US 20240094765A1

(19) **United States**

(12) **Patent Application Publication**

Leclerc et al.

(10) **Pub. No.: US 2024/0094765 A1**

(43) **Pub. Date: Mar. 21, 2024**

(54) **ELECTRONIC DEVICE**

(71) Applicant: **Apple Inc.**, Cupertino, CA (US)

(72) Inventors: **Michael E. Leclerc**, Mountain View, CA (US); **Simon J. Trivett**, Waterloo (CA); **Lauren M. Farrell**, Cupertino, CA (US); **Nicholas A. Rundle**, Cupertino, CA (US)

(21) Appl. No.: **18/370,298**

(22) Filed: **Sep. 19, 2023**

Related U.S. Application Data

(60) Provisional application No. 63/408,651, filed on Sep. 21, 2022.

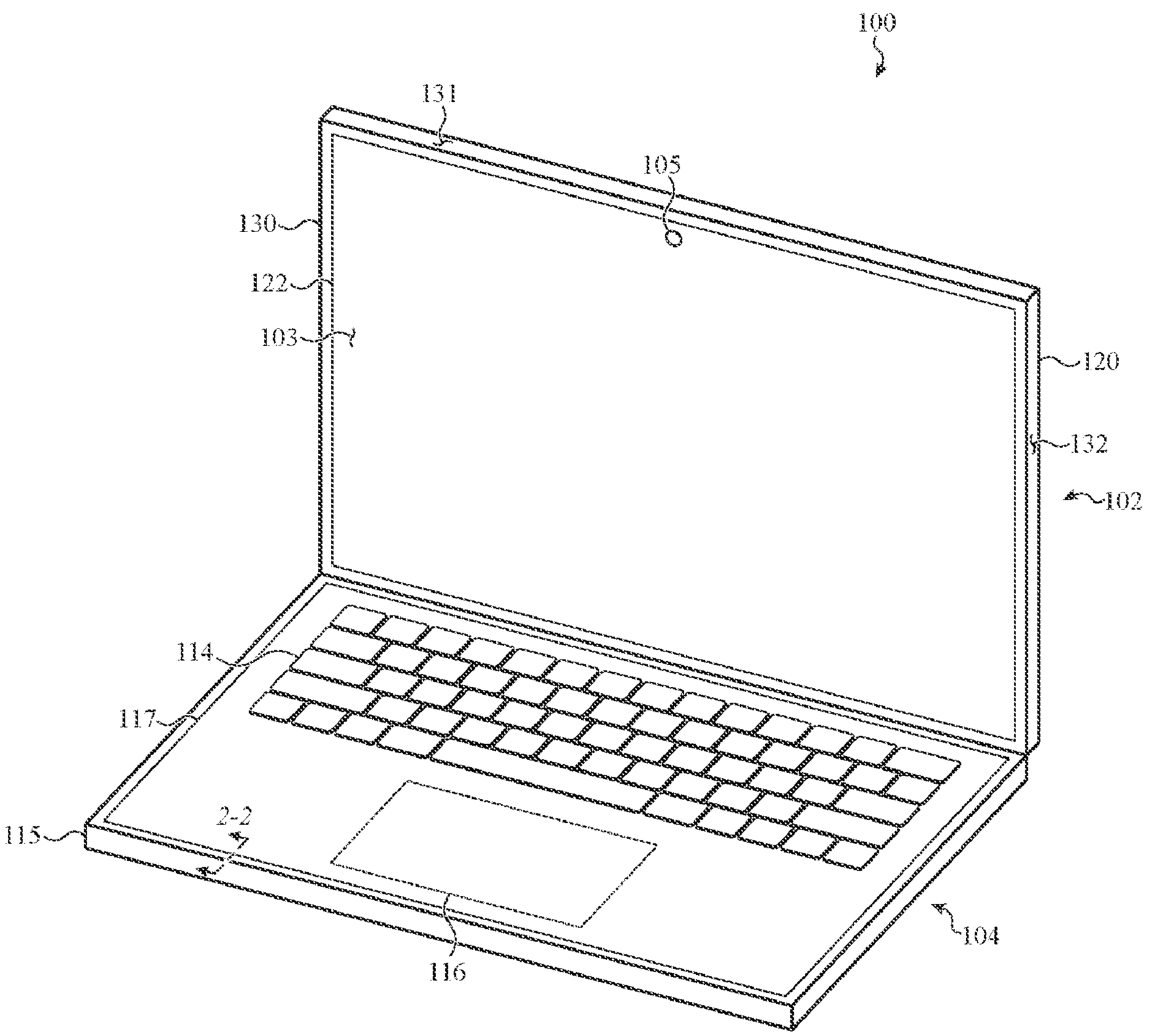
Publication Classification

(51) **Int. Cl.**
G06F 1/16 (2006.01)

(52) **U.S. Cl.**
CPC ***G06F 1/1616*** (2013.01); ***G06F 1/1643*** (2013.01); ***G06F 1/1686*** (2013.01)

(57) **ABSTRACT**

A laptop computer may include a base portion including a keyboard, and a display portion flexibly coupled to the base portion. The display portion may include a housing component formed of metal and defining a set of side surfaces, a front cover assembly coupled to the housing component and including a first glass member defining at least a portion of a front exterior surface of the display portion, and a display coupled to the first glass member, and a rear cover assembly coupled to the housing component and including a second glass member defining at least a portion of a rear exterior surface of the display portion.



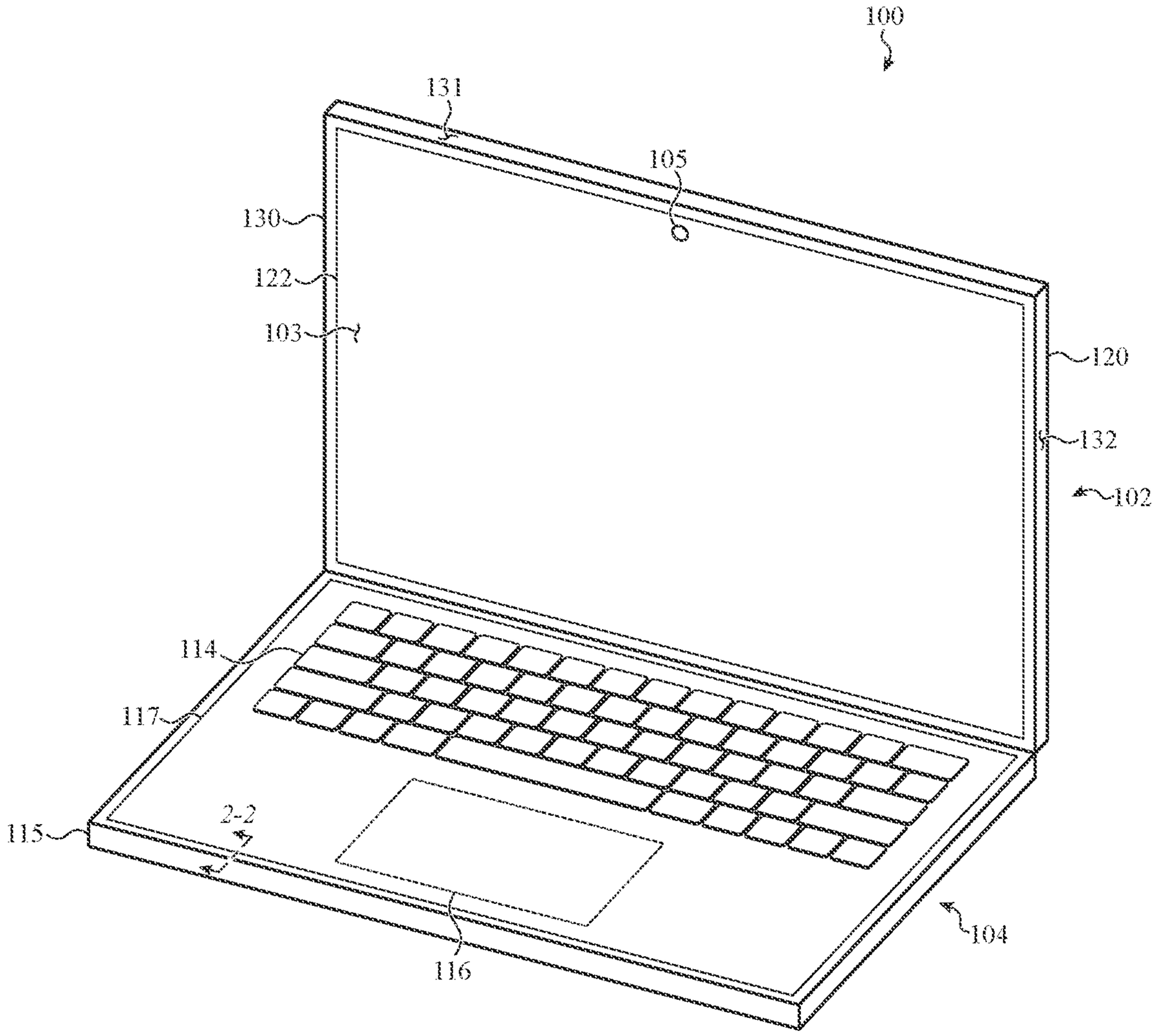


FIG. 1A

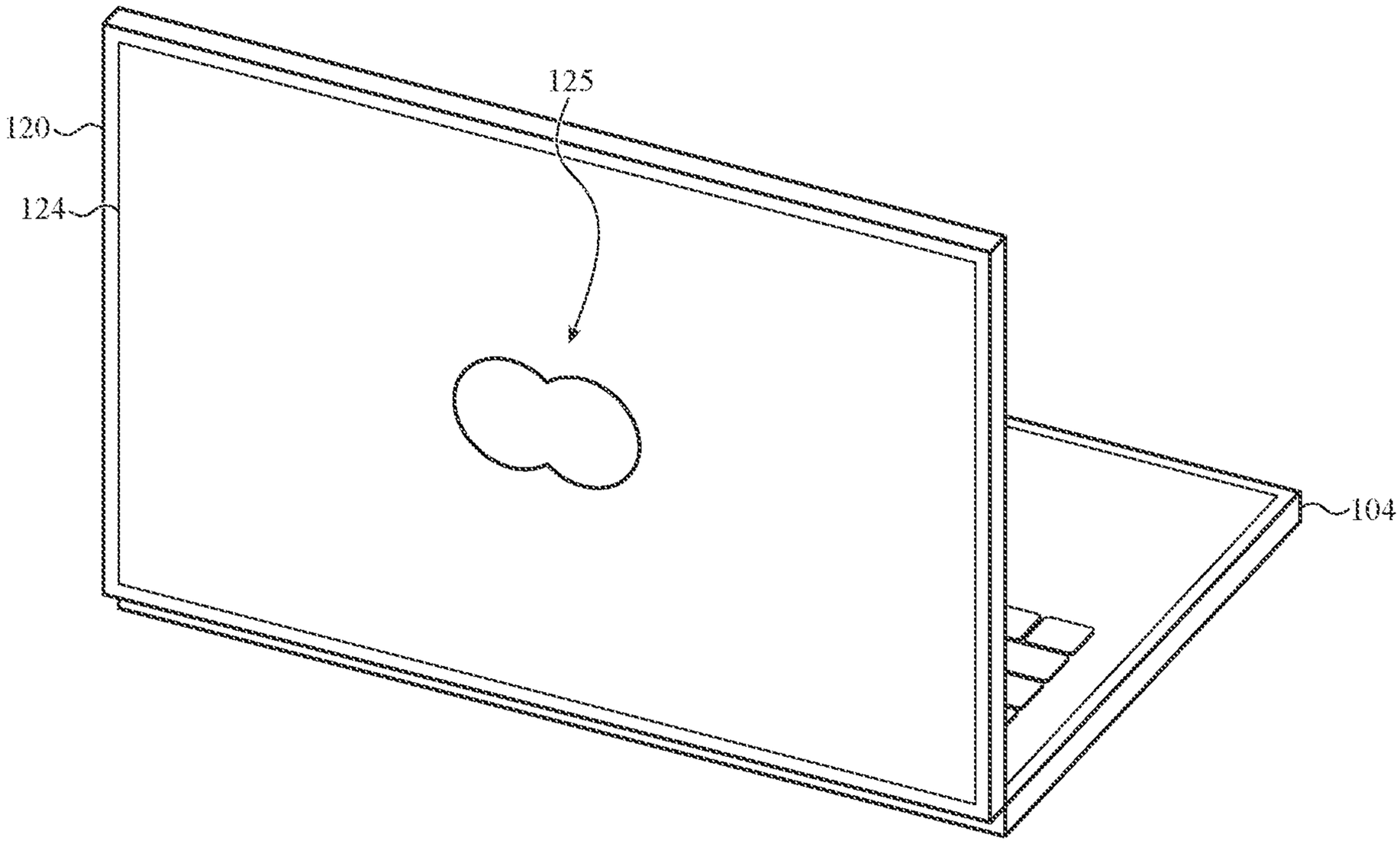


FIG. 1B

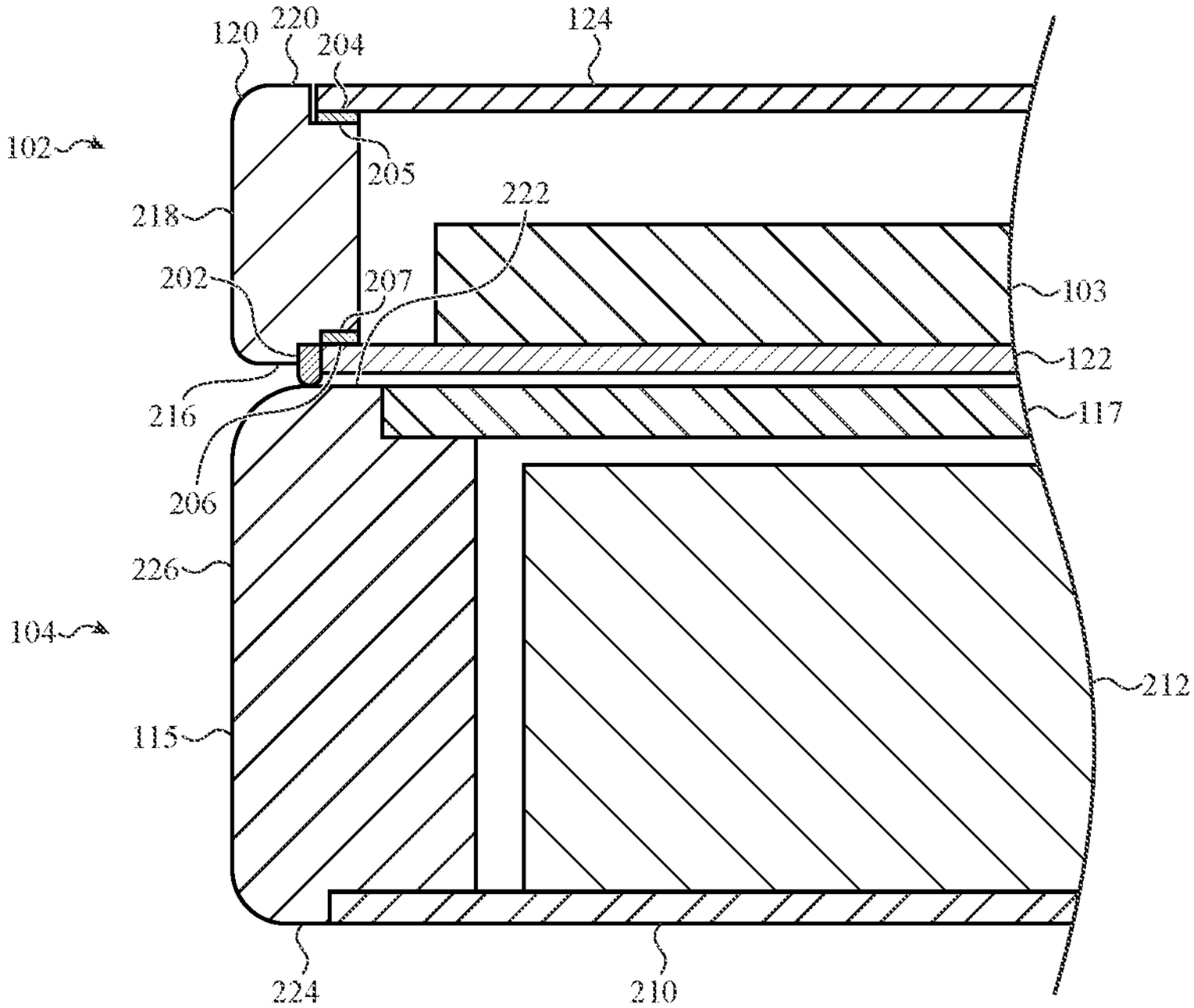

120
220
204
124
102
205
222
218
202
207
103
122
216
117
206
226
104
212
115
224
210

FIG. 2

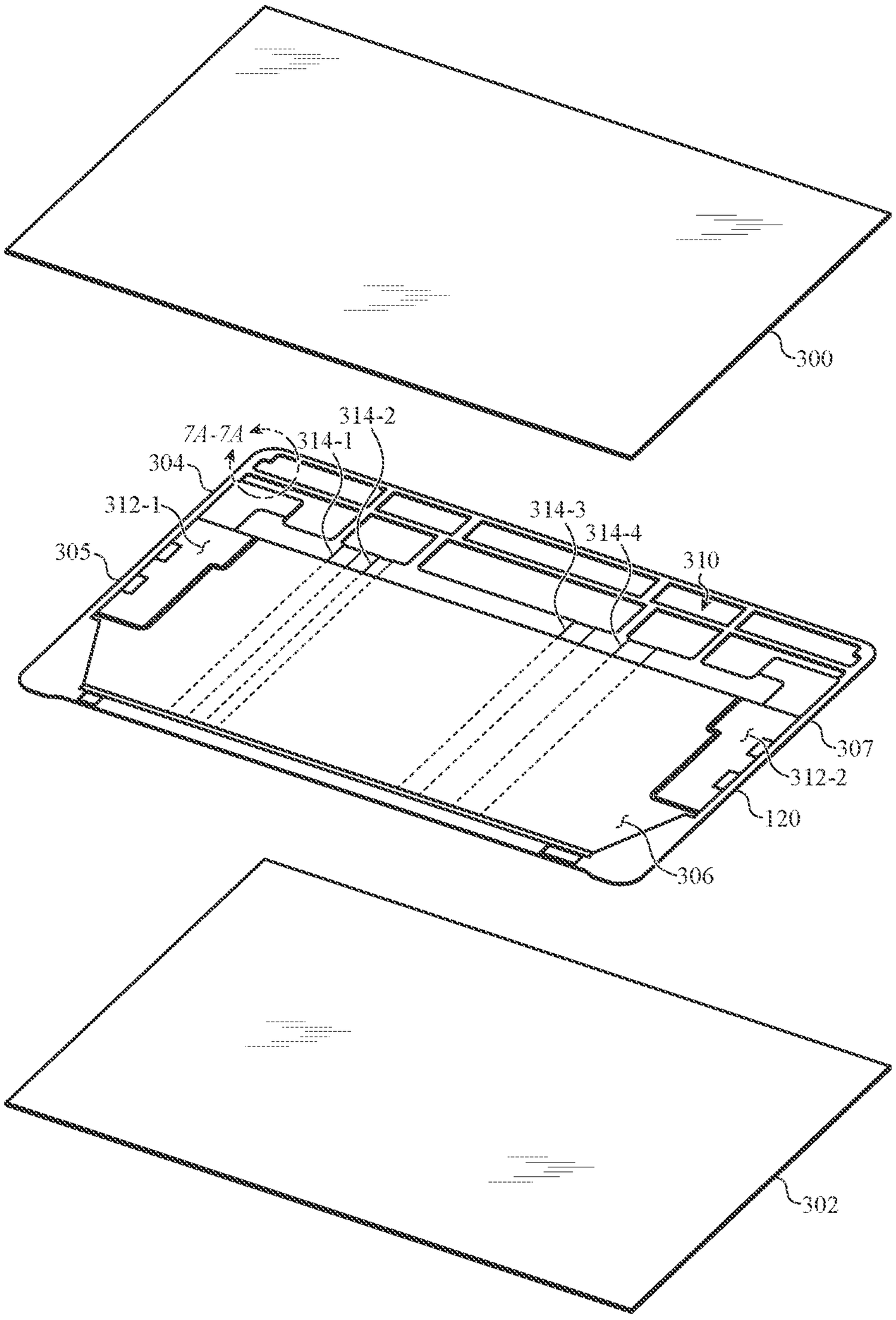

300
314-2
7A-7A
314-1
304
312-1
314-3
314-4
305
310
307
312-2
120
306
302

FIG. 3

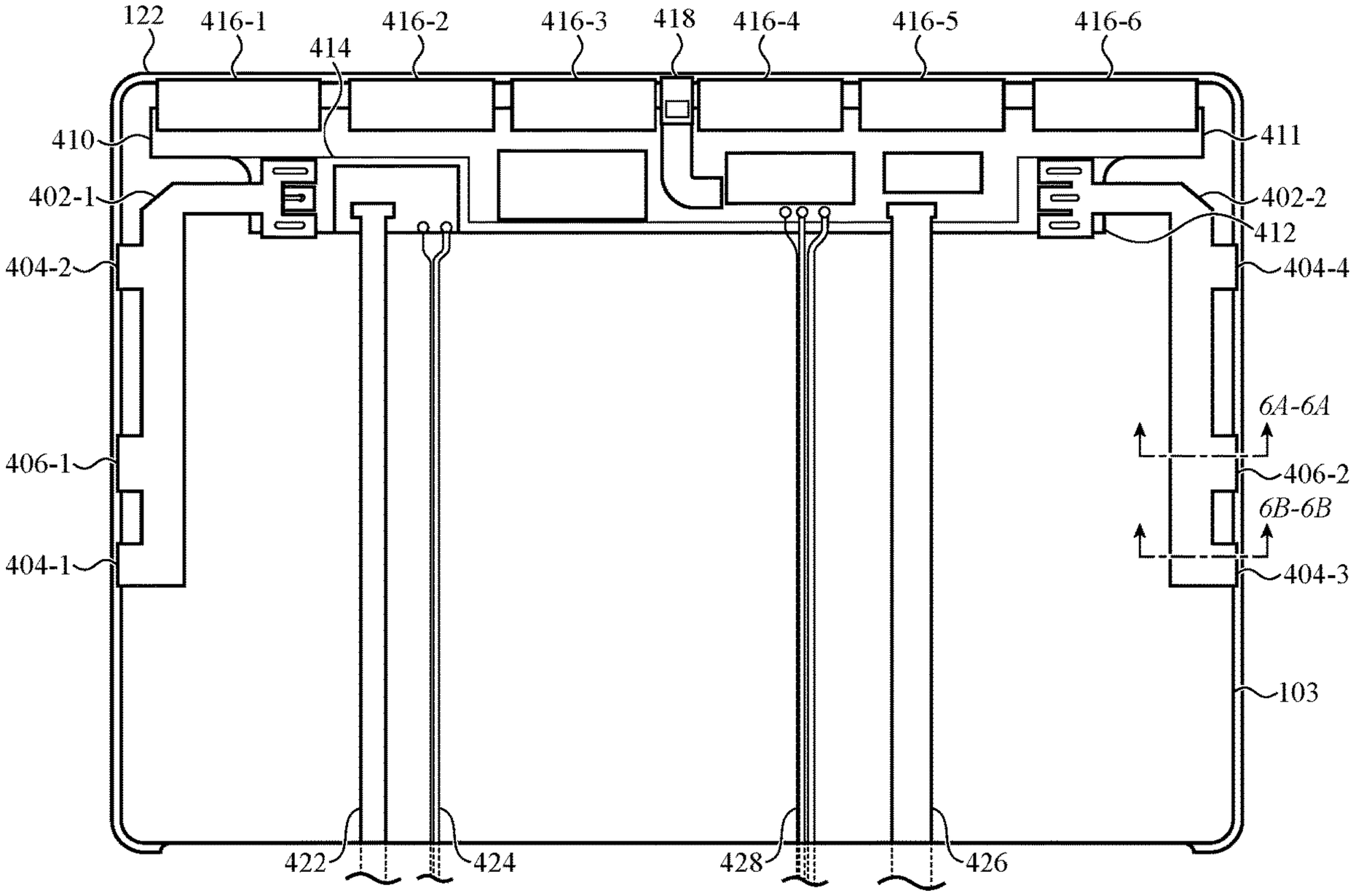

122
416-1
414
416-2
416-3
418
416-4
416-5
416-6
410
411
402-1
402-2
412
404-2
404-4
6A-6A
406-1
406-2
6B-6B
404-1
404-3
103
422
424
428
426

