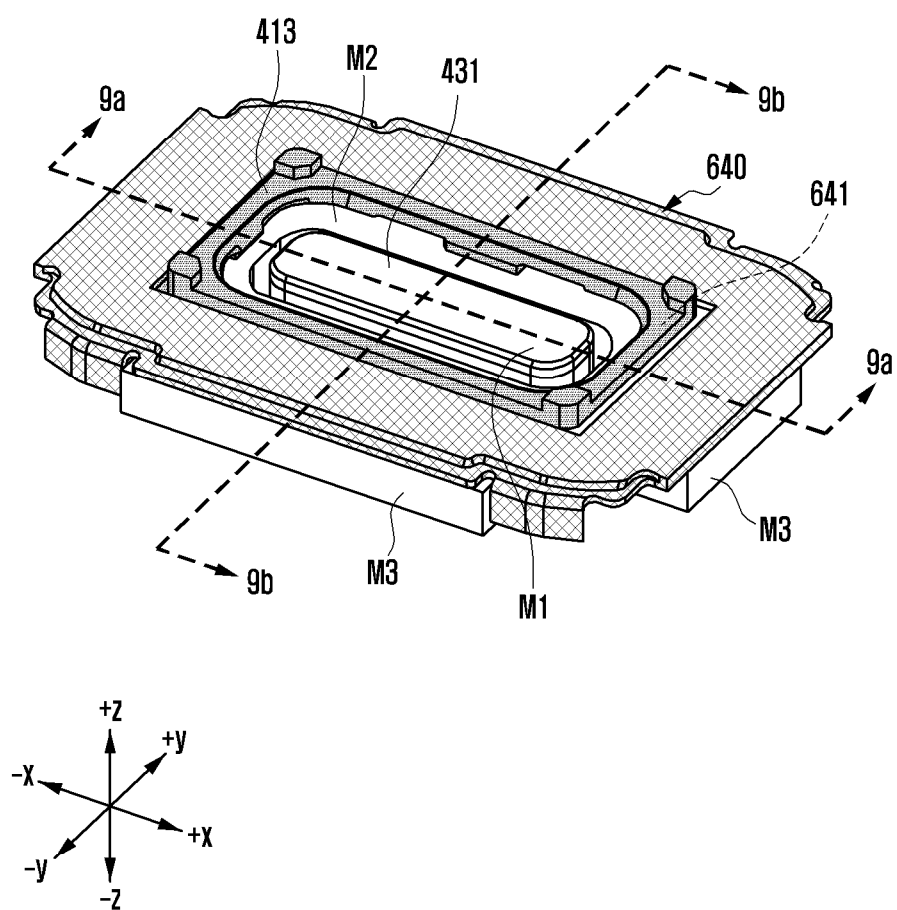


FIG. 9A

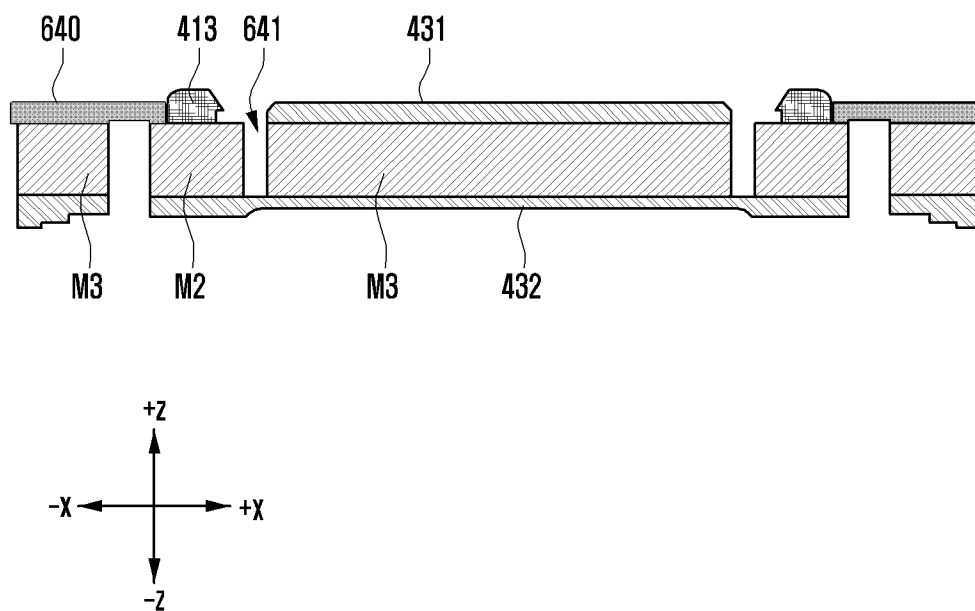


FIG. 9B

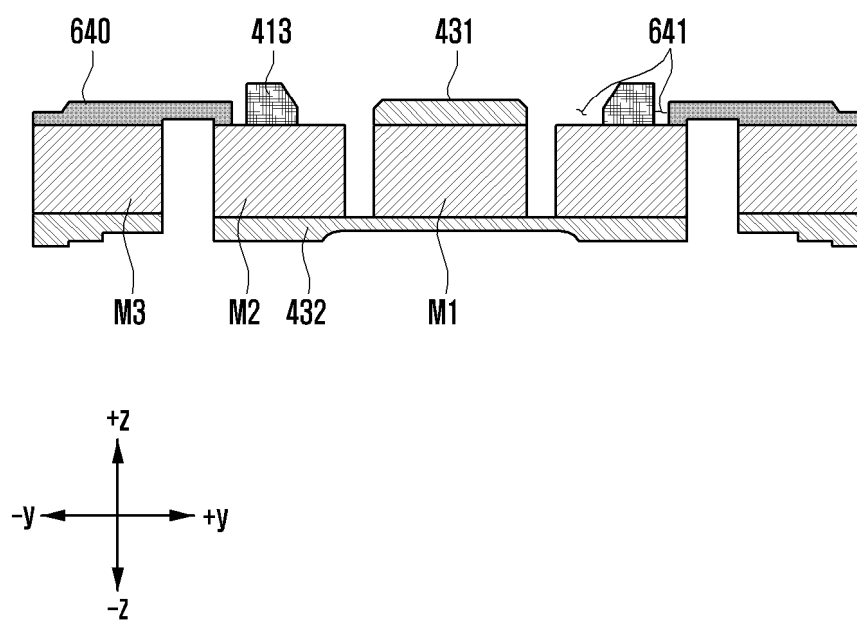


FIG. 10

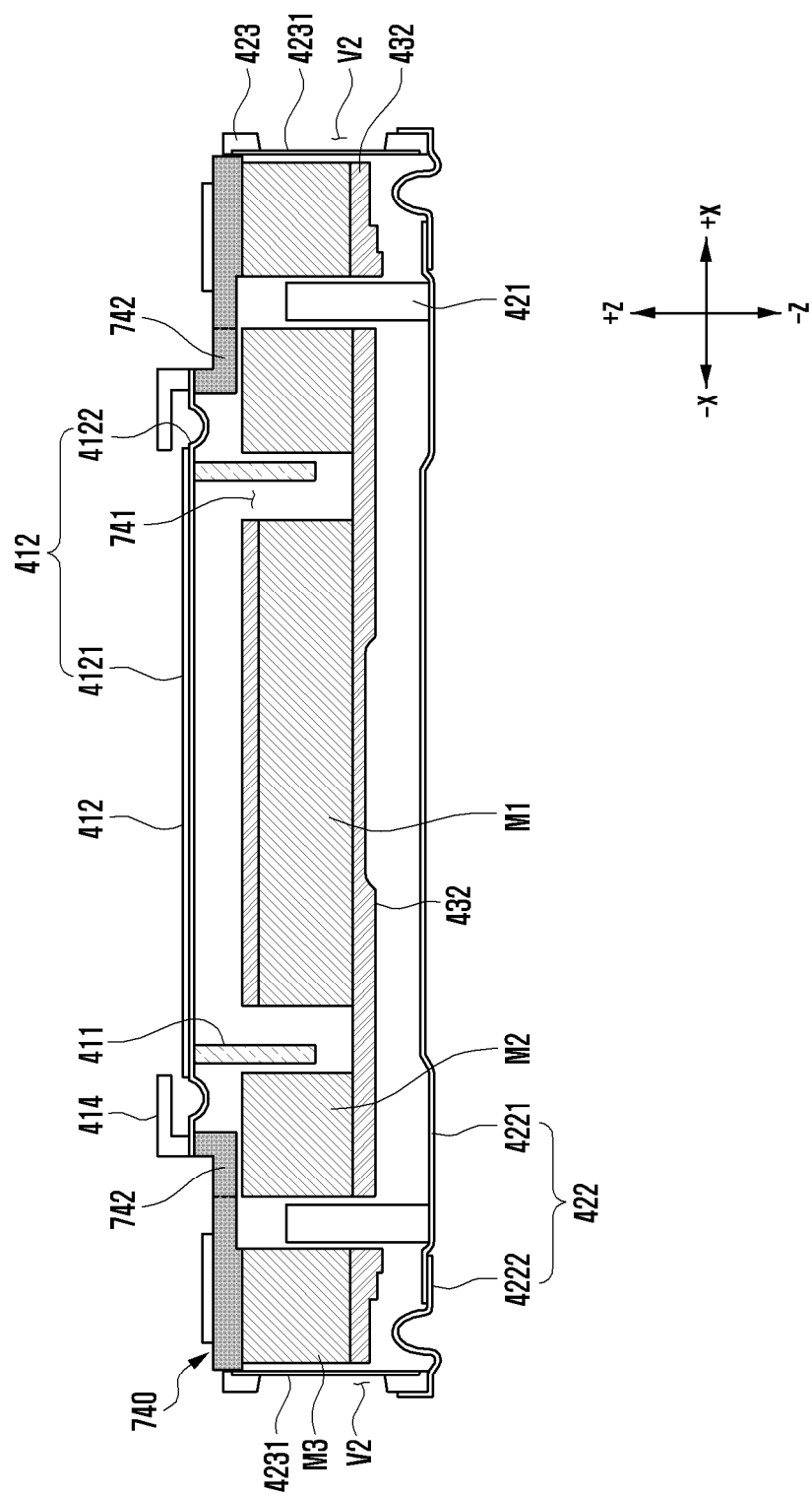
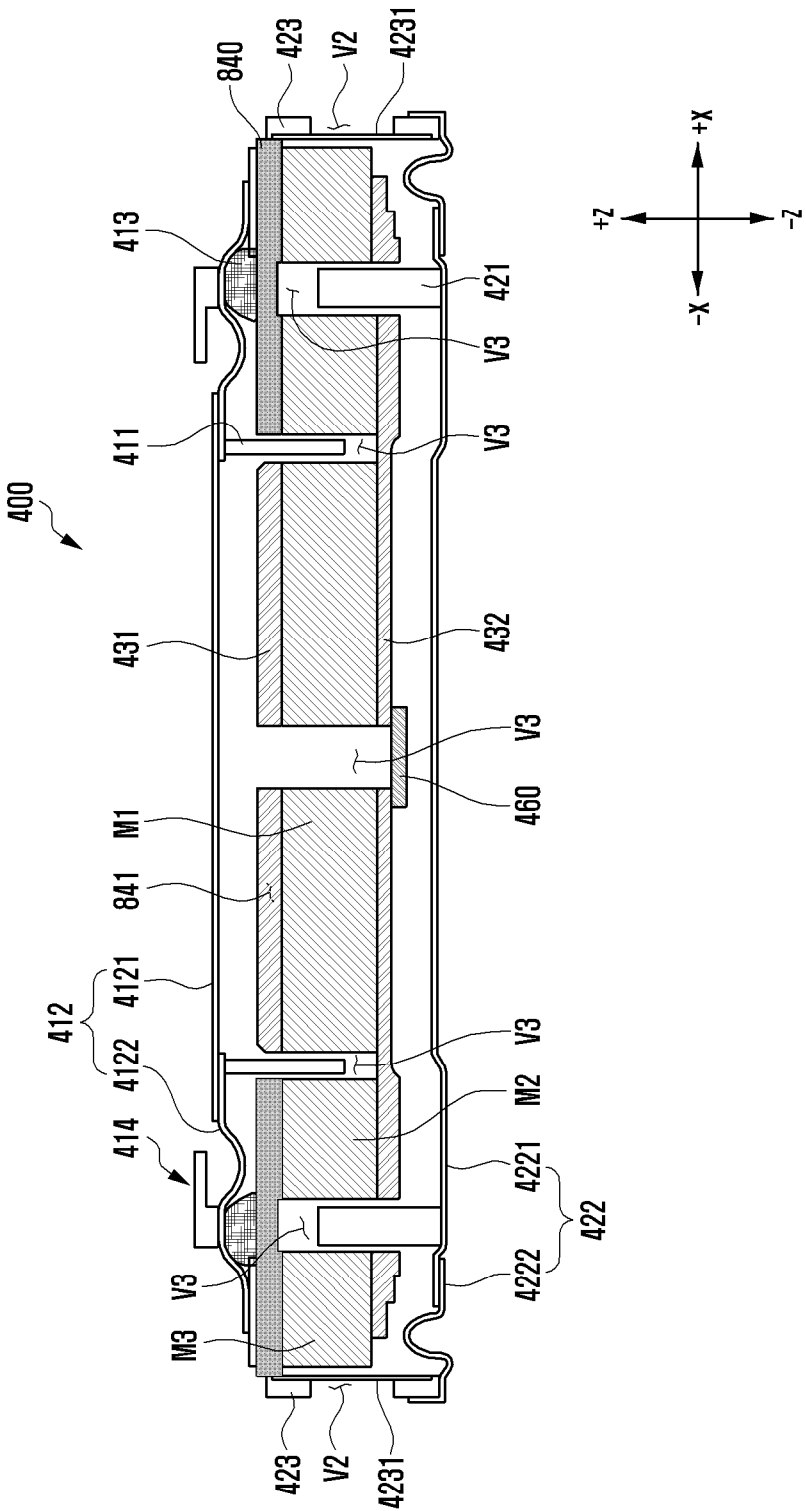


FIG. 11



INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2025/019047

A. CLASSIFICATION OF SUBJECT MATTER**H04R 7/16**(2006.01)i; **H04R 7/06**(2006.01)i; **H04R 9/04**(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H04R 7/16(2006.01); H04R 1/02(2006.01); H04R 1/10(2006.01); H04R 1/24(2006.01); H04R 1/32(2006.01);
H04R 9/02(2006.01); H04R 9/06(2006.01)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models: IPC as above

Japanese utility models and applications for utility models: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS (MOIP internal) & keywords: 다이폴 스피커(dipole speaker), 진동판(diaphragm), 자석(magnet), 오픈닝
(opening), 요크(yoke)**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KR 10-1177322 B1 (YOUNGBO ENGINEERING CO., LTD.) 30 August 2012 (2012-08-30) paragraphs [0003], [0024]-[0045] and figures 1-2	1-4,8-12,14-15
Y		5-7,13
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☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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Date of the actual completion of the international search

23 February 2026

Date of mailing of the international search report

23 February 2026

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