FIG. 4A

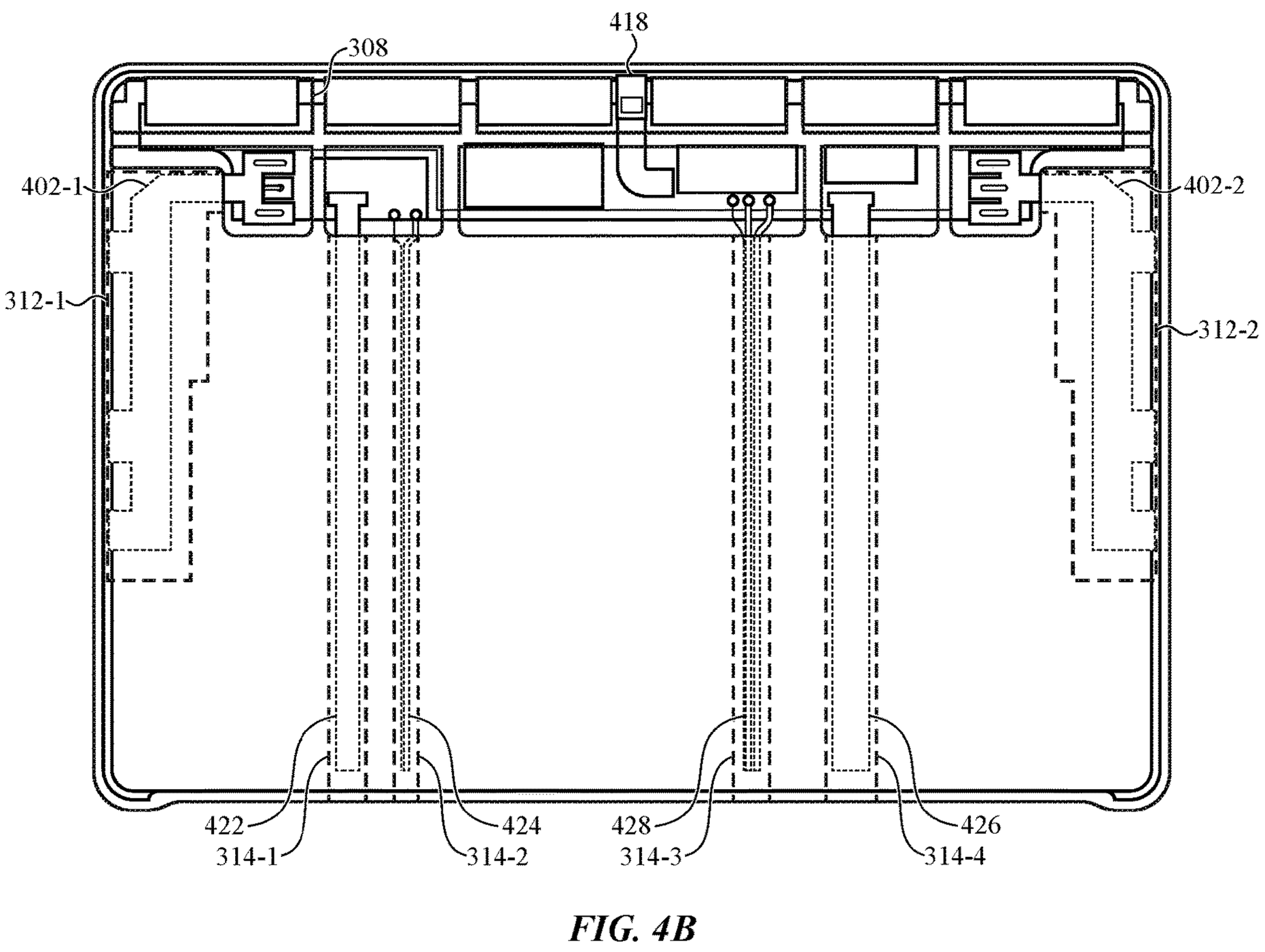

418
308
402-1
402-2
312-1
312-2
422
424
428
426
314-1
314-2
314-3
314-4

FIG. 4B

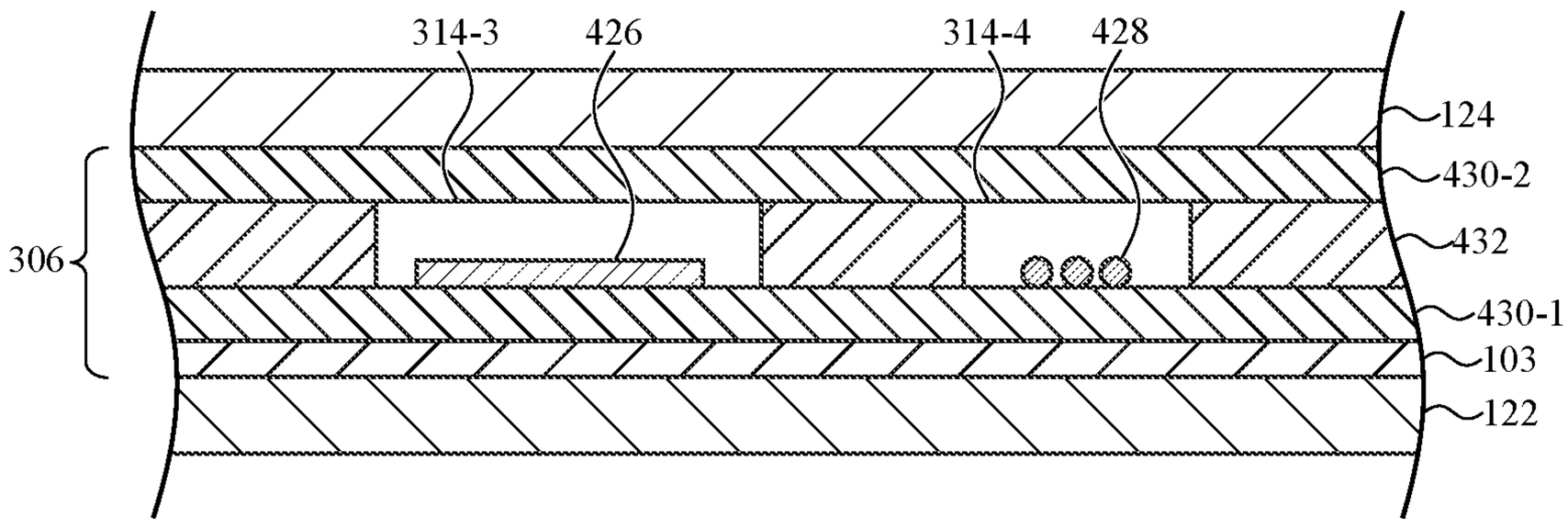


FIG. 4C

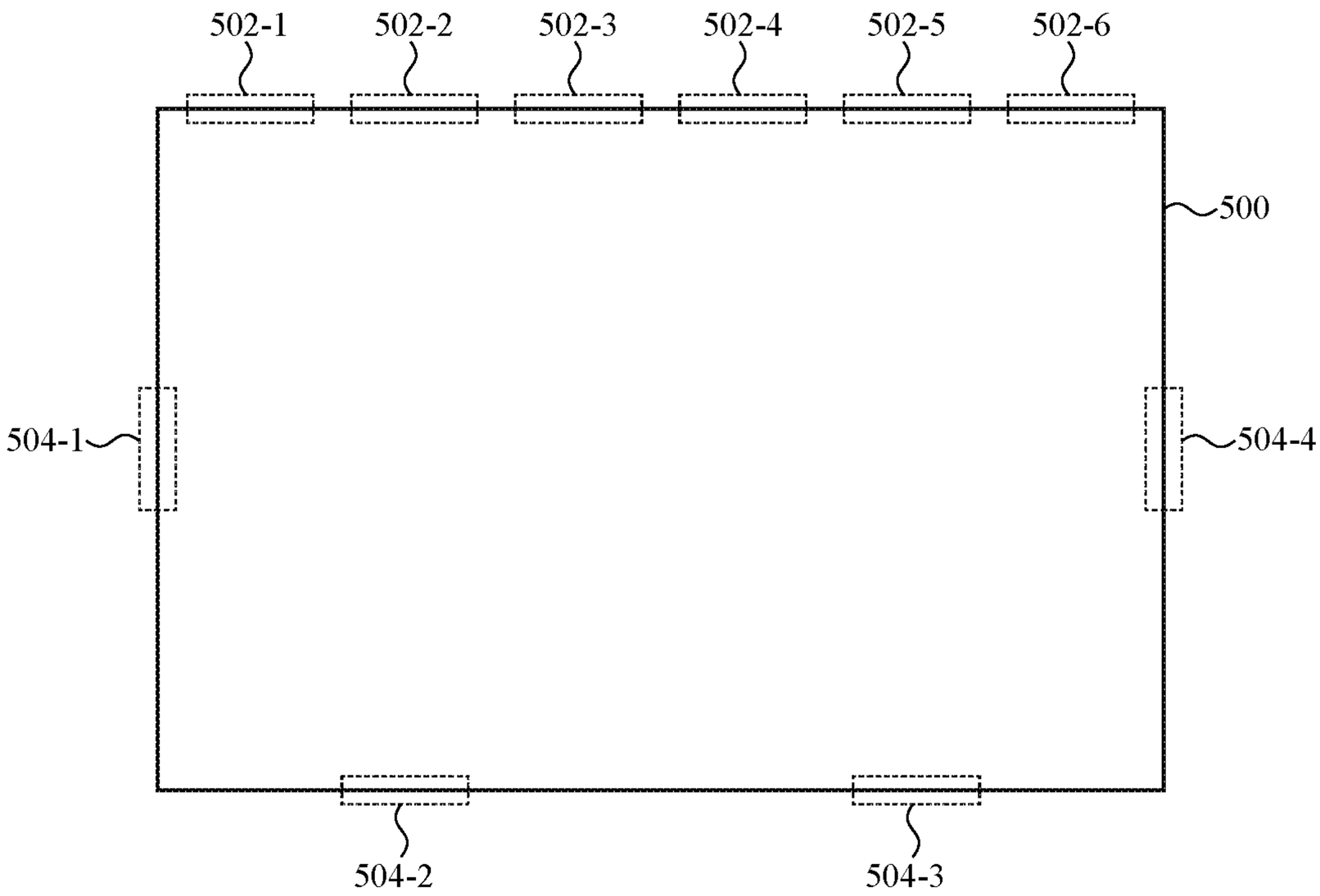

502-1
502-2
502-3
502-4
502-5
502-6
500
504-1
504-4
504-2
504-3

FIG. 5A

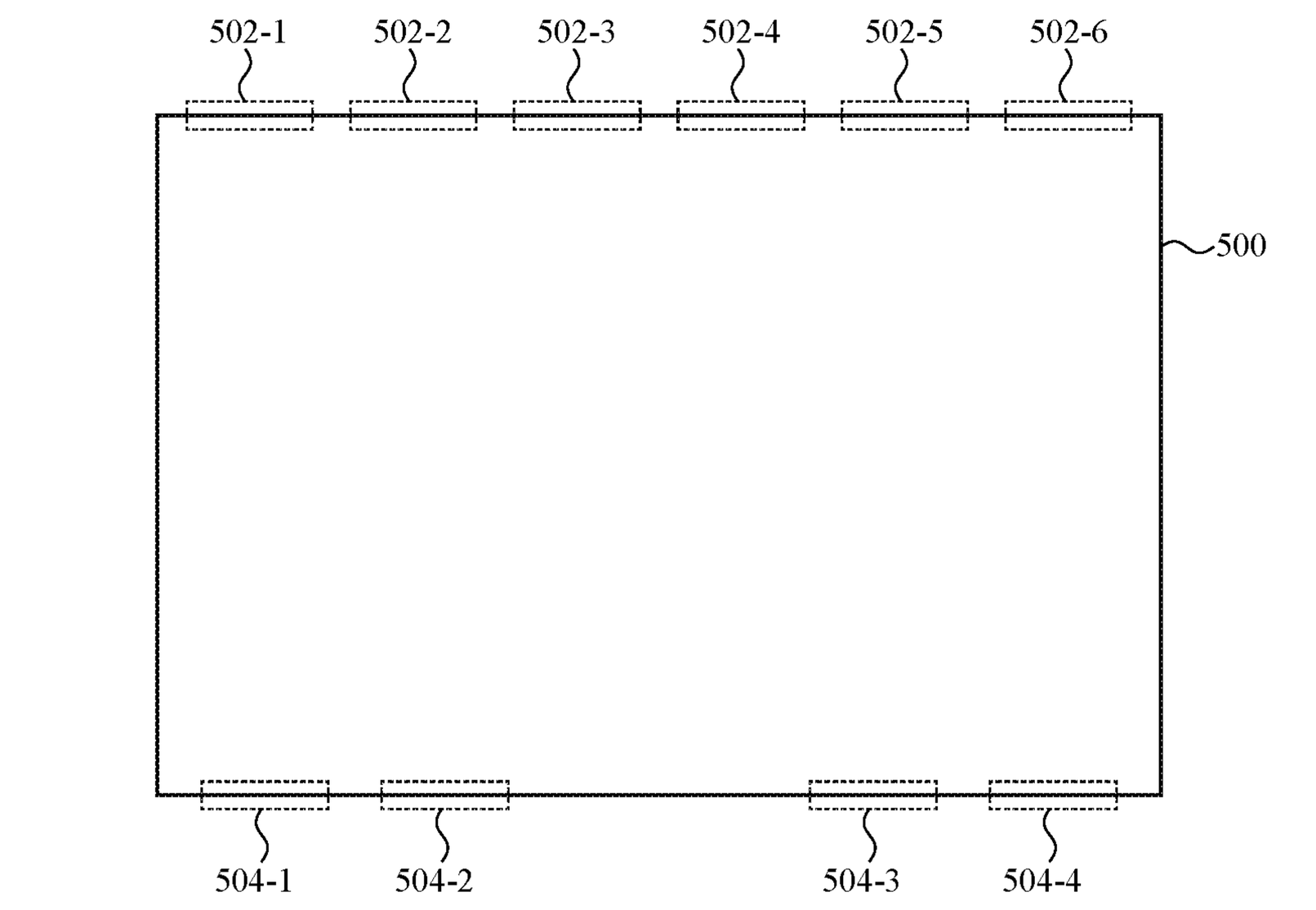

502-1
502-2
502-3
502-4
502-5
502-6
500
504-1
504-2
504-3
504-4

FIG. 5B

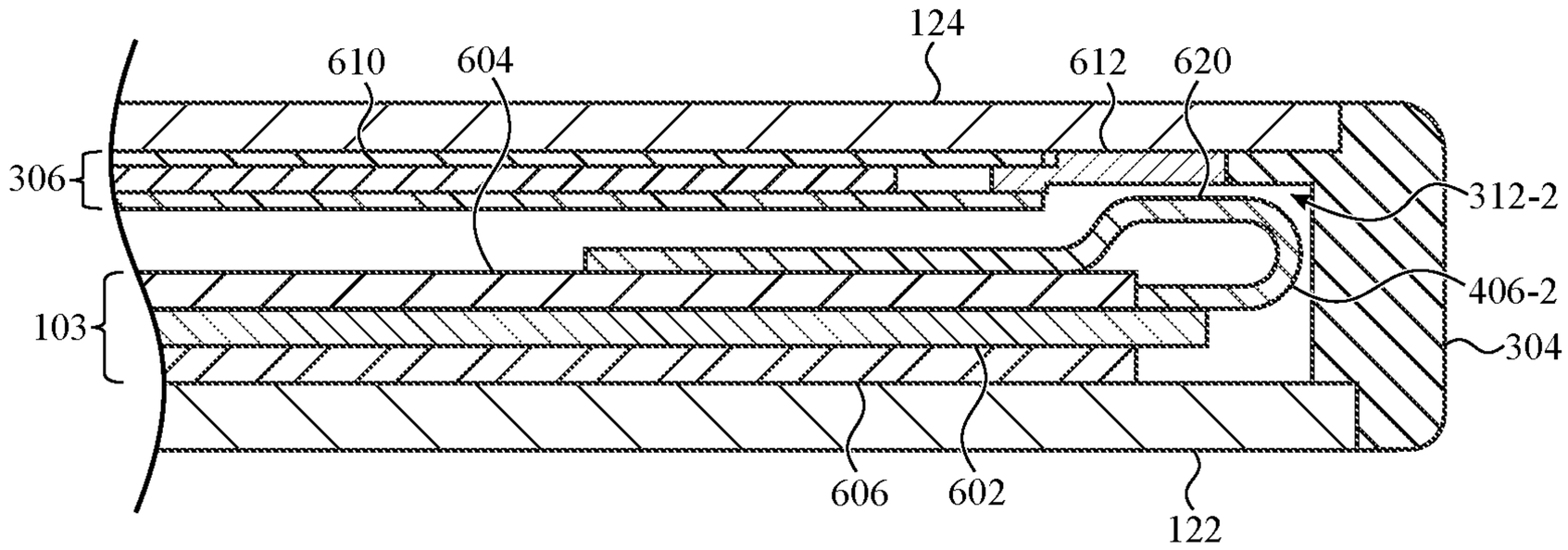

124
610
604
612
620
306
312-2
406-2
103
304
606
602
122

FIG. 6A

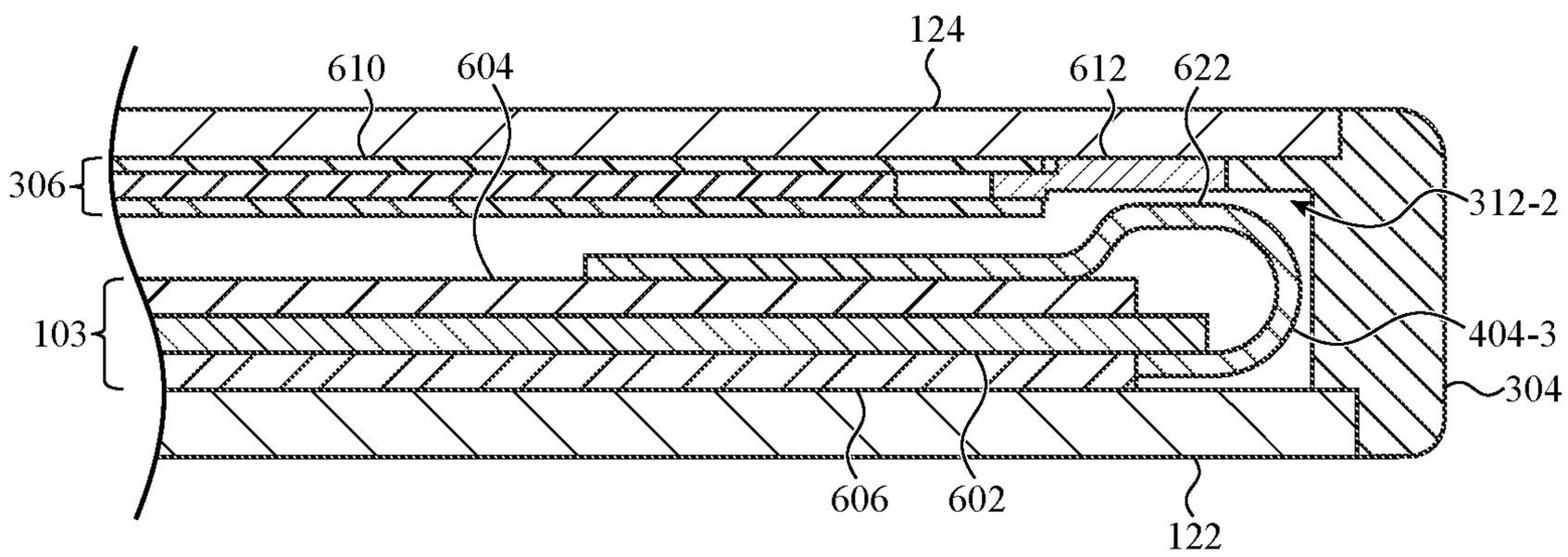

124
610
604
612
622
306
312-2
404-3
103
304
606
602
122

FIG. 6B

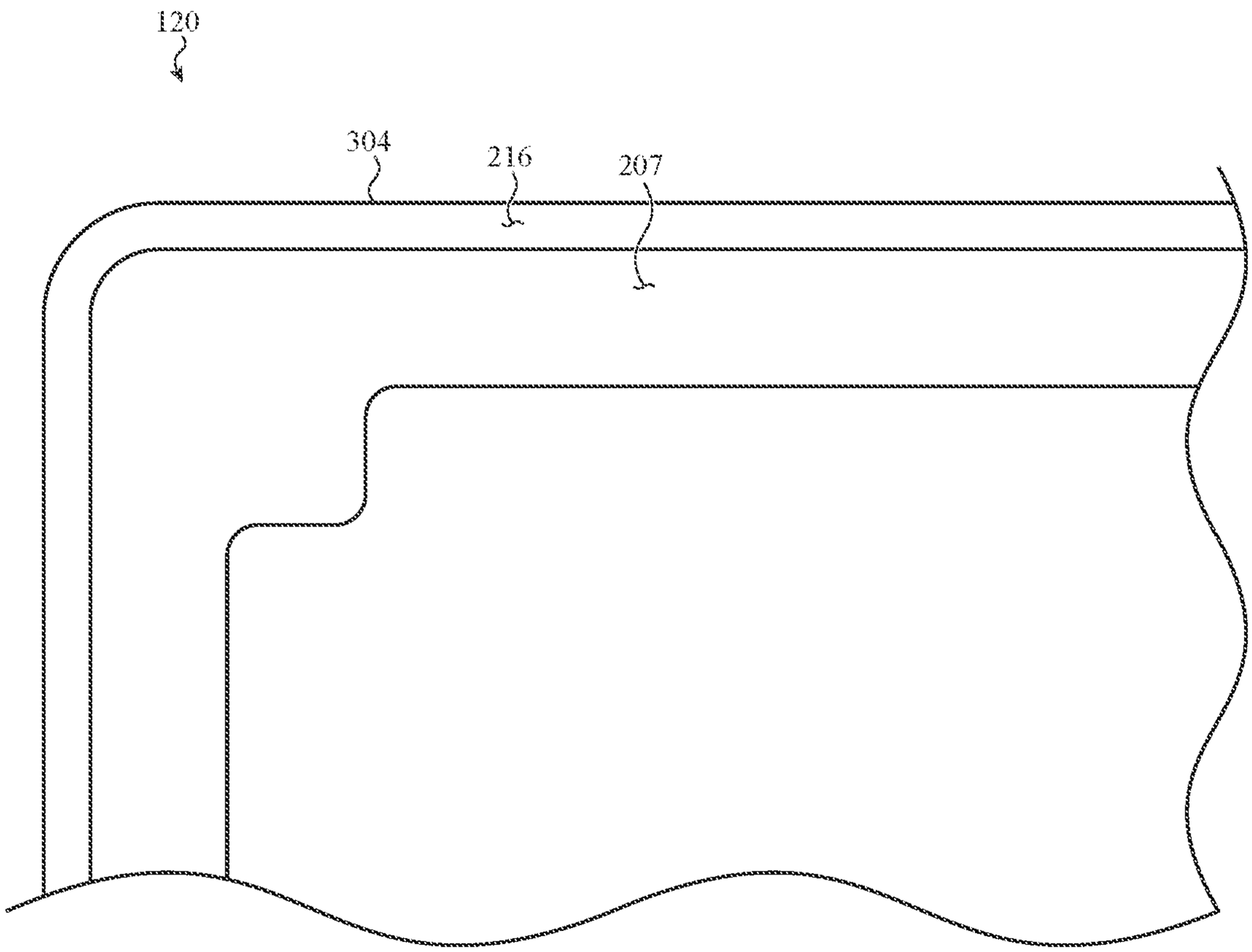


FIG. 7A

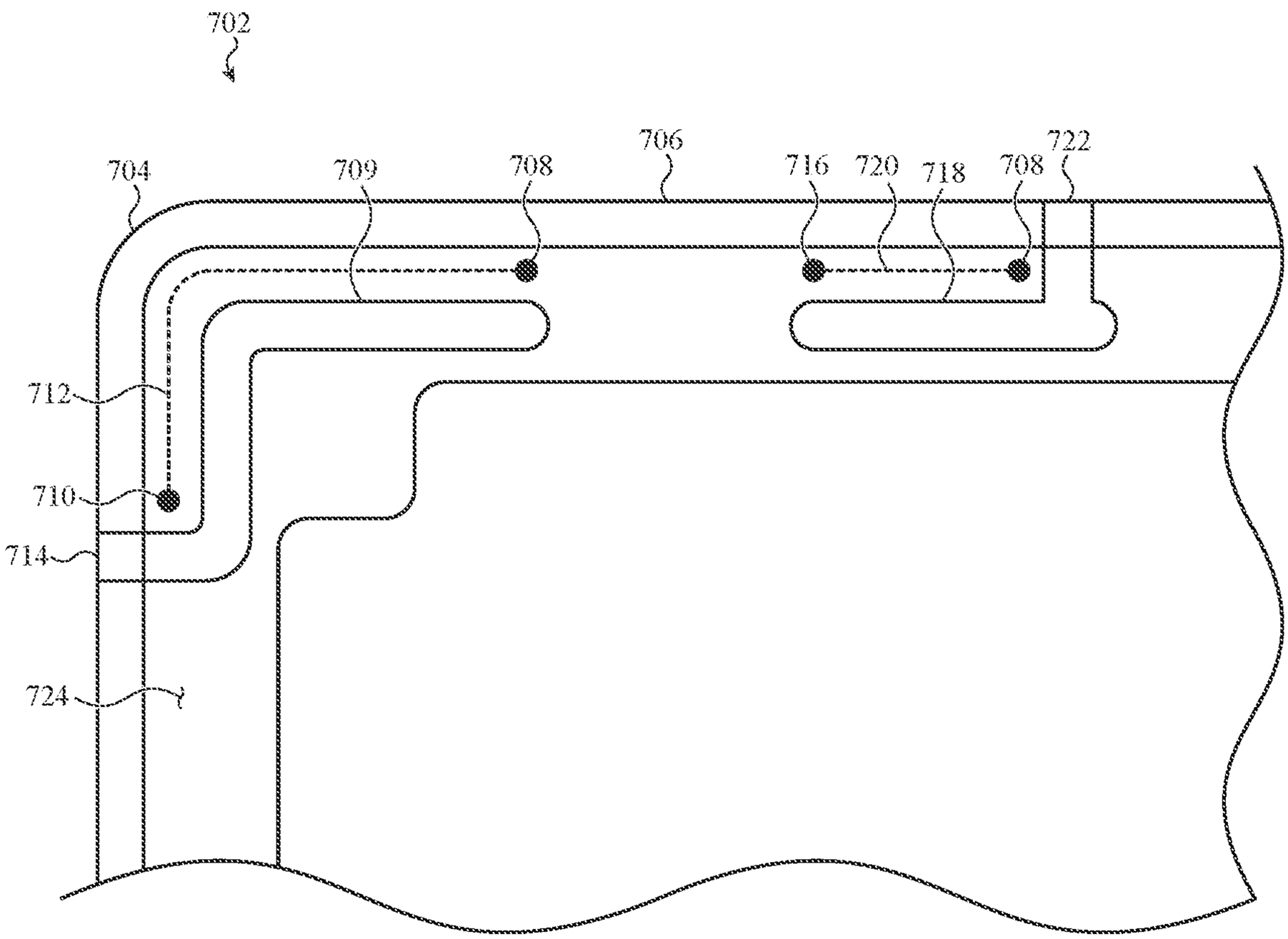


FIG. 7B

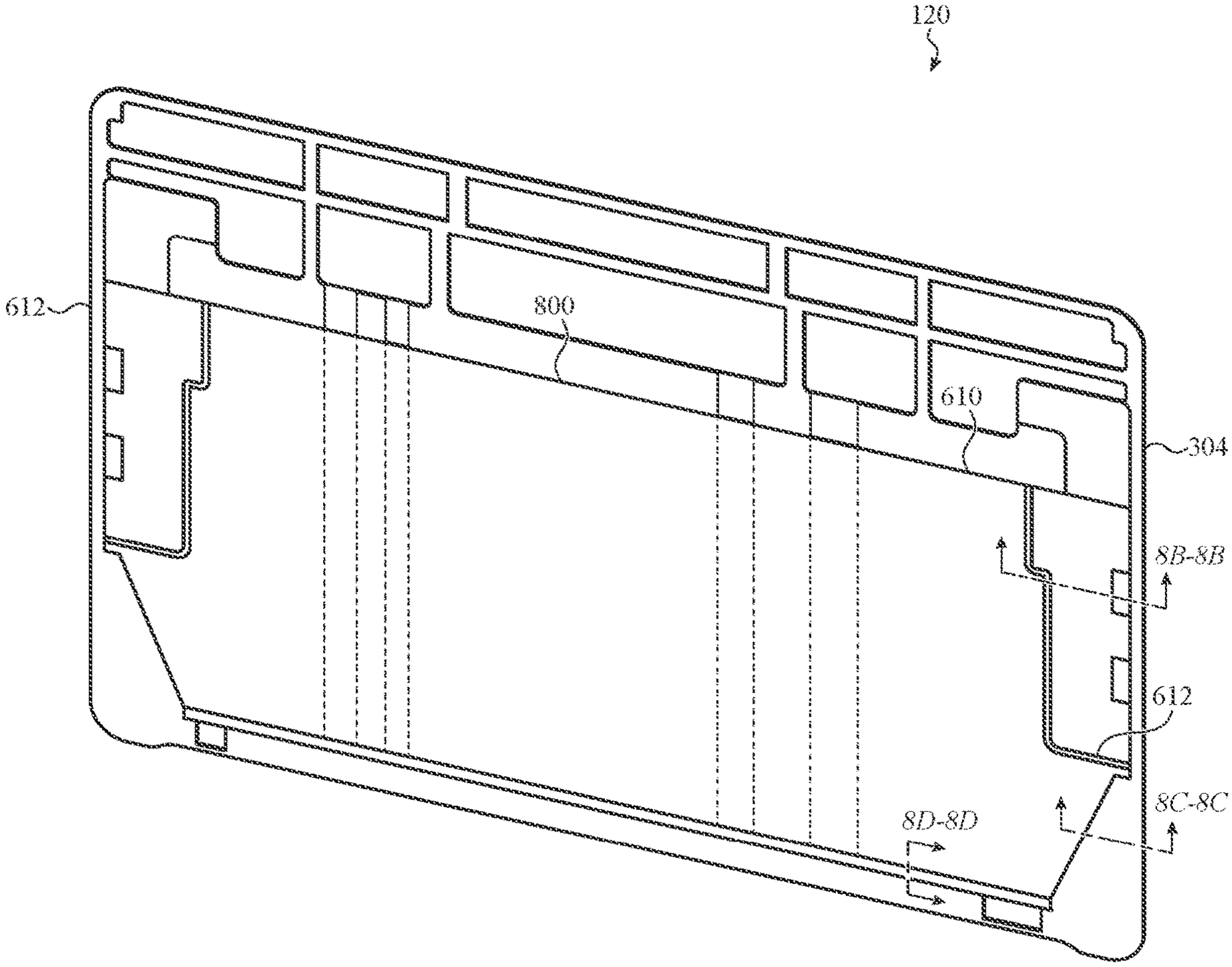


FIG. 8A

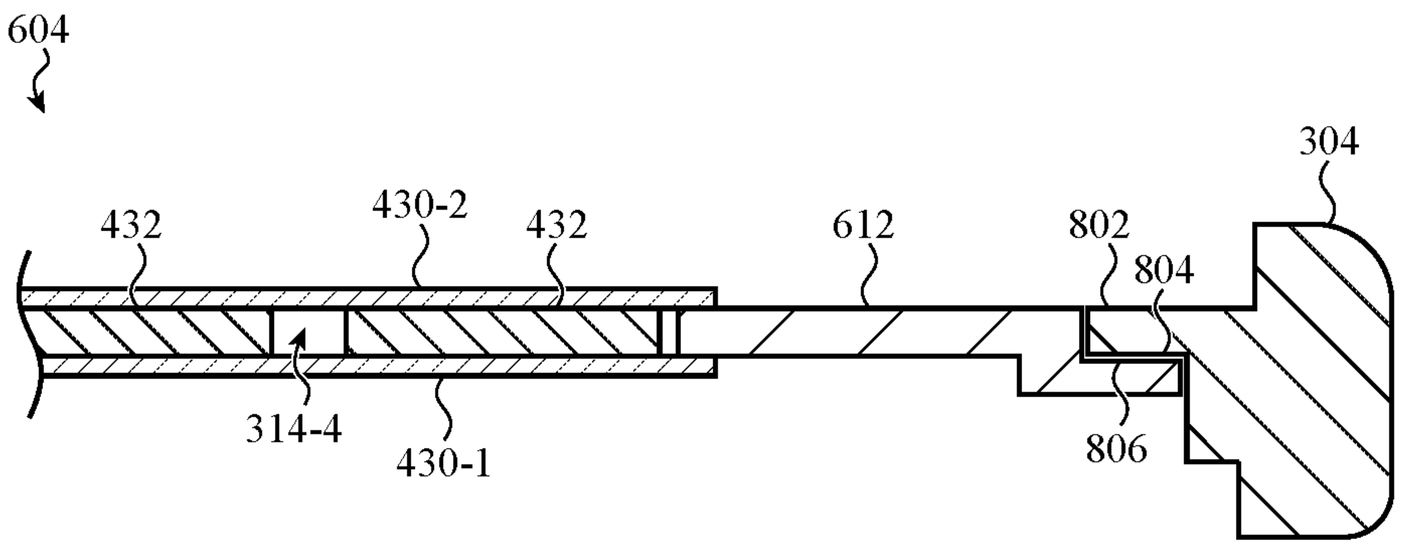


FIG. 8B

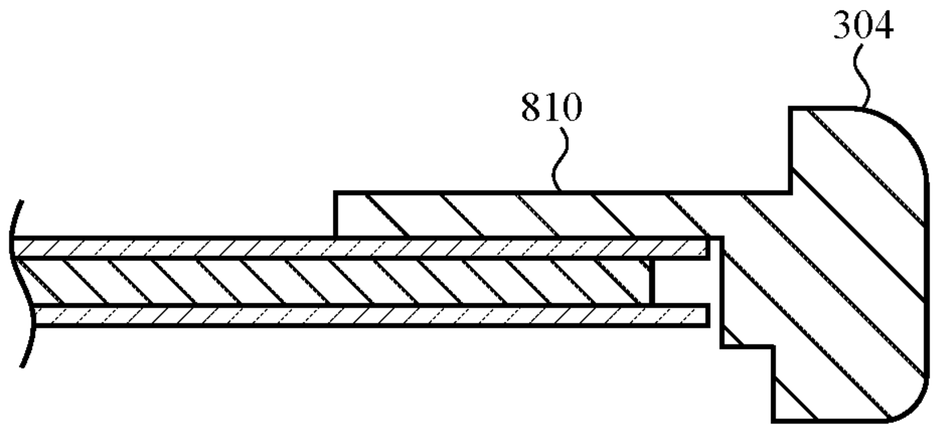


FIG. 8C

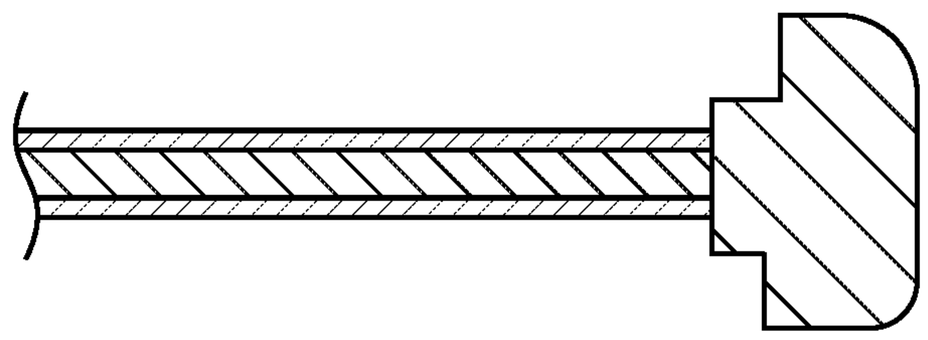


FIG. 8D

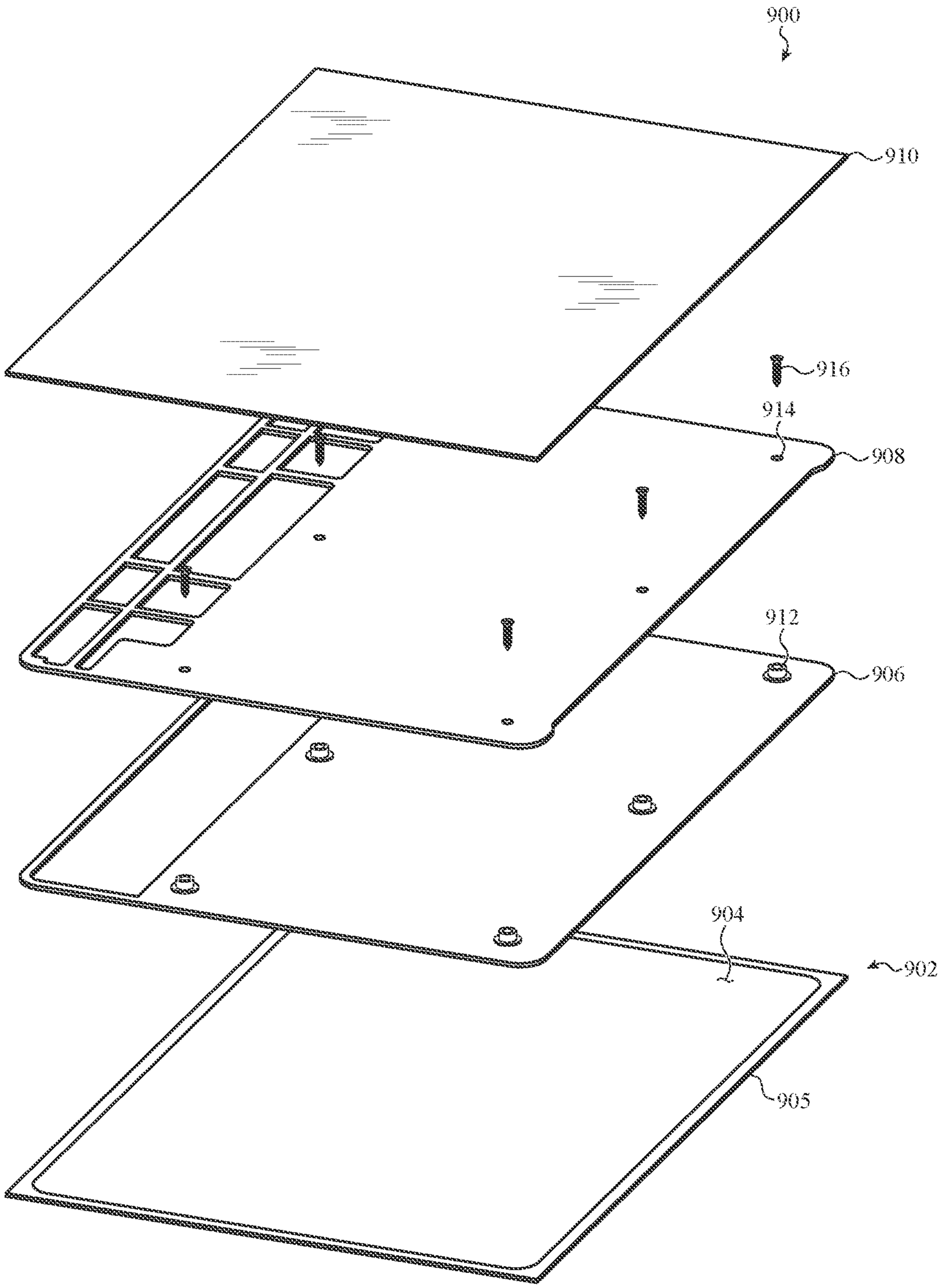


FIG. 9A

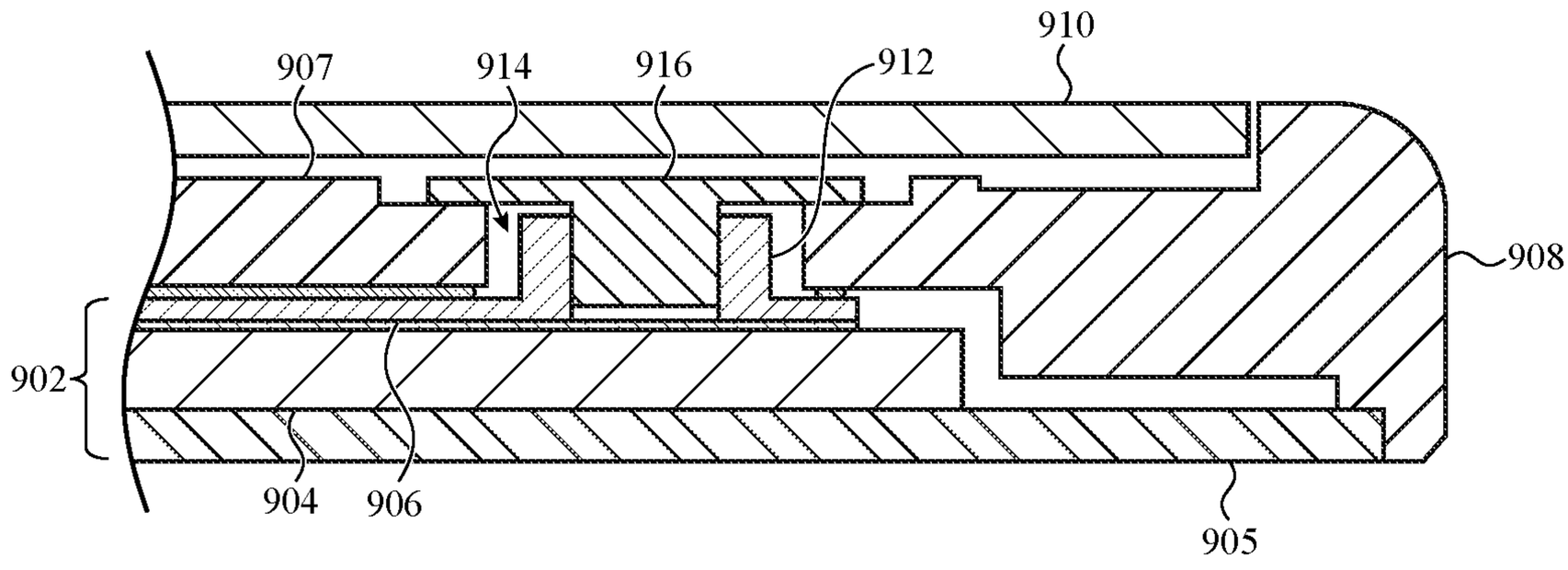


FIG. 9B

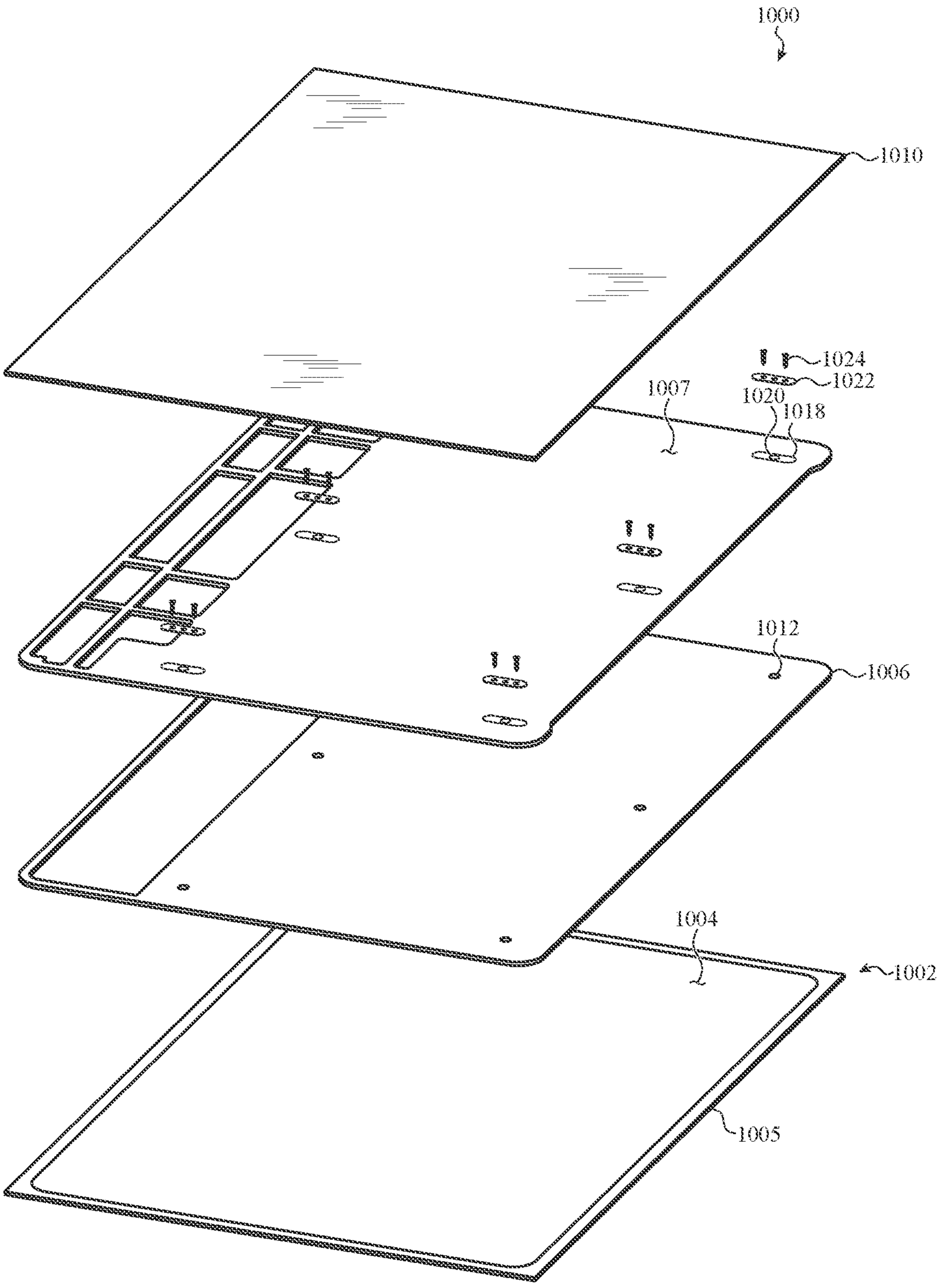


FIG. 10A

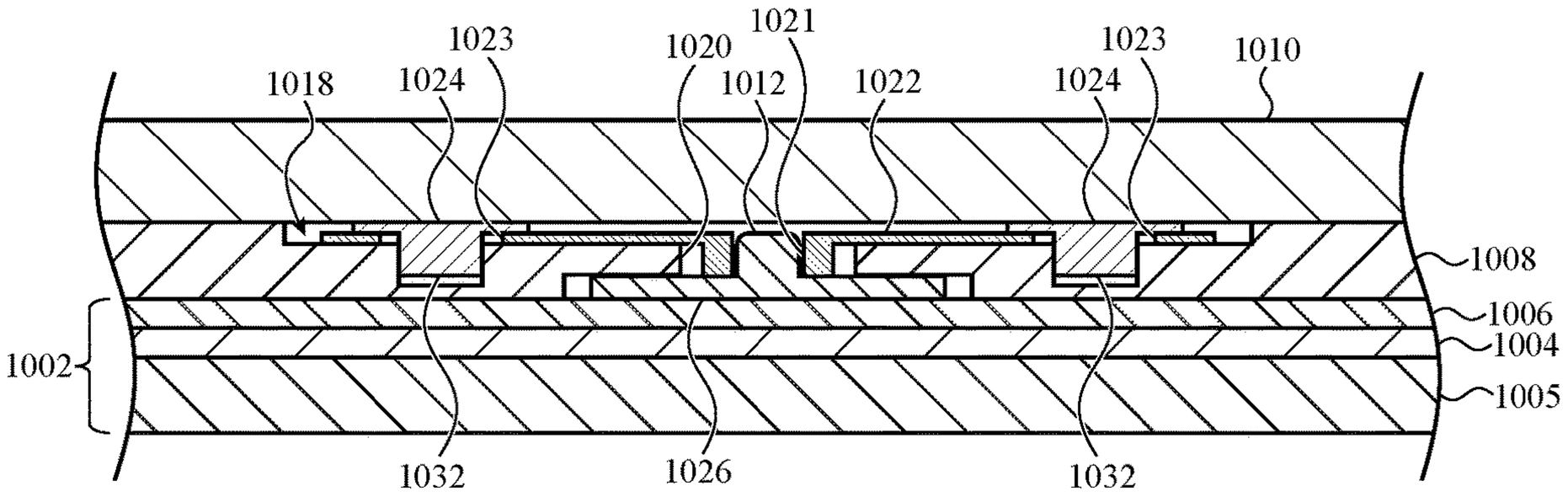

1023
1021
1020
1023
1018
1024
1012
1022
1024
1010
1008
1006
1004
1002
1005
1032
1026
1032

FIG. 10B

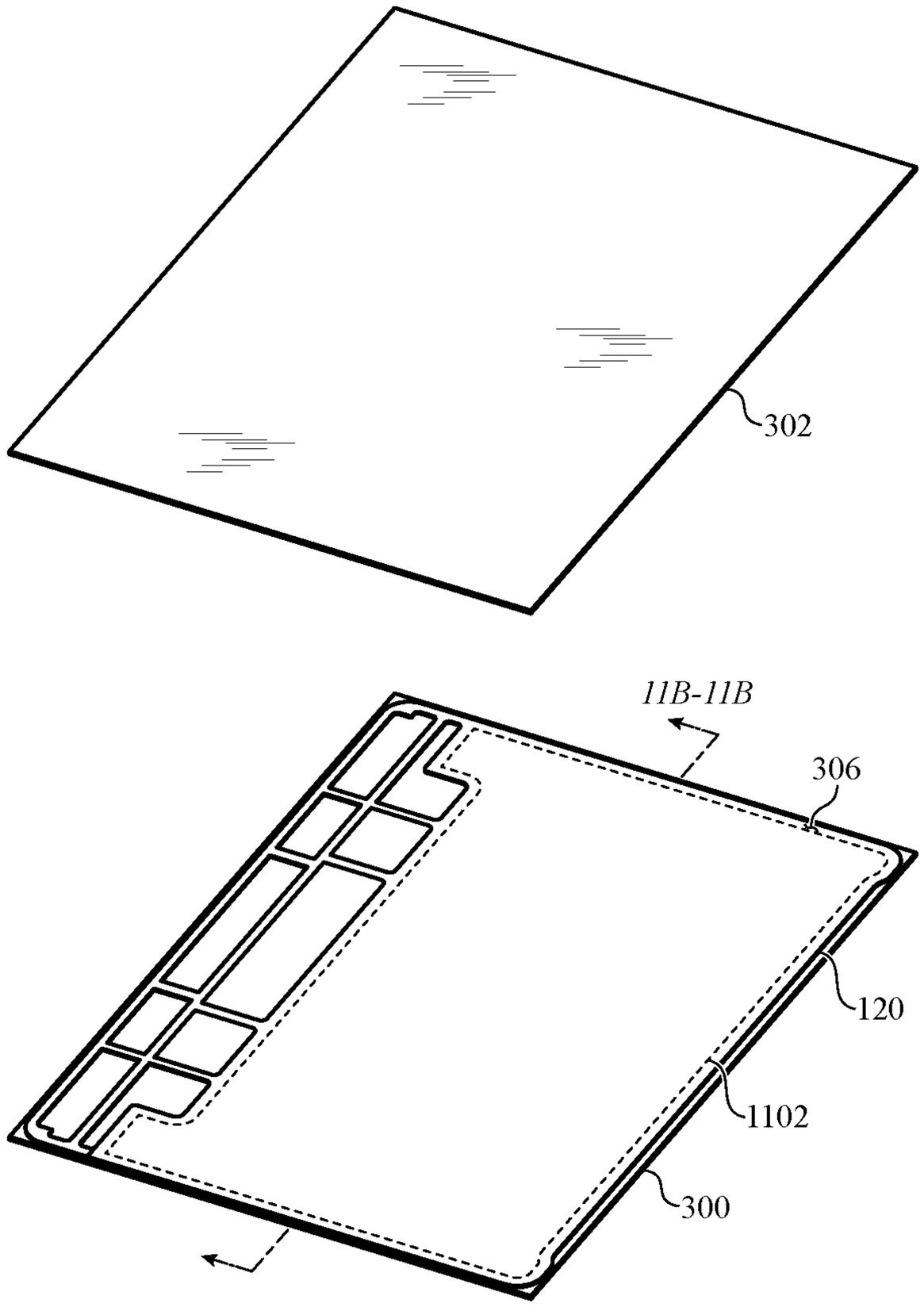


FIG. 11A

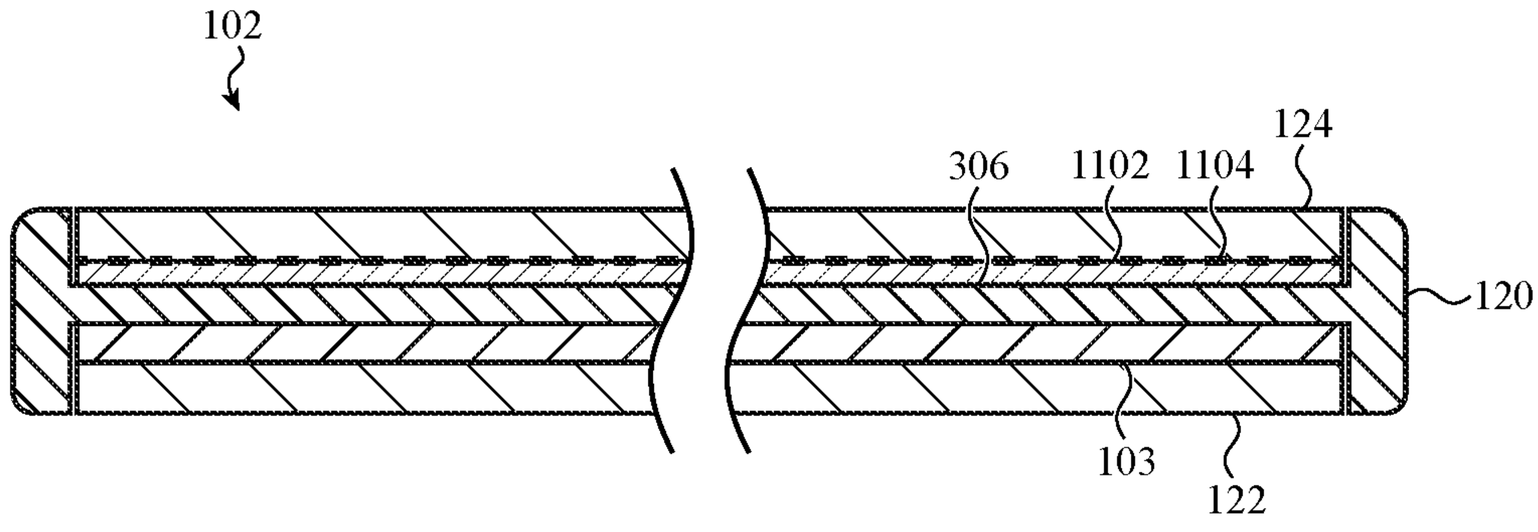


FIG. 11B

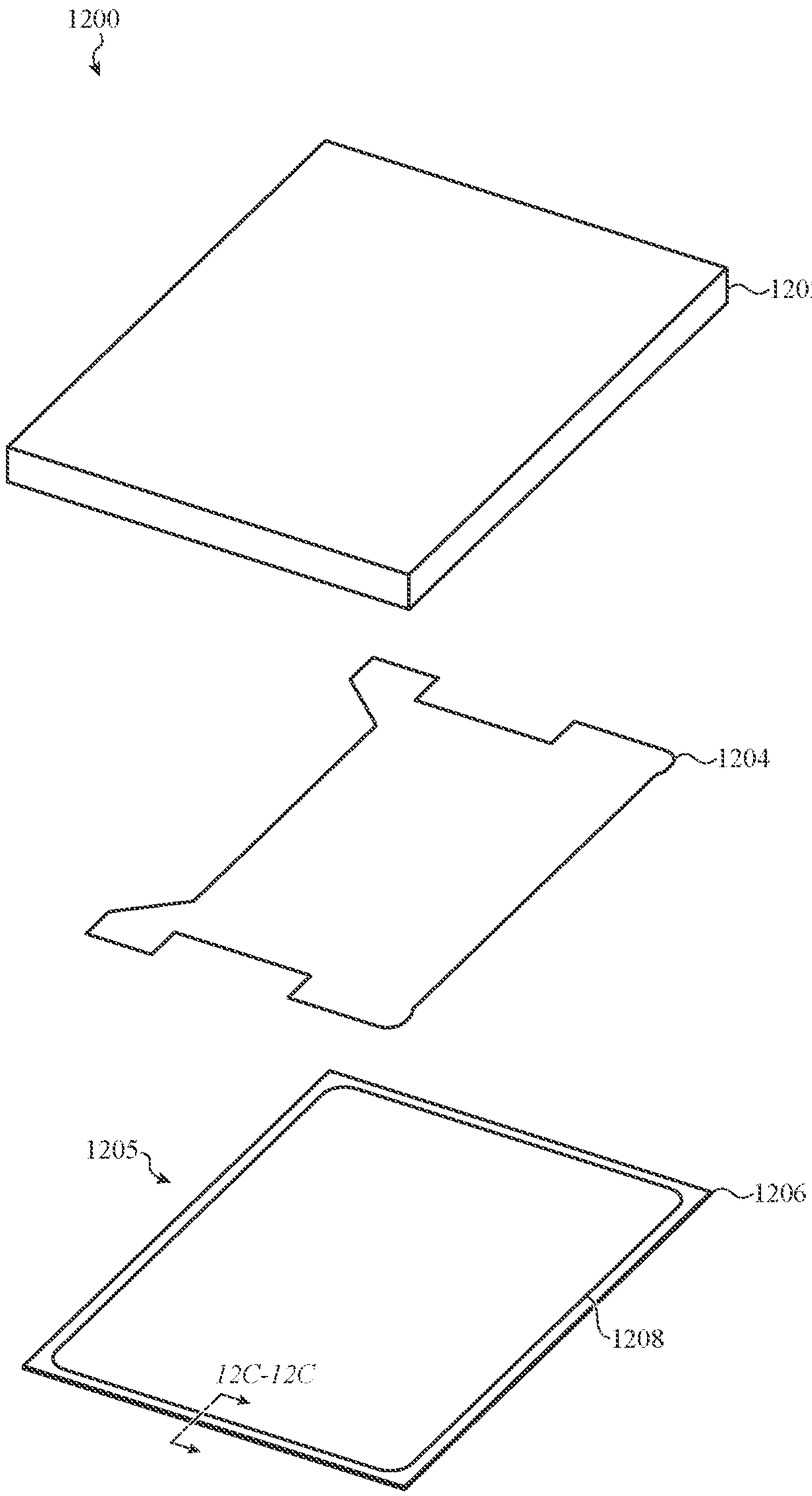


FIG. 12A

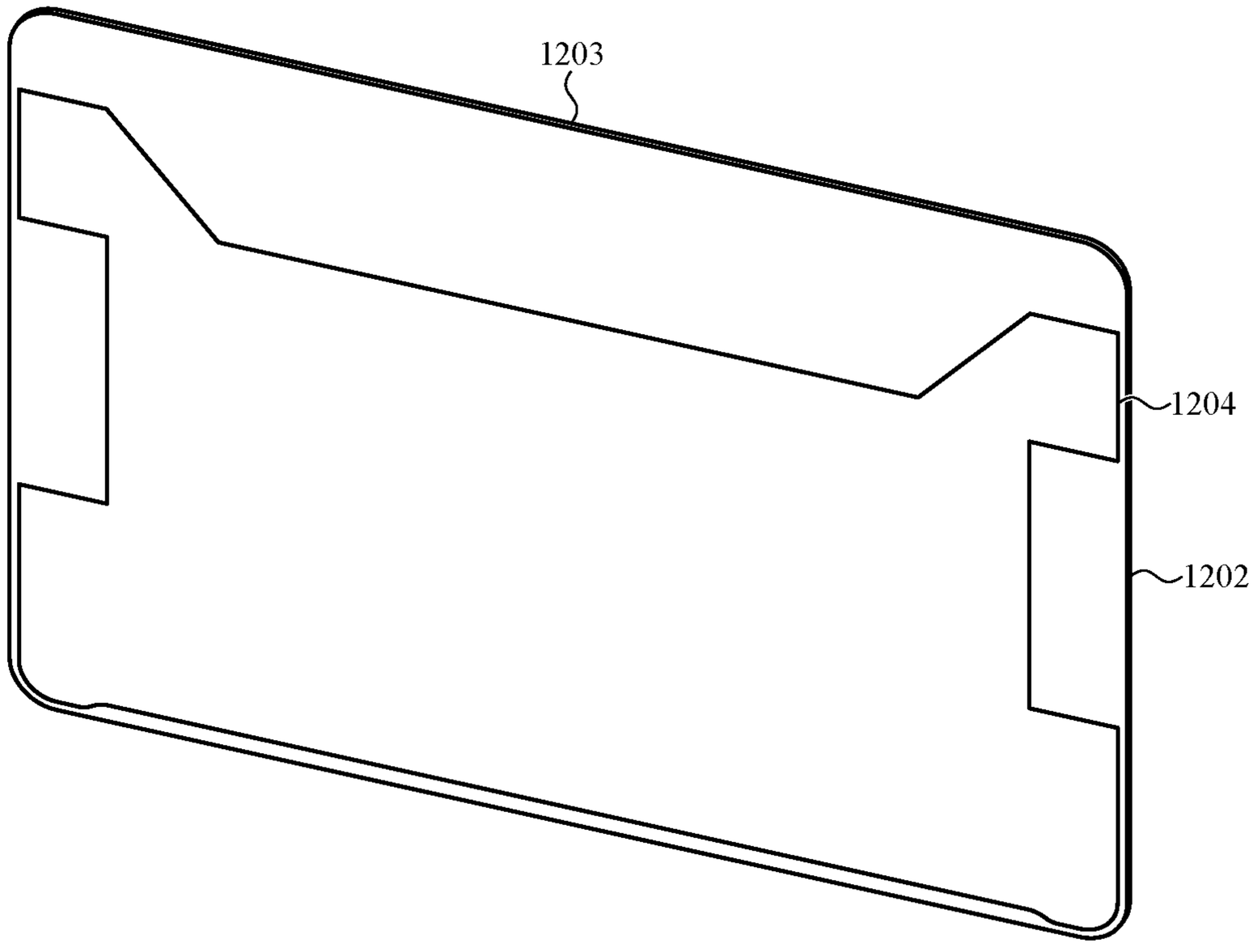


FIG. 12B

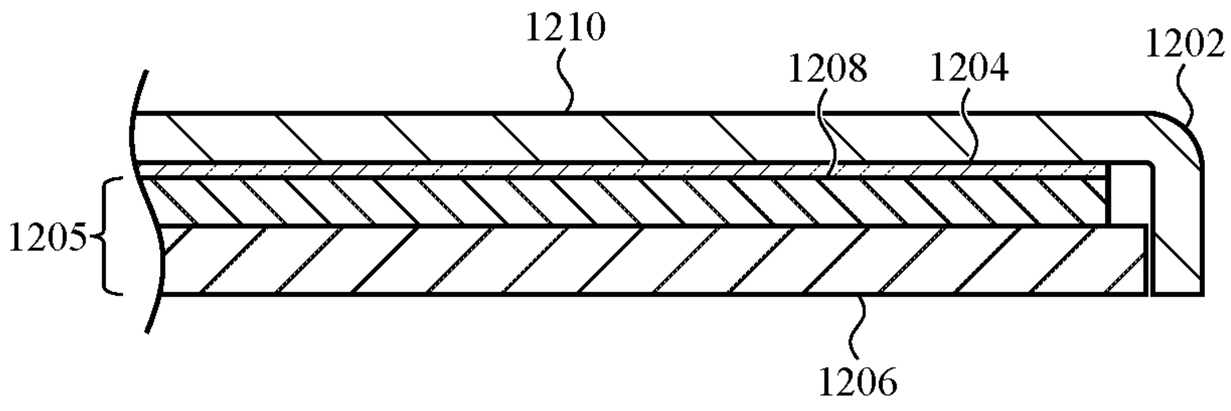


FIG. 12C

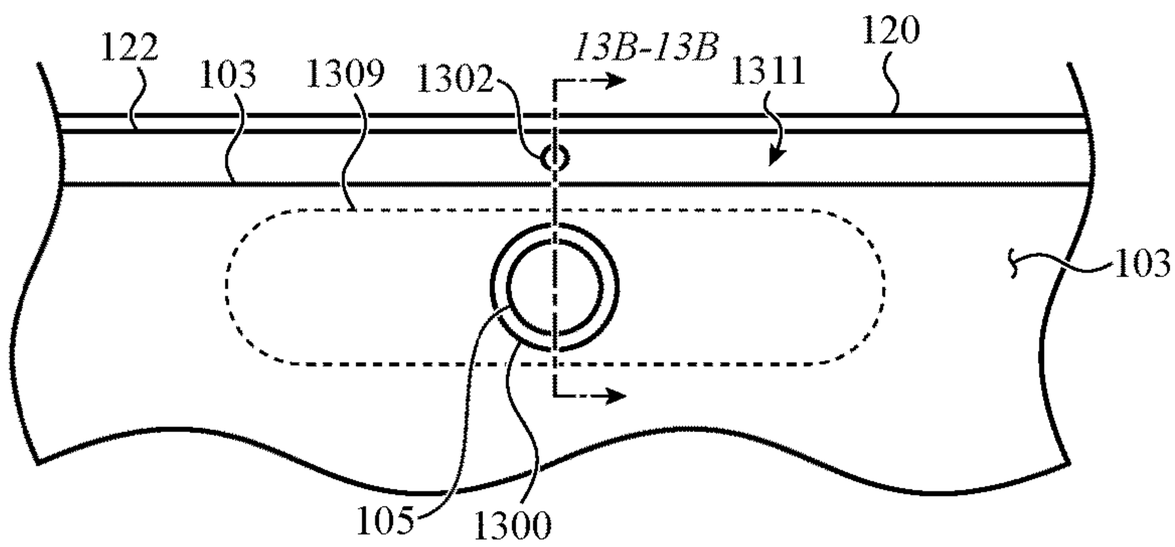


FIG. 13A

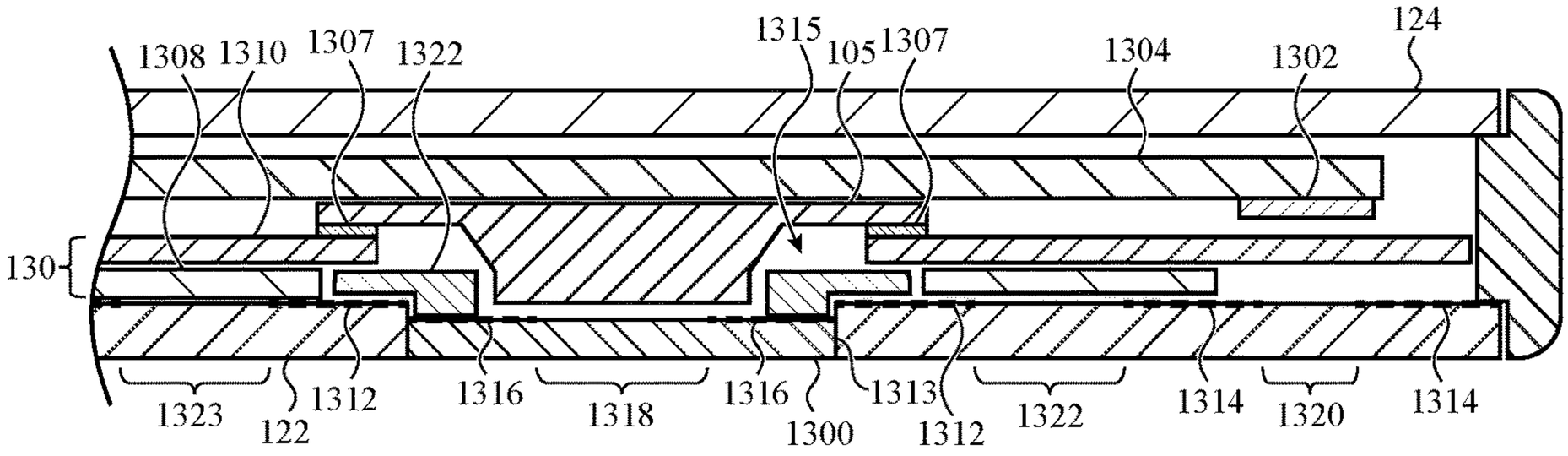


FIG. 13B

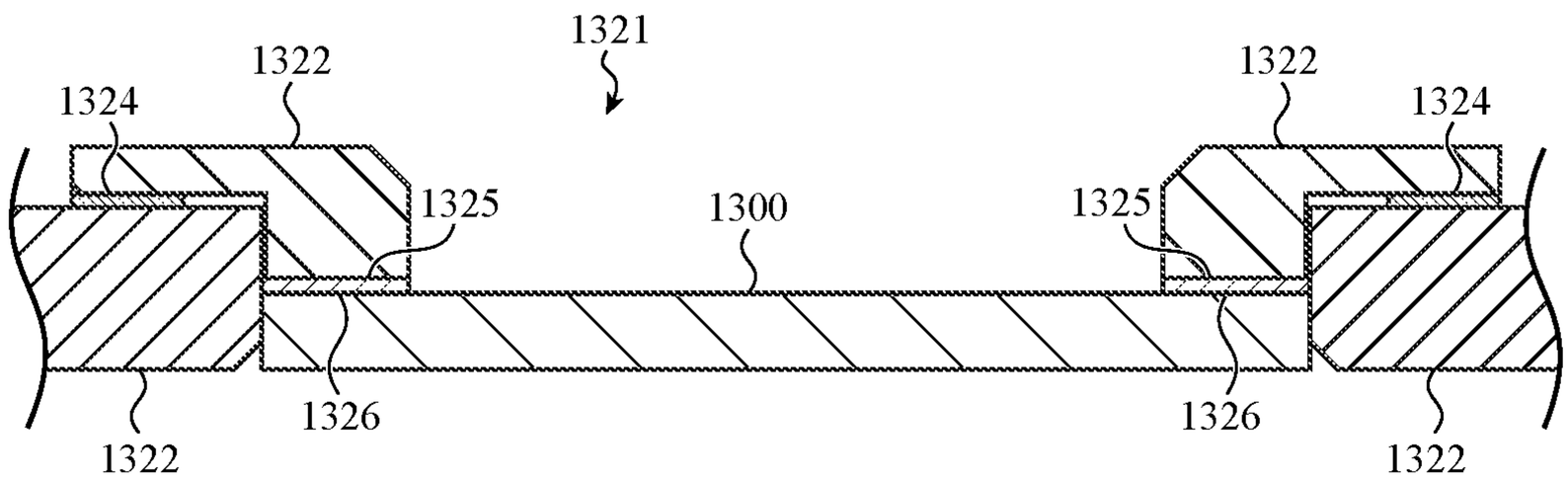


FIG. 13C

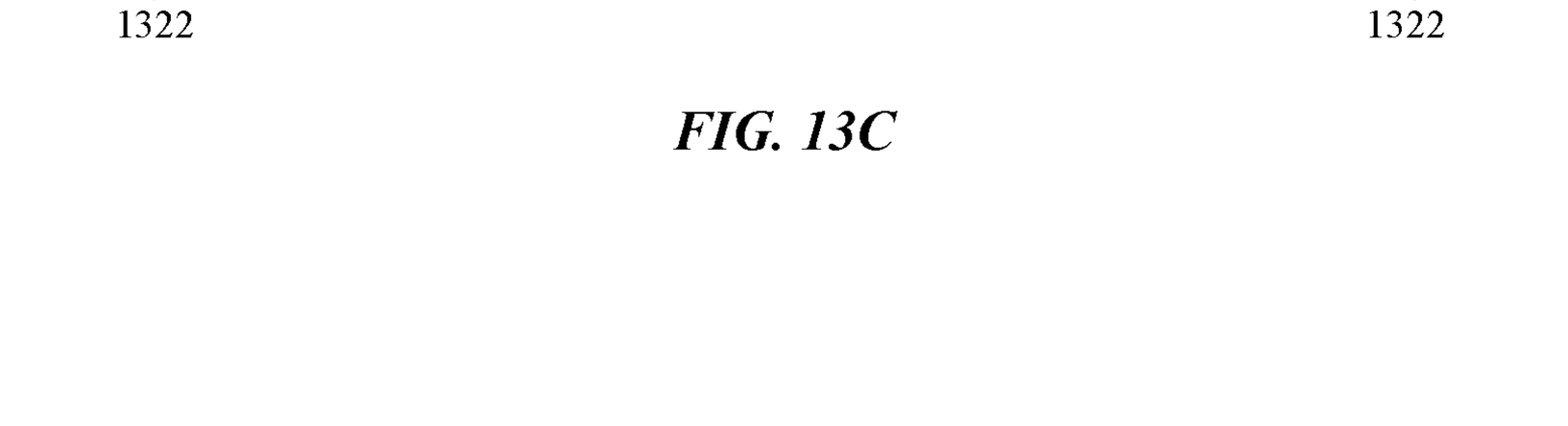


FIG. 13D

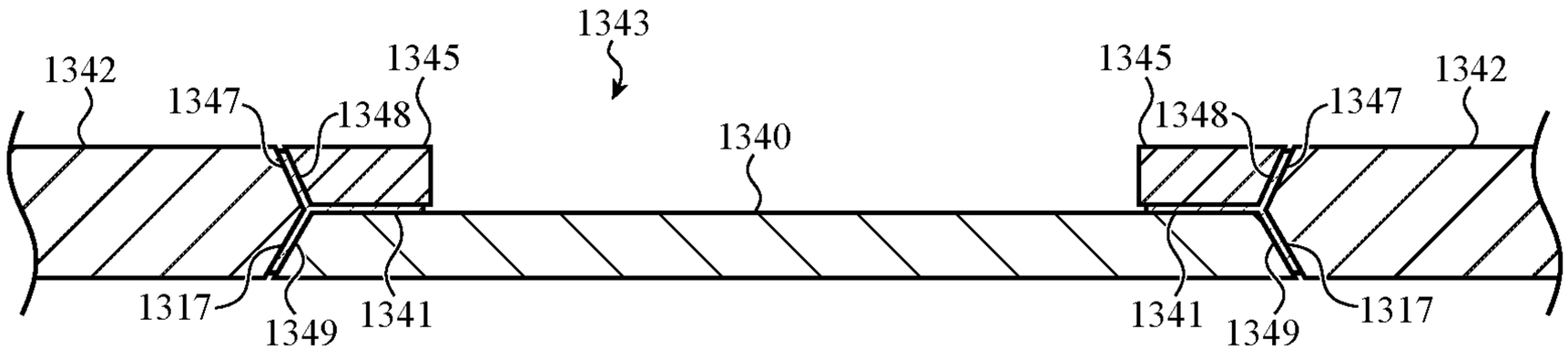


FIG. 13E

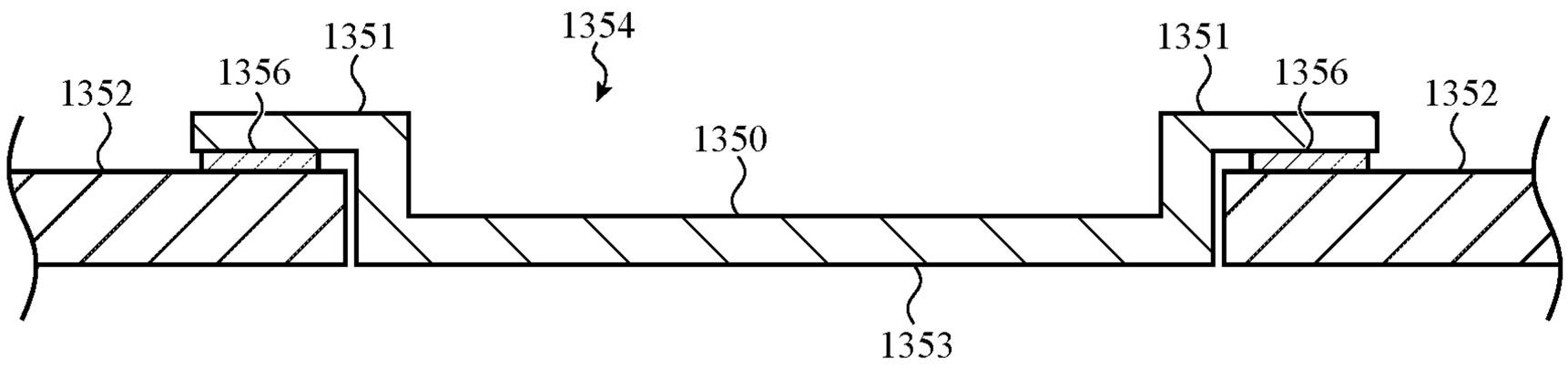


FIG. 13F

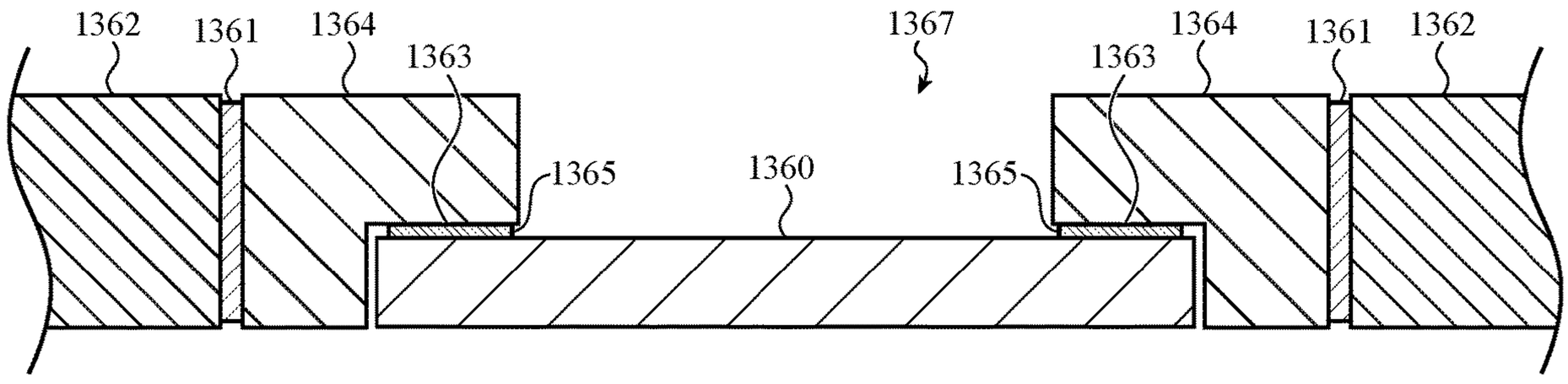


FIG. 13G

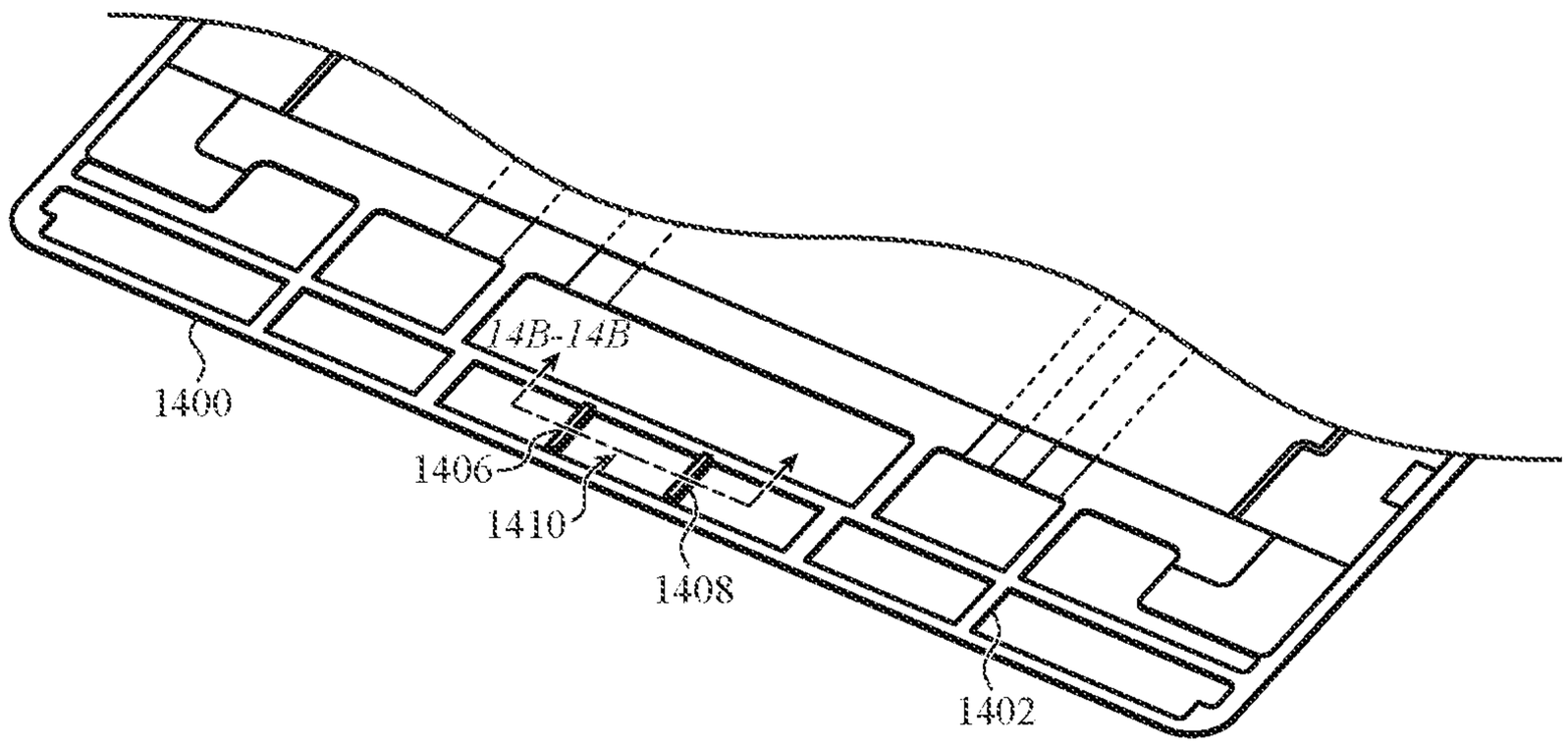


FIG. 14A

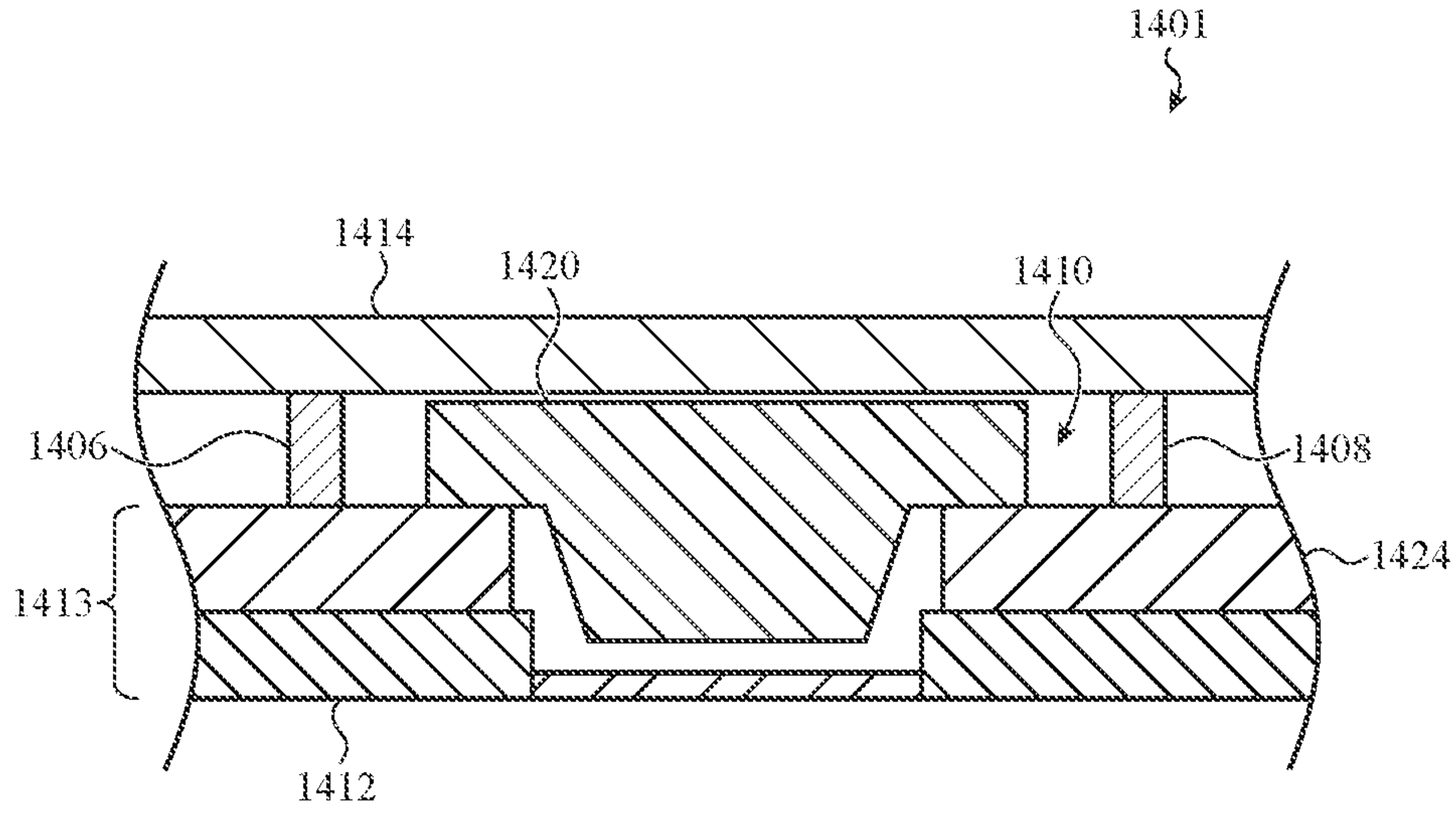


FIG. 14B

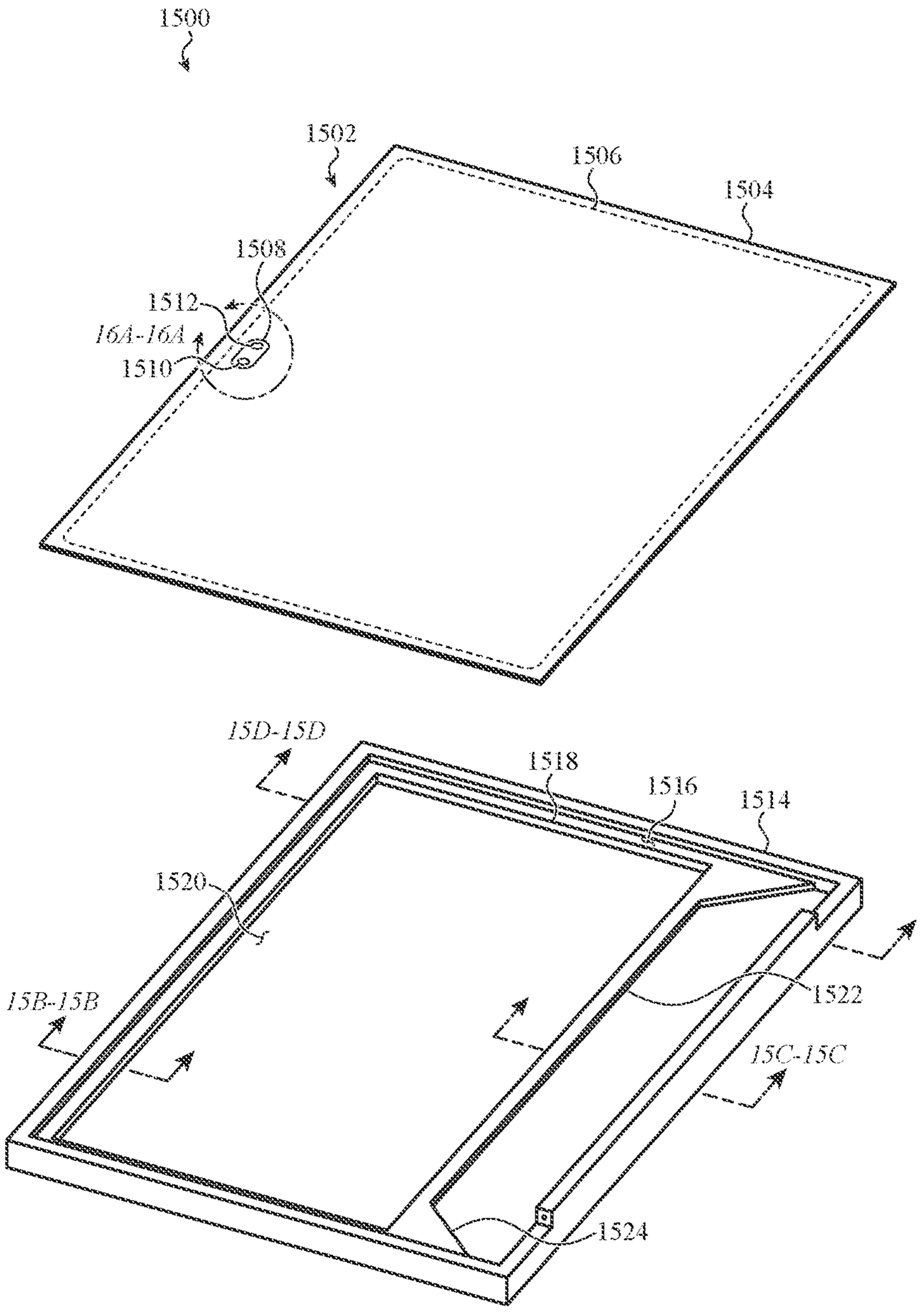

1500
1502
1506
1504
1508
1512
16A-16A
1510
15D-15D
1518
1516
1514
1520
15B-15B
1522
15C-15C
1524

FIG. 15A

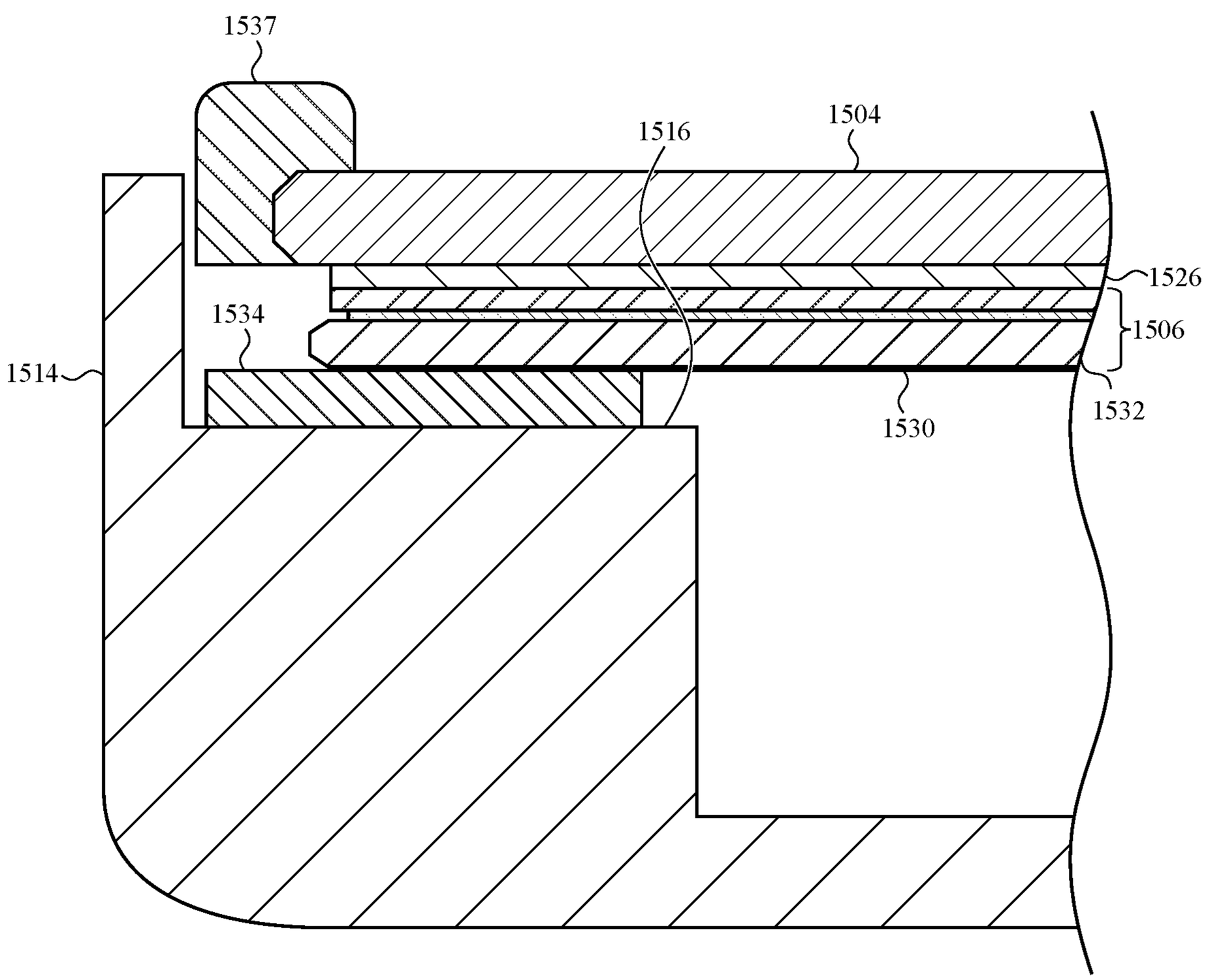


FIG. 15B

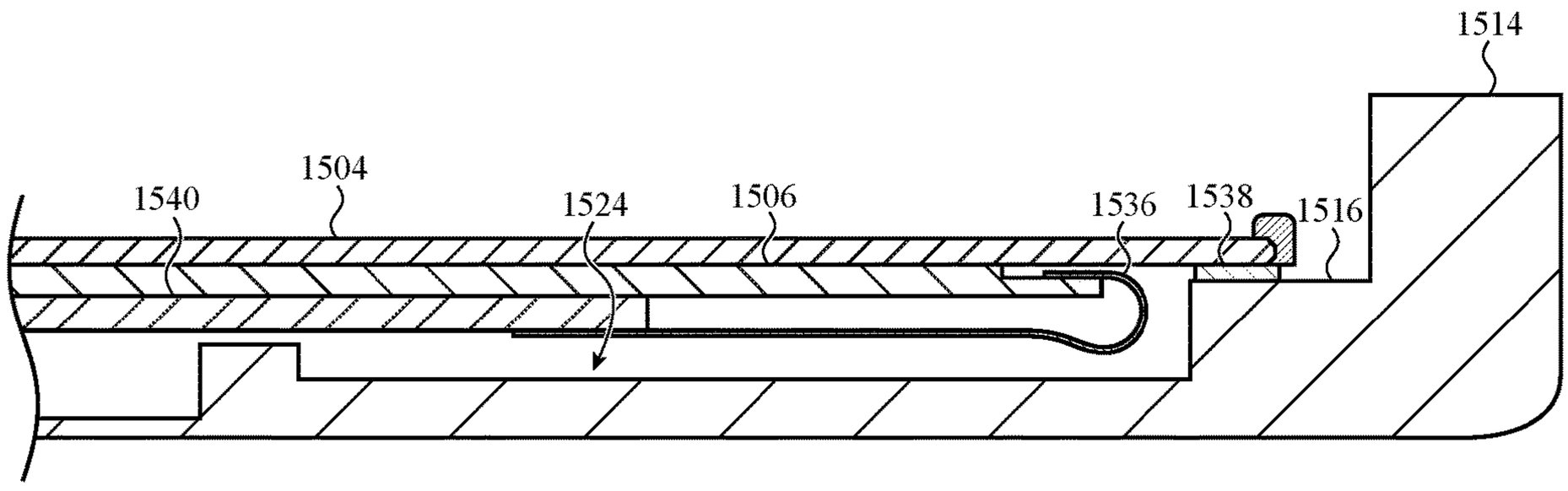


FIG. 15C

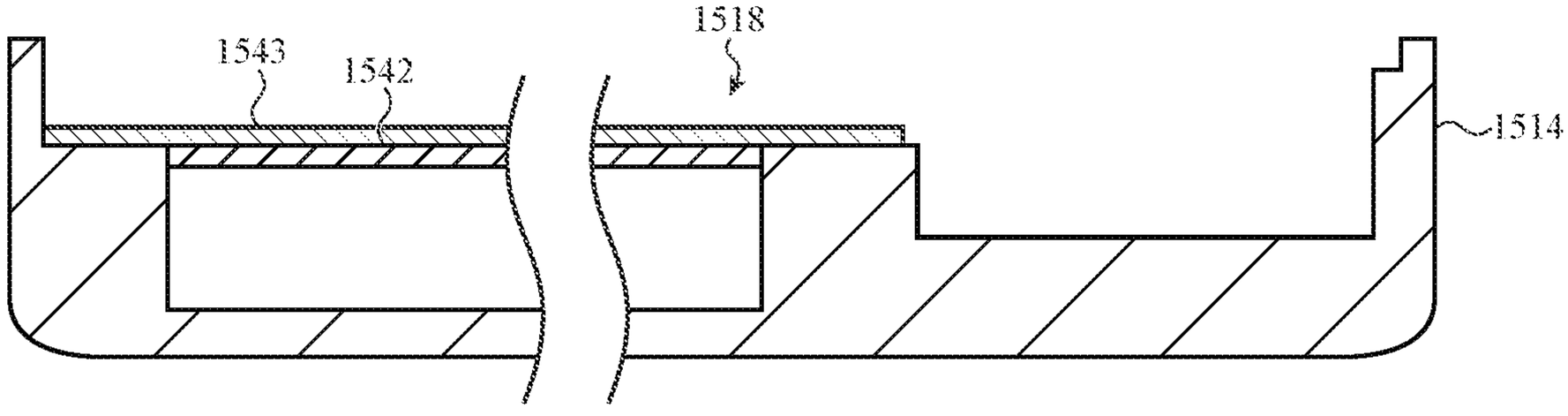


FIG. 15D

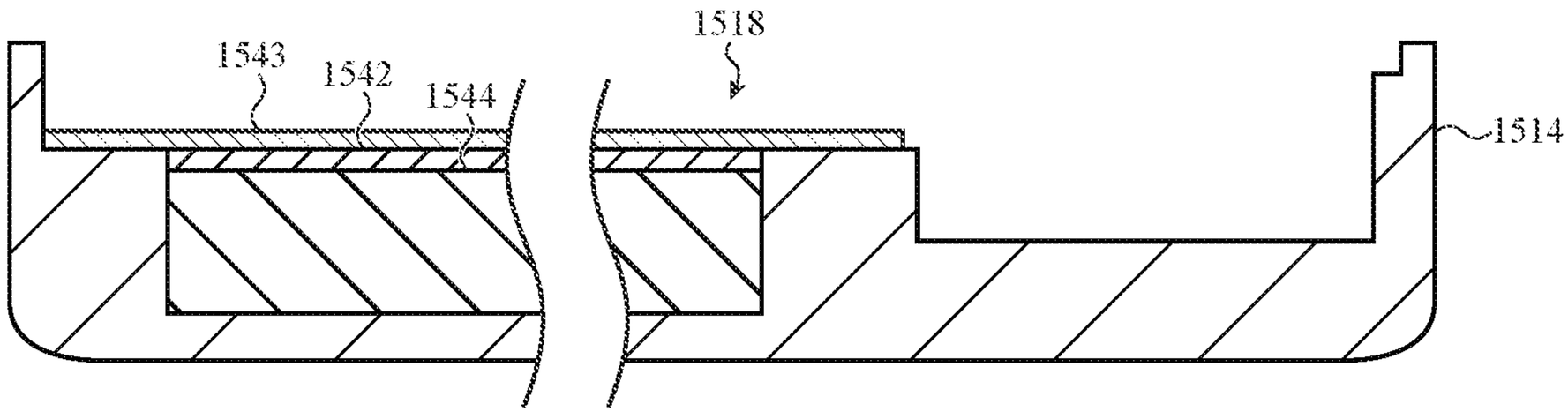


FIG. 15E

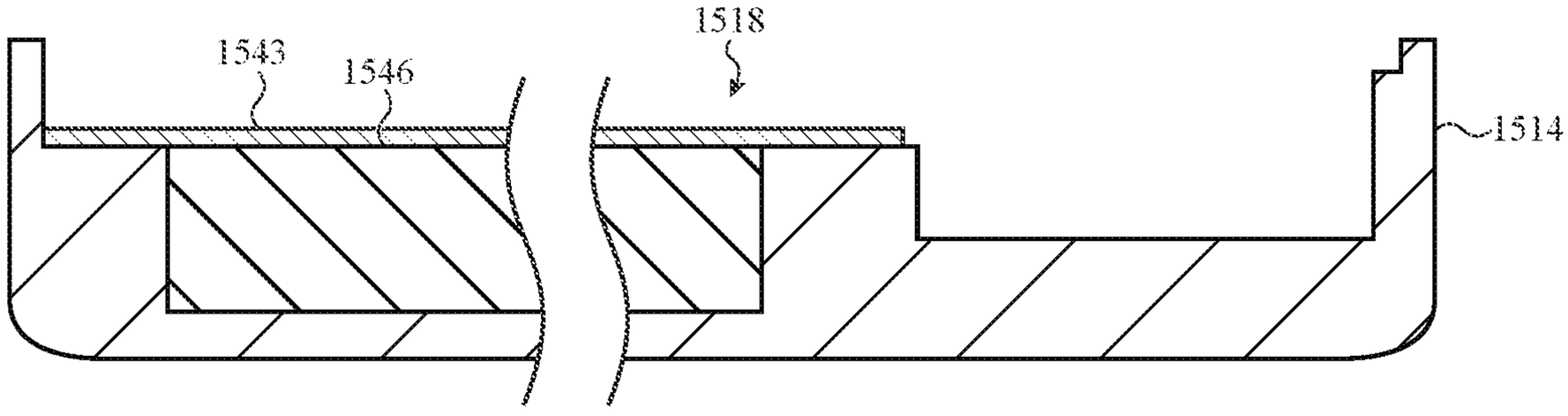


FIG. 15F

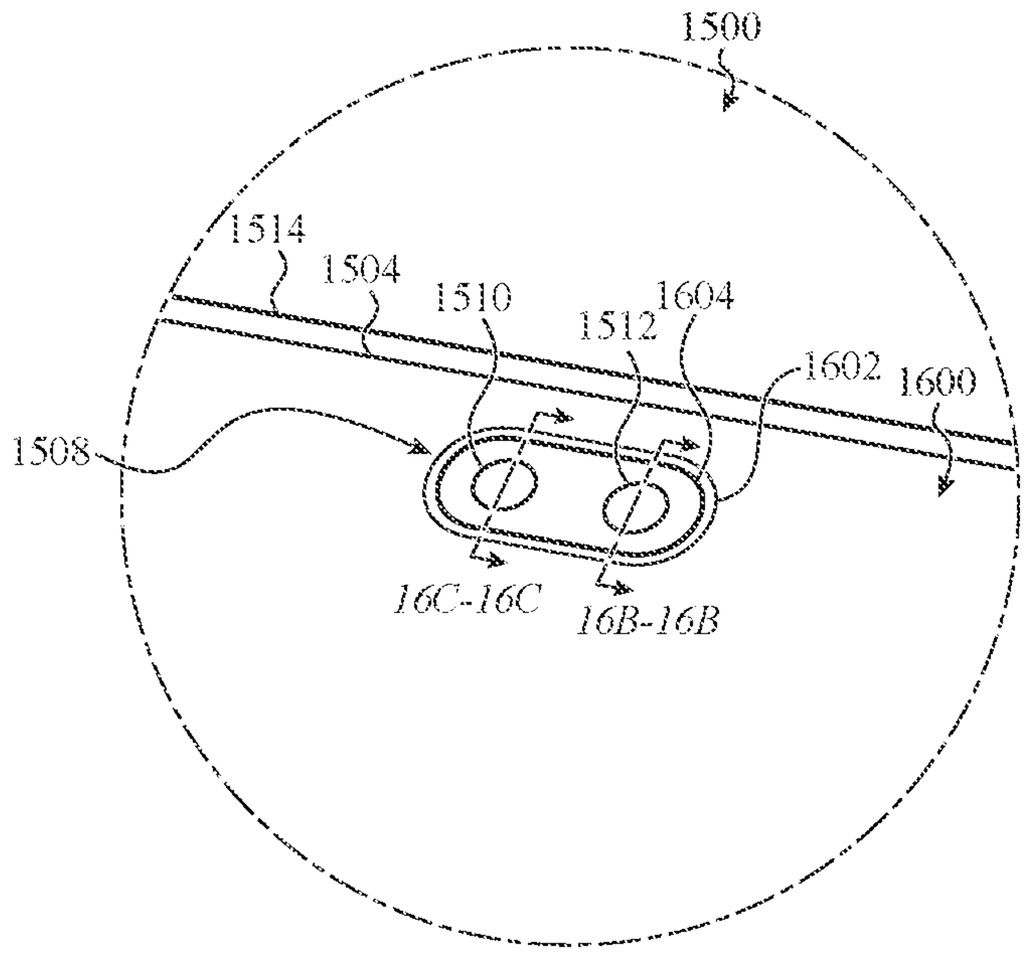


FIG. 16A

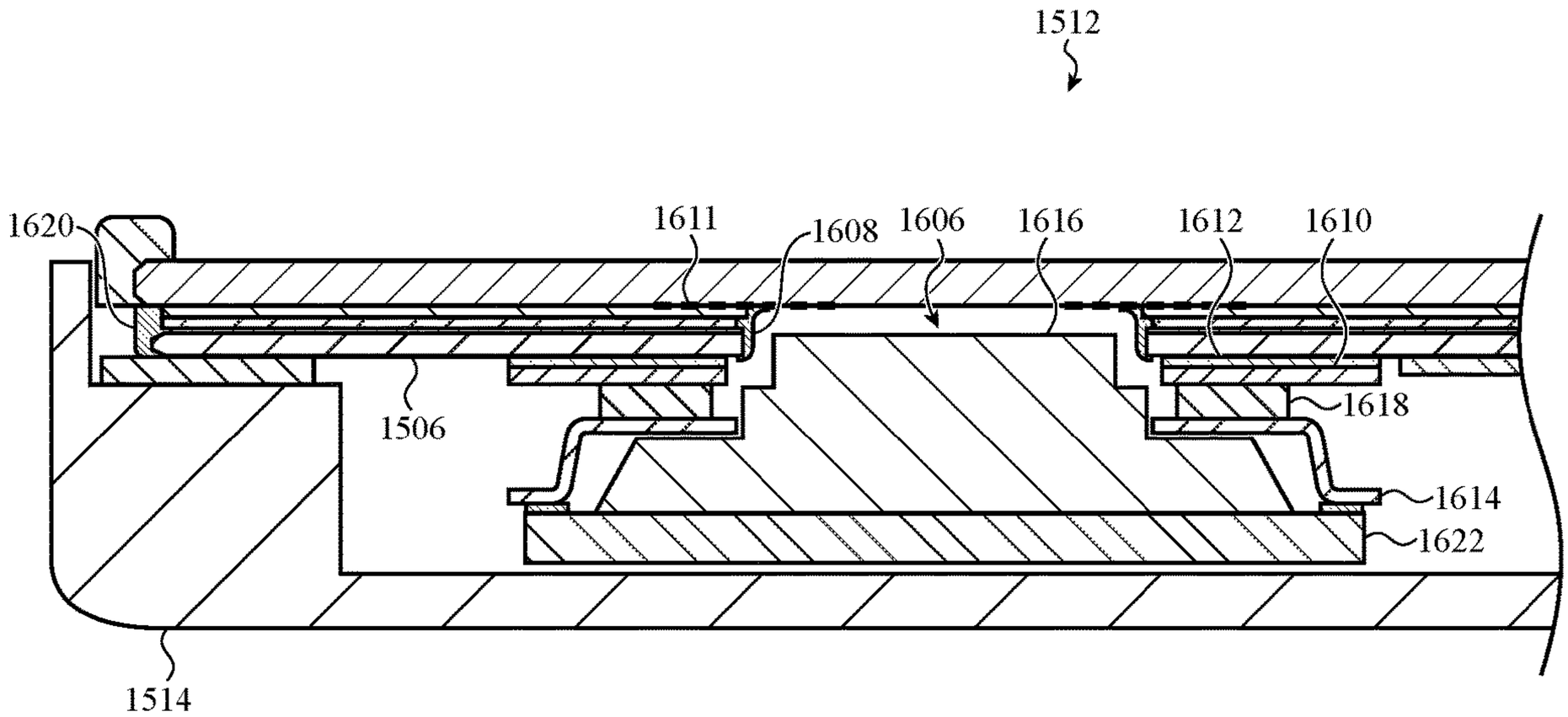

1512
1620
1611
1608
1606
1616
1612
1610
1506
1618
1614
1622
1514

FIG. 16B

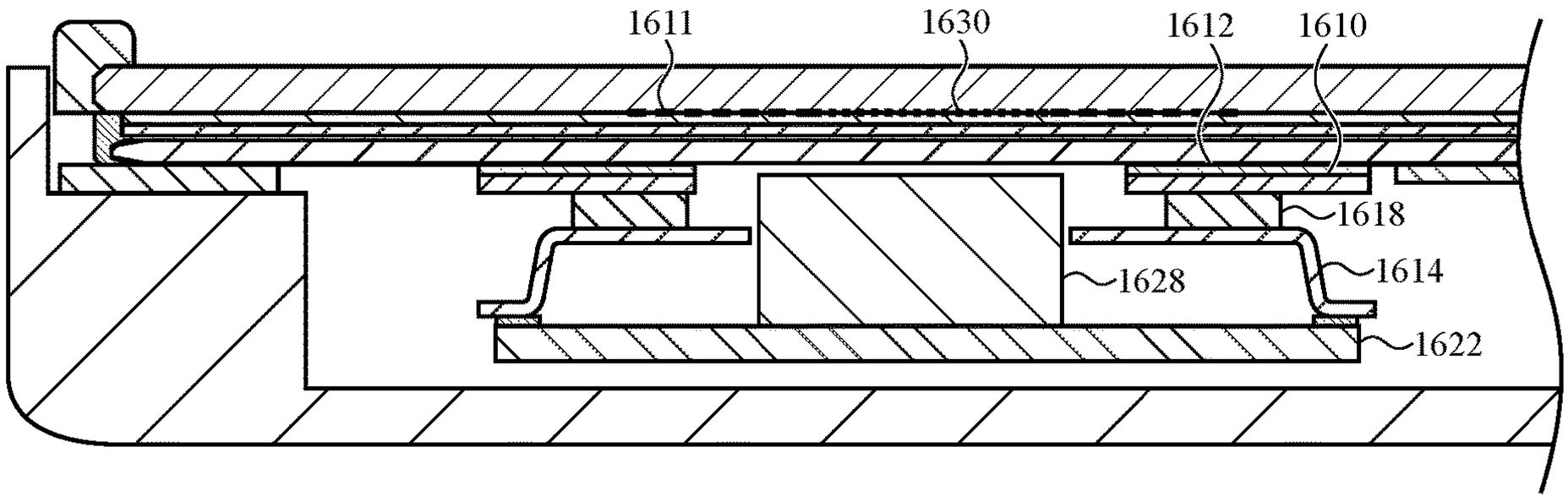


FIG. 16C

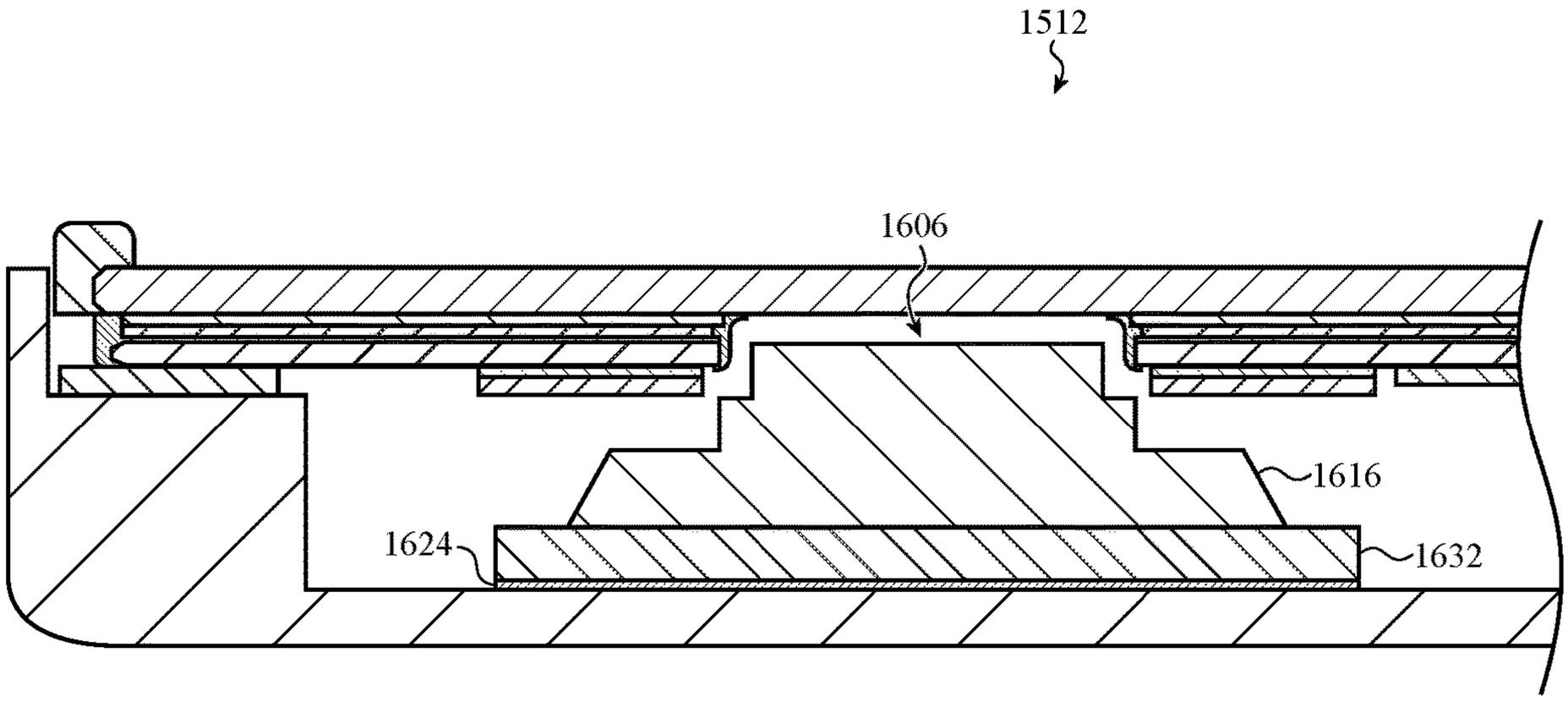


FIG. 16D

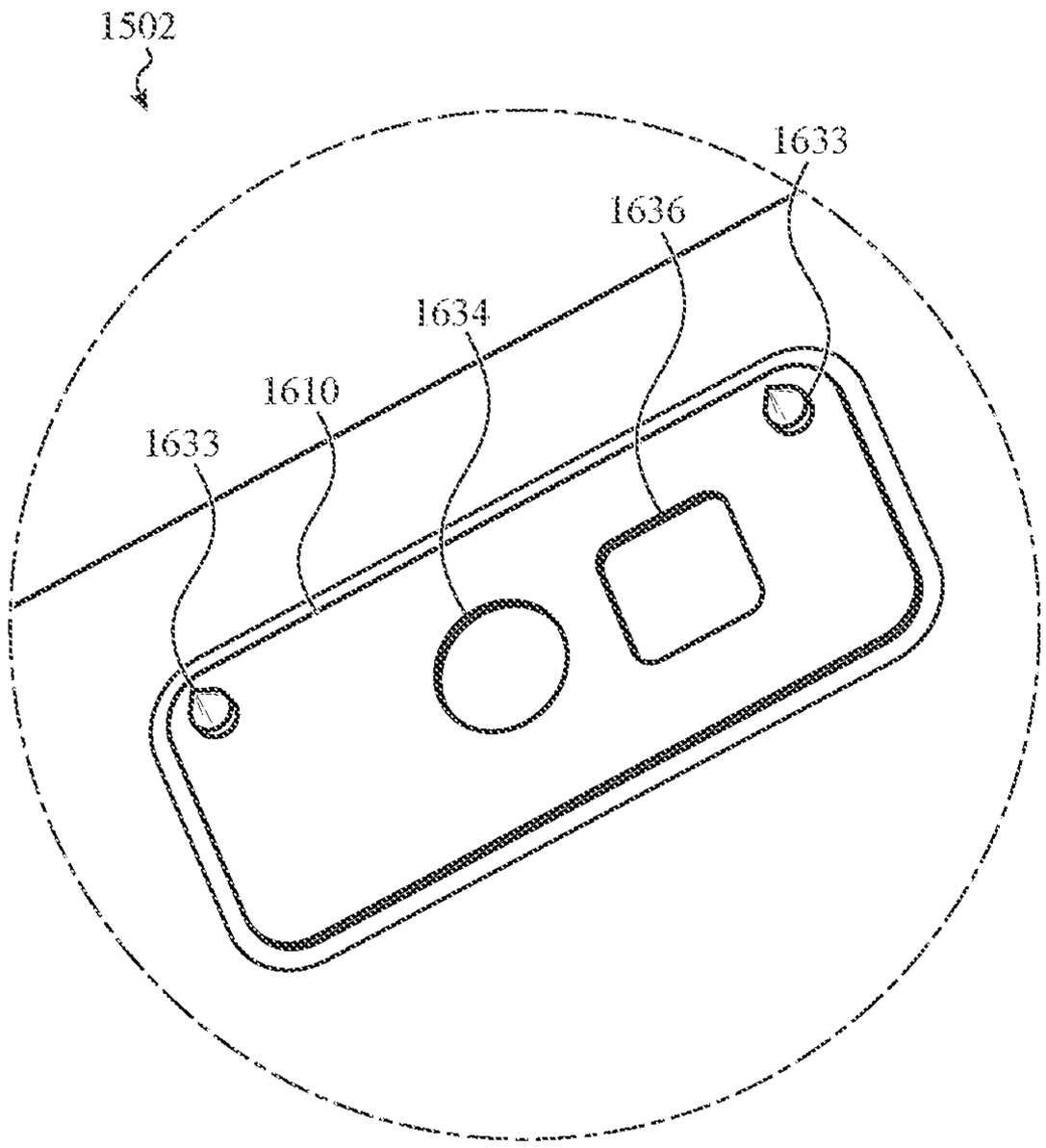


FIG. 16E

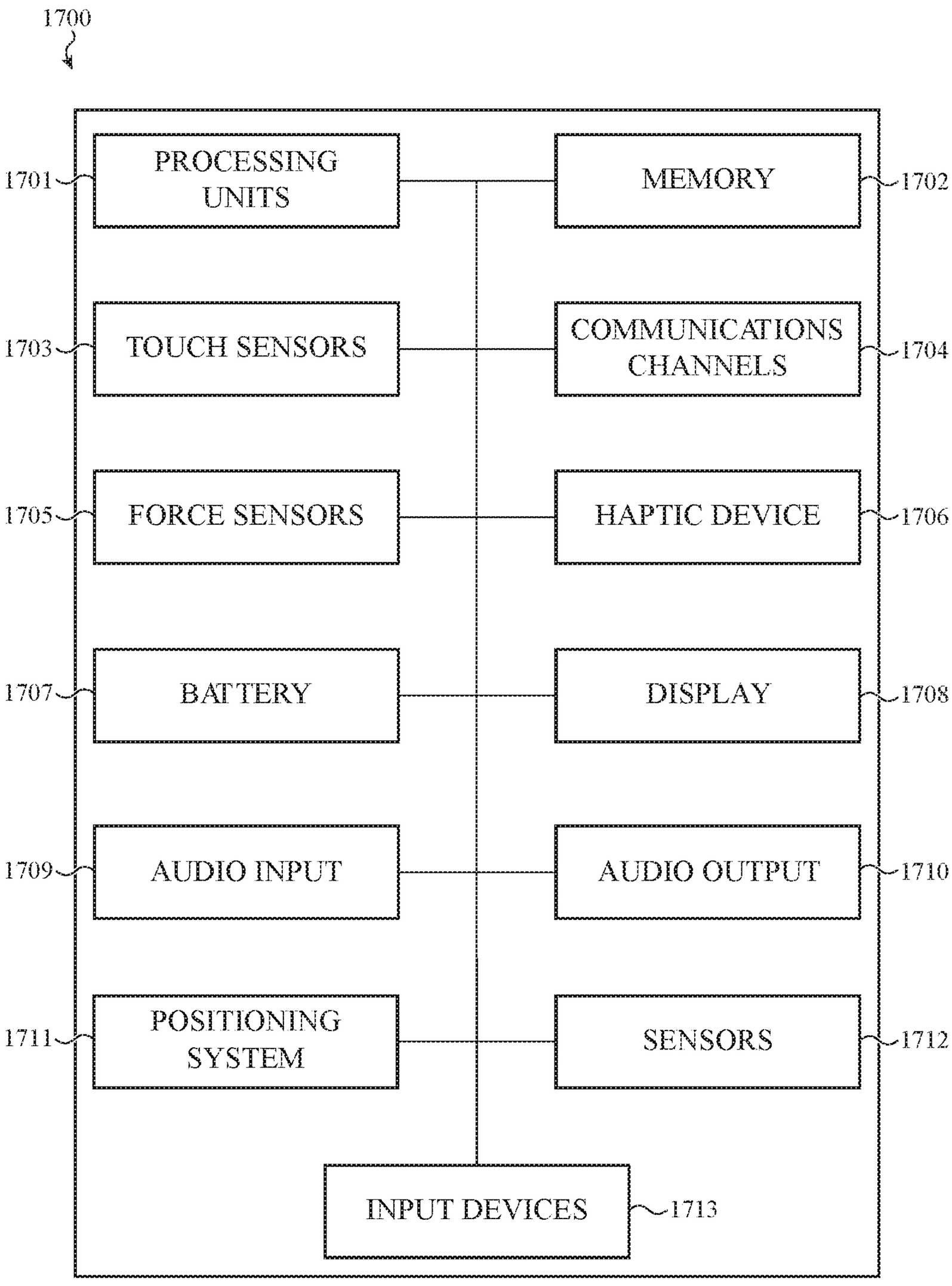

1700
PROCESSING UNITS
1701
MEMORY
1702
TOUCH SENSORS
1703
COMMUNICATIONS CHANNELS
1704
FORCE SENSORS
1705
HAPTIC DEVICE
1706
BATTERY
1707
DISPLAY
1708
AUDIO INPUT
1709
AUDIO OUTPUT
1710
POSITIONING SYSTEM
1711
SENSORS
1712
INPUT DEVICES
1713

FIG. 17

ELECTRONIC DEVICE

CROSS-REFERENCE TO RELATED APPLICATION(S)

[0001] This application is a nonprovisional patent application of and claims the benefit of U.S. Provisional Patent Application No. 63/408,651, filed Sep. 21, 2022 and titled "Electronic Device," the disclosure of which is hereby incorporated herein by reference in its entirety.

FIELD

[0002] The subject matter of this disclosure relates generally to electronic devices, and more particularly, to portable electronic devices such as laptop computers.

BACKGROUND

[0003] Modern consumer electronic devices take many shapes and forms, and have numerous uses and functions. Laptop computers, for example, are common types of computers that provide computing functions in a lightweight, portable form factor. Laptop computers may include input devices, such as keyboards and trackpads, and may have displays to produce graphical outputs.

SUMMARY

[0004] A laptop computer may include a base portion including a keyboard, and a display portion flexibly coupled to the base portion. The display portion may include a housing component formed of metal and defining a set of side surfaces, a front cover assembly coupled to the housing component and including a first glass member defining at least a portion of a front exterior surface of the display portion, and a display coupled to the first glass member, and a rear cover assembly coupled to the housing component and including a second glass member defining at least a portion of a rear exterior surface of the display portion.

[0005] The first glass member may define a first portion of the front exterior surface of the display portion, and the housing component may define a second portion of the front exterior surface of the display portion. The second glass member may define a first portion of the rear exterior surface of the display portion, and the housing component may define a second portion of the rear exterior surface of the display portion.

[0006] The rear cover assembly may further include an opaque mask structure coupled to an interior surface of the second glass member. The set of side surfaces defined by the housing component may include a first side surface, a second side surface, a third side surface, a first corner surface extending from the first side surface to the second side surface, and a second corner surface extending from the second side surface to the third side surface. The laptop computer may further include a touch-sensing layer positioned between the display and the first glass member.

[0007] A laptop computer may include a base portion including a keyboard and a display portion flexibly coupled to the base portion. The display portion may include a housing component defining a first opening along a front side of the housing component and a second opening along a rear side of the housing component, a front cover assembly positioned in the first opening and coupled to the housing component, the front cover assembly including a first glass member defining a display region, and a display coupled to the first glass member, and a rear cover assembly positioned in the second opening and coupled to the housing component, the rear cover assembly including a second glass member defining at least a portion of a rear exterior surface of the display portion.

[0008] A laptop computer may include a base portion including a keyboard and a display portion flexibly coupled to the base portion. The display portion may include a front cover assembly including a front cover including a first glass material and defining at least a portion of a front surface of the display portion, and a display positioned below the front cover. The display portion may further include a rear cover including a second glass material and defining at least a portion of a rear surface of the display portion, a housing component coupled to the front cover and rear cover and including a mid-chassis positioned between the front cover and the rear cover, a first flexible circuit element conductively coupled to a display component of the display and extending from the display along a first side edge of the display, at least a portion of the first flexible circuit element positioned between the mid-chassis and the front cover assembly, and a second flexible circuit element conductively coupled to a touch-sensing component of the display and extending from the display along a second side edge of the display different from the first side edge, at least a portion of the second flexible circuit element positioned between the mid-chassis and the front cover assembly. The second side edge of the display may be perpendicular to the first side edge.

[0009] The laptop computer may further include a third flexible circuit element conductively coupled to the touch-sensing component of the display and extending from the display along a third side edge of the display different from the first side edge and from the second side edge. The first side edge of the display may be a top side edge of the display, and the second and third side edges of the display may be lateral side edges of the display. A fourth side edge of the display may lack flexible circuit elements extending therefrom, and the fourth side edge of the display may be a bottom side edge of the display. The front cover assembly may further include a circuit board, the first flexible circuit element may be conductively coupled to a first segment of the circuit board, and the second and third flexible circuit elements may be conductively coupled to a second segment of the circuit board, the second segment of the circuit board conductively isolated from the first segment of the circuit board.

[0010] A laptop computer may include a base portion including a keyboard, and a display portion flexibly coupled to the base portion and including a housing component, and a cover structure coupled to the housing component and including a transparent cover member having a first thickness and defining a first hole and a transparent camera cover having a second thickness less than the first thickness and positioned in the first hole such that a recess may be defined along a rear surface of the cover structure. The display portion may further include a display coupled to the transparent cover member and defining a second hole extending through an active display region of the display and a camera having a lens assembly extending through the second hole and into the recess.

[0011] The transparent cover member may include glass, and the transparent camera cover may include sapphire. The second thickness may be less than or equal to half of the first

thickness. The laptop computer may further include a mounting structure adhered to an interior surface of the transparent cover member, the mounting structure defining a ledge positioned in the first hole, and the transparent camera cover may be adhered to the ledge of the mounting structure. The display may be configured to produce a graphical output in the active display region that surrounds the transparent camera cover. The laptop computer may further include a first opaque mask positioned along an interior surface of the transparent cover member and defining a first mask region around the first hole and a second opaque mask positioned along an interior surface of the transparent camera cover and defining a second mask region around a transparent window portion of the transparent camera cover.

[0012] A laptop computer may include a base portion including a keyboard, and a display portion flexibly coupled to the base portion and including a housing component including a first wall portion defining a first side exterior surface of the display portion, a second wall portion defining a second side exterior surface of the display portion opposite to the first side exterior surface, and a mid-chassis extending between the first wall portion and the second wall portion and defining an array of attachment holes. The display portion may further include a front cover assembly positioned along a first side of the mid-chassis and including a transparent cover member defining at least part of a front surface of the display portion, a display positioned below the transparent cover, and a mounting structure positioned below the display and including an array of attachment features. The display portion may further include a set of fasteners, each fastener of the set of fasteners extending through a respective attachment hole of the array of attachment holes and engaging with a respective attachment feature of the array of attachment features, and a rear cover assembly positioned along a second side of the mid-chassis and defining at least part of a rear surface of the display portion.

[0013] The housing component may be a unitary metal structure defining the mid-chassis, the first wall portion, and the second wall portion. The housing component may include a wall structure formed of metal and defining the first wall portion and the second wall portion, and the mid-chassis may be coupled to the wall structure. The mid-chassis may include a fiber-reinforced polymer sheet.

[0014] The fasteners of the set of fasteners may be threaded fasteners, and the attachment features of the array of attachment features may be threaded bosses. The mounting structure may include a metal plate, and the attachment features of the array of attachment features may be welded to the mounting structure.

[0015] A laptop computer may include a base portion including a keyboard, and a display portion flexibly coupled to the base portion and including a housing component defining a first wall portion defining a first exterior surface of the display portion, a second wall portion defining a second exterior surface of the display portion opposite to the first exterior surface, and a composite mid-chassis structure coupled to the first wall portion and the second wall portion and extending between the first wall portion and the second wall portion. The display portion may also include a front cover assembly coupled to a front side of the housing component and including a first glass member defining at least a portion of a front exterior surface of the display portion, and a display coupled to the first glass member, and a rear cover assembly coupled to a rear side of the housing component and including a second glass member defining at least a portion of a rear exterior surface of the display portion.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] The disclosure will be readily understood by the following detailed description in conjunction with the accompanying drawings, wherein like reference numerals designate like structural elements, and in which:

[0017] FIGS. **1**A-**1**B depict an example electronic device;

[0018] FIG. **2** depicts a partial cross-sectional view of the electronic device of FIGS. **1**A-**1**B;

[0019] FIG. **3** depicts an exploded view of a portion of the electronic device of FIGS. **1**A-**1**B;

[0020] FIGS. **4**A-**4**B depict an example front cover assembly for an electronic device;

[0021] FIG. **4**C depicts a partial cross-sectional view of the front cover assembly of FIGS. **4**A-**4**B;

[0022] FIGS. **5**A-**5**B depict example front cover assemblies for an electronic device;

[0023] FIGS. **6**A-**6**B depict partial cross-sectional views of a display portion for an electronic device;

[0024] FIGS. **7**A-**7**B depict portions of example housing components for an electronic device;

[0025] FIG. **8**A depicts an example housing component for a display portion of an electronic device;

[0026] FIGS. **8**B-**8**D depict partial cross-sectional views of example housing components for a display portion of an electronic device;

[0027] FIG. **9**A depicts an exploded view of an example display portion;

[0028] FIG. **9**B depicts a partial cross-sectional view of the display portion of FIG. **9**A;

[0029] FIG. **10**A depicts an exploded view of another example display portion;

[0030] FIG. **10**B depicts a partial cross-sectional view of the display portion of FIG. **10**A;

[0031] FIG. **11**A depicts an exploded view of another example display portion;

[0032] FIG. **11**B depicts a partial cross-sectional view of the display portion of FIG. **11**A;

[0033] FIG. **12**A depicts an exploded view of another example display portion;

[0034] FIG. **12**B depicts a portion of the display portion of FIG. **12**A;

[0035] FIG. **12**C depicts a partial cross-sectional view of the display portion of FIG. **12**A;

[0036] FIG. **13**A depicts a portion of an example display portion including a camera;

[0037] FIG. **13**B depicts a partial cross-sectional view of the display portion of FIG. **13**A;

[0038] FIGS. **13**C-**13**G depict partial cross-sectional views of a camera window portion of a display portion;

[0039] FIG. **14**A depicts an example housing component for an electronic device;

[0040] FIG. **14**B depicts a partial cross-sectional view of a display portion including the housing component of FIG. **14**A;

[0041] FIG. **15**A depicts an exploded view of another example display portion;

[0042] FIGS. **15**B-**15**F depict partial cross-sectional views of the display portion of FIG. **15**A;

[0043] FIG. **16**A depicts a portion of the example display portion of FIG. **15**A;

[0044] FIGS. **16**B-**16**D depict partial cross-sectional views of the display portion of FIG. **15**A;

[0045] FIG. **16**E depicts a portion of a front cover assembly; and

[0046] FIG. **17** depicts a schematic diagram of an example electronic device.

DETAILED DESCRIPTION

[0047] Reference will now be made in detail to representative embodiments illustrated in the accompanying drawings. It should be understood that the following descriptions are not intended to limit the embodiments to one preferred embodiment. To the contrary, it is intended to cover alternatives, modifications, and equivalents as can be included within the spirit and scope of the described embodiments as defined by the appended claims.

[0048] Laptop computers as described herein include a base portion, which includes input devices such as a keyboard, trackpad, and the like, and a display portion that is flexibly coupled to the base portion (e.g., via a hinge). The display portion includes a display, which may be a touch- and/or force-sensitive display, and may include a camera for capturing images (e.g., still or video images) of a user, such as for videoconferencing purposes.

[0049] Because laptop computers are typically portable devices, factors such as size, weight, and durability can affect the overall usefulness of the device. Further, the particular materials used for the laptop computer, and in particular, for the enclosure components, can impact the size, weight, and durability of the computer. For example, enclosure materials such as plastic may be light, but may have relatively low durability.

[0050] Described herein are laptop computers in which the display portion has a metal housing component that defines the peripheral side surfaces of the display portion (e.g., a band-like structure around the periphery of the display portion), and glass sheets for the front and back surfaces of the display portion. This configuration produces a display portion that is thin and light, while maintaining a high degree of stiffness. Additionally, because the back of the display portion is made of glass, the back may be more resistant to scratches, cracking, warping, and other damage to which other materials may be susceptible.

[0051] FIGS. **1**A-**1**B depict a computing device **100** (or simply "device **100**"). The device **100** may be or may resemble a portable computer, also known as a laptop or notebook computer, that has a display portion **102** and a base portion **104** flexibly or pivotally coupled to the display portion **102** (e.g., so that the display portion **102** is able to rotate, pivot, flex, articulate, or otherwise move relative to the base portion **104**). The display portion **102** includes a display **103** that provides a primary means of conveying visual information to the user, such as by displaying graphical user interfaces. The display portion **102** also includes a camera **105**. The camera **105** may capture images (e.g., still and/or video images), such as for videoconferencing functions, general image capture/recording, or the like.

[0052] The base portion **104** may include a keyboard **114** and a trackpad region **116**. The keyboard **114** may be any type of keyboard that can receive typing inputs. For example, the keyboard **114** may be a keyboard with moving keys (e.g., movable keycaps supported by a key mechanism such as a scissor mechanism). As another example, the keyboard **114** may be a virtual keyboard, such as a keyboard that is displayed on a touch-sensitive input surface (e.g., a touch-screen). Other types of keyboards may also be used.

[0053] The trackpad region **116** may be configured to detect touch- and/or force-based inputs applied to the base portion **104** in the trackpad region **116**. For example, the trackpad region **116** may detect clicks, taps, gestures (e.g., swiping, pinching), multi-touch inputs, and the like. While FIG. **1**A illustrates one example shape, size, and location of a trackpad region **116**, other configurations are also possible. For example, the trackpad region **116** may be larger or smaller than that shown in FIG. **1**A. In some cases, the trackpad region **116** may include substantially the entire region of the upper surface of the base portion **104** other than the keyboard **114**.

[0054] The base portion **104** may include a base housing component **115** and a top structure **117**. The base housing component **115** may define peripheral side surfaces **226** of the base portion **104**, and the top structure **117** may define at least a portion of an upper surface of the base portion **104**. The base housing component **115** may define a portion **222** of the upper surface of the base portion **104**, and a portion **224** of the lower or bottom surface of the base portion **104**. As shown, the surfaces **222**, **226**, and **224** define a continuous surface that extends from the top of the base portion **104** to the bottom of the base portion **104**. The base portion **104** may also include a bottom structure **210**. The bottom structure **210** may be a plate or sheet that is coupled to the base housing component **115** and defines a bottom surface of the base portion **104**. The bottom structure **210** may comprise metal, a polymer, a composite structure, glass, or another suitable material or combination of materials.

[0055] In some cases, the base housing component **115** is formed of a metal material, and the top structure **117** is formed of glass, sapphire, ceramic, or glass ceramic. Other materials and combinations of materials are also contemplated for the base housing component **115** and the top structure **117**. For example, both the base housing component **115** and the top structure **117** may be formed from metal (e.g., the same or different metals). In some cases, the base portion **104** may have a single component or structure that defines the side and top surfaces of the base portion **104**.

[0056] The base portion **104** may also include device components **212**. The device components **212** may include all or some of the components described with respect to FIG. **17**. For example, the device components **212** may include one or more of a battery, a logic board, a processor, memory, a haptic device, a keyboard, a trackpad, a communication port, a charging port, battery charging circuitry, and the like. Other components (or systems or portions of systems) may also be included in (or otherwise coupled to) the base portion **104**.

[0057] The display portion **102** may include a housing component **120**, a front cover **122**, and a rear cover **124**. The housing component **120** may be formed from metal and may define a portion of at least three exterior peripheral sides **130**, **131**, **132** of the display portion **102**. As described herein, the housing component **120** may further define a portion of each of the front and rear exterior surfaces of the display portion **102**. As described herein, the housing component **120** may define pockets along its front and rear sides, and the front and rear covers **122**, **124** may be positioned in the pockets and attached to the housing component **120**.

[0058] The front cover **122**, which may be part of a front cover assembly as described herein, may be formed from glass or another transparent material (e.g., ceramic, glass ceramic, a polymer, etc.), and may define at least a portion of the front exterior surface of the display portion **102**. The rear cover **124**, which may be part of a rear cover assembly as described herein, may be formed from glass or another transparent material (e.g., ceramic, glass ceramic, a polymer, etc.), and may define at least a portion of the rear exterior surface of the display portion **102**. The rear cover **124** may include an indicia **125**, such as a logo, icon, shape, or the like. In some cases, the indicia **125** may be defined by one or more layers (e.g., ink layers, deposited coatings, etc.) applied to a surface of a glass or other transparent material of the rear cover **124**. The front and rear covers **122**, **124** may be positioned in pockets defined by the housing component **120** or otherwise coupled to the housing component **120**.

[0059] The front cover **122** and the rear cover **124** may define substantially the entire front and rear surfaces, respectively, of the display portion **102**. In some cases, the front cover **122** defines greater than about 90%, greater than about 95%, or greater than about 98% of the front surface of the display portion **102**. In some cases, the portions of the front surface that are not defined by the front cover **122** are defined by a portion **216** of the housing component **120** (FIG. **2**), and optionally a gasket **202** (FIG. **2**). In some cases, the rear cover **124** defines greater than about 90%, greater than about 95%, or greater than about 98% of the rear surface of the display portion **102**. In some cases, the portions of the rear surface that are not defined by the rear cover **122** are defined by a portion **220** of the housing component **120** (FIG. **2**). In some cases, the front cover **122** and the rear cover **124** have substantially the same outward-facing areas (e.g., the area of the front surface defined by the front cover **122** may be substantially equal to the area of the rear surface defined by the rear cover **124**. For example, the areas of the outward-facing surfaces of the front and rear covers may differ by less than about 20%, less than about 10%, less than about 5%, or less than about 2.5%. In some cases, the width of the front cover **122** may be substantially equal to the width of the rear cover **124** (e.g., differing by less than about 10% or less than about 5%, or less than about 2.5%, or less than about 1%). In some cases, the height of the front cover **122** may be substantially equal to the height of the rear cover **124** (e.g., differing by less than about 10% or less than about 5%, or less than about 2.5%, or less than about 1%).

[0060] The front and rear covers **122**, **124** may be coupled to the housing component **120** with techniques that produce a shear-resistant coupling between the covers and the housing component **120** (e.g., a high degree of resistance to relative motion in a plane parallel to the front and/or rear surfaces of the covers). Shear-resistant couplings may impart a high degree of stiffness to the display portion **102**. Examples of shear-resistant couplings are described herein, and include, for example, fastening the covers to the housing component **120** via fasteners or other mechanical interlocking features that extend into or through a mid-chassis section of the housing component **120**, attaching the covers to a mid-chassis section with adhesives over a large area (e.g., at least 50% of the area of the covers), and the like.

[0061] FIG. **2** is a partial cross-sectional view of the device **100**, viewed along line **2-2** in FIG. **1**A. FIG. **1**A illustrates the device **100** in an open position (e.g., with the display portion **102** in an open position relative to the base portion **104**), while FIG. **2** illustrates the device **100** in a closed position (e.g., with the display portion **102** in a closed position relative to the base portion **104**).

[0062] The display portion **102** may include a gasket **202** positioned between the outer periphery of the front cover **122** and a lip or flange portion of the housing component **120**. The gasket **202** may protrude past the front exterior surface of the front cover **122**, and may prevent or reduce the likelihood of the front cover **122** contacting the base portion **104**. The gasket **202** may also prevent or inhibit the peripheral sides of the front cover **122** from contacting the surrounding lip or flange portion of the housing component **120**. The gasket **202** may be formed from a polymer material, and may provide a degree of compliance between the various structures and components that it contacts and/or is positioned between.

[0063] As shown in FIG. **2**, the housing component **120** (e.g., one or more wall portions of the housing component **120**) defines a peripheral exterior surface **218** of the display portion **102**. In some cases, the peripheral exterior surface **218** extends along or otherwise defines at least three peripheral sides of the display portion **102** (e.g., a top peripheral side and two lateral peripheral sides). In some cases, the peripheral exterior surface **218** is continuous along multiple sides of the display portion **102**. For example, the housing component **120** may define a smooth, continuous surface that extends along a first lateral side of the display portion **102** (e.g., a vertical side, when the display portion **102** is in an open position), a top side of the display portion **102**, and a second lateral side of the display portion **102**.

[0064] As noted above, the housing component **120** may define front and rear openings, and the front and rear covers **122**, **124** may be positioned in the openings and coupled to the housing component **120**. The housing component **120** may define ledges, such as ledges **207**, **205**, in the openings, and the front and rear covers **122**, **124**, respectively, may be positioned on the ledges **207**, **205**. Adhesive structures **206**, **204** may adhere portions of the front and rear covers **122**, **124** to the ledges **207**, **205**. The adhesive structures **206**, **204** may include adhesive films, cured liquid adhesives, adhesive gaskets, or the like. As used herein, adhesive structures may include a single adhesive material (e.g., an adhesive polymer), or multiple materials and/or components, and may include both adhesive components and non-adhesive components (e.g., an adhesive structure may include a foam substrate and one or more adhesive layers on the surfaces the foam substrate).

[0065] The display **103** may be coupled to the front cover **122** and may display graphical outputs that are visible in a display region of the front cover **122**. The display **103** may include various display components, such as liquid crystal display (LCD) components, light source(s) (e.g., light emitting diodes (LEDs), organic LEDs (OLEDs)), filter layers, polarizers, light diffusers, covers (e.g., glass or plastic cover sheets), circuit layers, electrode layers, and the like. The display **103** may also include other components such as structural components that support any of the aforementioned components.

[0066] In some cases, the display **103** includes components of a touch-sensing system to facilitate the detection of touch inputs applied to the front cover **122**. Such components may include, for example, one or more layers of

conductive traces (e.g., electrodes) to facilitate capacitive and/or resistive touch-sensing operations. In some cases, the touch-sensing layers may be positioned between the display layers that produce graphical outputs. In some cases, the display **103** may have an integrated (on-cell) touch-sensing system. For example, an array of electrodes (or other touch-sensing components) that are integrated into the display may be time and/or frequency multiplexed in order to provide both display and touch-sensing functionality. The electrodes may be configured to detect a location of a touch, a gesture input, multi-touch input, or other types of touch input along the external surface of the front cover **122**. Other types of touch-sensing systems may also be used, and may be integrated into or part of the display **103**, or they may be separate from the display **103**.

[0067] As described herein, the display portion **102** may include a band-like housing component **120** that defines a set of side surfaces of the display portion **102** (such as the peripheral exterior surface **218**). Additionally, the housing component **120** may define a portion of each of the front and rear surfaces of the display portion **102**. For example, the housing component **120** may define a portion **220** of the rear surface of the display portion **102**, and a portion **216** of the front surface of the display portion **102**. As shown, the surfaces **216**, **218**, and **220** define a continuous surface that extends from the front of the display portion **102** to the rear of the display portion **102**.

[0068] The portion **216** may define a frame-like structure that at least partially surrounds the front cover **122**, and the portion **220** may define a frame-like structure that at least partially surrounds the rear cover **124**. For example, the portions **216**, **220** of the housing component **120** that at least partially surround the covers may extend along three sides of the covers (e.g., the left and right (e.g., vertical) sides and a top (e.g., horizontal) side. In some cases, the portions **216**, **220** of the housing component **120** that at least partially surround the covers may extend along four corners of the covers, and may extend along a portion of a fourth side of the covers (e.g., the lower, horizontal side).

[0069] FIG. **3** is an exploded view of the display portion **102**, showing the front and rear cover assemblies **300**, **302** removed from the housing component **120**. The front and rear cover assemblies **300**, **302** include the front and rear covers **122**, **124**, respectively, as well as additional components. For example, the front cover assembly **300** may include a display (e.g., the display **103**) attached thereto, as well as other components and/or materials such as a front-facing camera, circuit boards, an ambient light sensor, an indicator light, attachment and/or fastening structures, masking structures, and the like. The rear cover assembly **302** may include attachment and/or fastening structures, masking structures, circuit boards, a rear-facing camera, or the like.

[0070] The housing component **120** may include a wall structure **304** that defines the side exterior surfaces of the display portion **102**, as described above, and a mid-chassis **306**. The mid-chassis **306** may define a plate-like structure that is positioned between the front cover assembly **300** and the rear cover assembly **302**. The mid-chassis **306** may extend from a first wall portion **305** that defines a first side exterior surface of the display portion **102** to a second wall portion **307** that defines a second (opposite) side exterior surface of the display portion **102**.

[0071] The mid-chassis **306** may be formed from a separate material or structure from the wall structure **304**, as shown in FIG. **3**. For example, the wall structure **304** may be a first structure (e.g., a structure formed from metal such as aluminum), and the mid-chassis may be a second structure (e.g., a structure formed from a composite material) that is secured to the wall structure **304** via adhesive, fasteners, mechanical interlocking features, or other attachment techniques. In some examples, the mid-chassis **306** and the wall structure **304** are formed from a single piece of material (e.g., the mid-chassis **306** and the wall structure **304** may be machined from a single piece of metal).

[0072] The mid-chassis **306** may provide structural benefits to the display portion **102**. In particular, by providing a mid-chassis **306** that extends between wall portions, the housing component **120** may have a greater stiffness, strength, or other structural characteristic as compared to a housing component **120** that instead includes an empty space or hole between the wall portions. Further, the mid-chassis **306** may include mounting features to which the front and/or rear cover assemblies may be coupled, or that may otherwise be used to couple the front cover assembly and/or the rear cover assembly to the housing component **120**. For example, as described herein, the mid-chassis **306** may define holes, and the front cover assembly may be coupled to the housing component **120** by fasteners that extend through the holes from the rear side of the housing component **120**. In some cases, the use of fasteners to couple a cover assembly to the mid-chassis **306** may improve repairability of the device, as it may allow the cover assembly to be coupled to the mid-chassis **306** with less adhesive or lower-strength adhesives than would be used if fasteners were not used. Thus, a cover assembly may be removed from the mid-chassis more easily and/or less destructively, allowing faster and more efficient repairs and/or replacement of components.

[0073] In some cases, components may be adhered to a surface of the mid-chassis. For example, the rear cover assembly **302** may be adhered to the mid-chassis **306** (e.g., all or substantially all of the surface of the mid-chassis **306** that faces the rear cover assembly **302** may be adhered to the rear cover assembly).

[0074] Coupling one or both of the front cover assembly **300** and the rear cover assembly **302** to the mid-chassis **306** may enhance one or more structural characteristics of the display portion **102**. For example, coupling a cover assembly to the mid-chassis **306** reduces the ability of the cover assembly to move relative to the mid-chassis **306** in a plane parallel to the main surface of the cover assembly and mid-chassis (e.g., it may increase the shear strength of the display portion **102**), or otherwise reduces the ability of the cover assembly and/or the mid-chassis to bow outward or inward relative to the other. This arrangement may improve the overall stiffness (e.g., resistance to bending or twisting) of the display portion **102** as compared to other coupling techniques (e.g., adhering the cover assemblies to the wall structure **304** only around the outer perimeter of the cover assemblies).

[0075] The mid-chassis **306** may define a web structure **308** that defines one or more holes (e.g., hole **310**). The holes may accommodate components that are attached to a cover assembly, such as the front cover assembly **300**. For example, as shown in FIGS. **4**A-**4**B, the front cover assembly **300** may include display components (e.g., circuit

boards, flexible circuit elements, cameras, etc.) that are coupled to or are otherwise positioned along an interior side of the front cover assembly **300**. Such components extend at least partially into the holes (or otherwise be aligned with the holes). The holes may therefore allow the display portion **102** to be thinner than might be achieved if the mid-chassis were continuous (e.g., defining an unbroken plate-like structure) in that area, while the web structure **308** maintains a higher degree of structural integrity (e.g., stiffness, strength, etc.) than might be achieved if a single opening were provided instead (e.g., if the web structure were omitted in favor of a single opening extending from one lateral side of the housing component to the other.

[0076] The mid-chassis **306** may also define recesses **312** (e.g., **312-1**, **312-2**) that accommodate components of a cover assembly. For example, as described herein, flexible circuit elements of the front cover assembly **300** may extend into the recesses **312** when the front cover assembly **300** is attached to the housing component **120**. The recesses **312** may provide clearance for the flexible circuit elements without significantly increasing the thickness of the mid-chassis and/or the display portion **102** as a whole (e.g., by configuring the mid-chassis **306** to tightly conform to irregular features and/or topography of the front cover assembly **300**).

[0077] The mid-chassis **306** may also define channels **314** (e.g., **314-1-314-4**) that extend through the mid-chassis. As described herein, components such as wires, cables, flexible circuit elements, or the like may extend through or otherwise be positioned in the channels **314**. For example, wires providing electrical power from the base portion **104** of the device **100** to display components and touch-sensing components of the display portion **102** may extend through channels **314**, and flexible circuit elements coupling the display components and touch-sensing components to processing systems in the base portion **104** may also extend through channels **314**. In some cases, power and data connections may be positioned in different channels **314** to prevent or reduce the likelihood of electrical interference or crosstalk between the power and data signals.

[0078] FIG. **4**A depicts an interior of the front cover assembly **300**. The front cover assembly **300** includes the front cover **122** and the display **103** coupled to the front cover **122**. As described herein, the display **103** may include display components (e.g., components that contribute to producing graphical outputs) and touch-sensing components (e.g., components that facilitate touch-sensing operations). In order to provide signals to and from the display and touch-sensing components, flexible circuit elements may conductively couple the display and touch-sensing components to other circuit elements of the device. For example, flexible circuit elements **416** (e.g., **416-1-416-6**) may be conductively coupled to a display component of the display **103** and to a circuit board **410**, and flexible circuit elements **404** (e.g., **404-1-404-4**) and **406** (e.g., **406-1-406-2**) may be conductively coupled to a touch-sensing component of the display **103** and to the circuit board **410**. The flexible circuit elements **404-1**, **404-2**, and **406-1** may be part of a single flexible circuit structure **402-1**, and the flexible circuit elements **404-3**, **404-4**, and **406-1** may be part of a single flexible circuit structure **402-2**.

[0079] The flexible circuit elements **404**, **406**, **416** may extend from edges of the display **103** and loop back to extend along the back of the front cover assembly (e.g., between the mid-chassis and the front cover assembly) and couple to the circuit board **410**. The loops of the flexible circuit elements **404**, **406**, **416** may generally extend into a border region of the front cover **122** that is outside the active display region (e.g., between the active display region and the front-facing portion **216** of the housing component **120**). Because of the location of the loops at the perimeter of the display, minimizing the loop size may facilitate the use of a smaller border (e.g., inactive) region around the perimeter of the display. This in turn may allow a display portion, and thus the device **100**, to be made smaller and/or lighter for an active area of a given size.

[0080] The locations of the flexible circuit elements for the display components and touch-sensing components in the display **103** may be selected so as to minimize or reduce the size of the inactive border around the active display region. In the example shown in FIG. **4**A, the flexible circuit elements **416** that are conductively coupled to the display component of the display **103** extend from the display along a first edge of the display (e.g., the top edge of the display). Further, the flexible circuit elements **404** and **406** that are conductively coupled to the touch-sensing component of the display **103** extend from the display along edges of the display that are different from the first edge. For example, the flexible circuit elements **404-1**, **404-2**, and **406-1** extend from the display **103** along a second side edge (e.g., a first lateral side edge) that is perpendicular to the first side edge, and the flexible circuit elements **404-3**, **404-4**, and **406-2** extend from the display along a third side edge (e.g., a second lateral side edge) that is also perpendicular to the first side edge (and parallel to the second side edge). The arrangement of flexible circuit elements in FIG. **4**A also distributes the flexible circuit elements around the perimeter of the display **103** without overlaps (e.g., without having one flexible circuit element loop wrap over another flexible circuit element loop), which may further facilitate a smaller border region around the active region of the display.

[0081] The flexible circuit elements **404** and **406** may conductively couple to conductive traces on a touch-sensing element in the display **103**. In some cases, the flexible circuit elements **404** are conductively coupled to transmit (Tx) traces (e.g., electrical signals are provided to those traces via the flexible circuit elements **404**), and the flexible circuit elements **406** are conductively coupled to receive (Rx) traces (e.g., those traces are monitored for electrical responses indicative of touch inputs). In other examples, the flexible circuit elements **404** are coupled to Rx traces, and the flexible circuit elements **406** are coupled to Tx traces.

[0082] As shown in FIG. **4**A, no flexible circuit elements couple to the display along the bottom side edge of the display **103**. In some cases, the display portion **102** couples to a hinge or other flexible coupling along the bottom side of the display portion **102**.

[0083] The flexible circuit elements for the display and touch-sensitive components may be coupled to a circuit board **410** that is positioned along an interior or rear side of the front cover assembly **300**. The circuit board **410** may be positioned along the top side of the front cover assembly **300**, and may include circuit components for the display **103**, such as display circuitry for generating graphical outputs, and touch-sensing circuitry for detecting touch inputs. In some cases, the circuit board **410** defines a first segment **411** that is electrically isolated from a second segment **412**. For example, the first segment **411** of the circuit board **410**

may include conductive traces or layers to interconnect various electrical components coupled to the first segment **411**, and the second segment **412** of the circuit board **410** may include conductive traces or layers to interconnect various electrical components coupled to the second segment **412**, and the conductive traces or layers of the first and second segments may be physically and/or electrically isolated from one another (e.g., they may not touch one another). As shown, the boundary **414** represents the boundary between the first and second segments **411**, **412**, and may represent a portion of the circuit board **410** where no conductive traces or layers are present (e.g., a physical gap between the conductive elements of the circuit board). The electrical isolation between the segments of the circuit board **410** may help prevent or inhibit crosstalk or other interference between the display and the touch-sensing circuitry.

[0084] In some cases, a front-facing camera **418** may be coupled to the circuit board as well. For example, the front-facing camera **418** may be coupled to the first segment **411** of the circuit board. In other cases, the front-facing camera **418** may be coupled to a separate circuit board, which may be conductively coupled to the circuit board **410** or conductively isolated from the circuit board **410**.

[0085] As described herein, electrical components in the display portion **102** may be conductively coupled to electrical components in the base portion **104**. For example, the display components and touch-sensing components may utilize power and data connections to the components (e.g., a power source, processors, memory, etc.) in the base portion **104**. For example, conductive elements **422**, **424** may be conductively coupled to the circuit board **410** (e.g., the second segment **412**) to provide data and power connections (respectively) to the touch-sensing components of the display **103**, and conductive elements **426**, **428** may be conductively coupled to the circuit board **410** (e.g., the first segment **411**) to provide data and power connections (respectively) to the display components of the display **103**. As shown, power and data connections are provided by separate conductive elements (e.g., data connections are provided by flexible circuit elements **422**, **426** and power connections are provided by wires **424**, **428**), though this is merely one example arrangement. In other examples, a single conducive element may provide both data and power connections for the display components and another single conductive element may provide both data and power connections for the touch-sensing components.

[0086] As described above, the conductive elements that provide power and data connections to the front cover assembly **300** may be positioned in and/or extend through channels **314** in the housing component **120**. FIG. **4**B illustrates the front cover assembly **300** and the housing component **120**, viewed from a rear side of the housing component **120**. As shown, the conductive elements **422**, **424**, **426**, and **428** are positioned in and/or extend through the channels **314-1**, **314-2**, **314-4**, and **314-3**, respectively. The conductive elements may be extended through the channels when the front cover assembly **300** is assembled to the housing component **120**. For example, the conductive elements may be coupled to the front cover assembly **300**, and then threaded through the channels **314** when the front cover assembly is attached to the housing component **120**. In another example, conductive elements may be pre-assembled with the housing component **120** (e.g., built into the mid-chassis when the mid-chassis is assembled and/or attached to the wall structure), and conductively coupled to the front cover assembly during assembly.

[0087] FIG. **4**C depicts a partial cross-sectional view of the display portion **102**, viewed along line **4**C-**4**C in FIG. **4**B. FIG. **4**C illustrates the mid-chassis **306** positioned between the rear cover **124** and the front cover **122** (and display **103**). In this example, the mid-chassis **306** (e.g., a plate member that at least partially defines the mid-chassis) includes first and second shell layers **430** (**430-1**, **430-2**), and a core **432** between the shell layers **430**. The shell layers **430** may be formed from a composite material, such as a fiber-reinforced polymer material. The core **432** may be formed from a low-density polymer material such as a foam, or other suitable core material. The core **432** may define the channels **314**, such as the channels **314-3**, **314-4** shown in FIG. **4**C, and the conductive elements **426** (e.g., a flexible circuit element) and **428** (e.g., one or more wires) may be positioned in the channels. As described above, these are merely examples of conductive elements that may be used, and more or different conductive elements and/or arrangements of conductive elements in the channels **314** are also contemplated.

[0088] FIG. **4**B also illustrates the positioning of the flexible circuit structures **402** (and the associated flexible circuit elements **404**, **406**) in the recesses **312**. For example, the flexible circuit structure **402-1** (and thus the flexible circuit elements **404-1**, **404-2**, and **406-1**) is positioned at least partially in the recess **312-1**, and the flexible circuit structure **402-2** (and thus the flexible circuit elements **404-3**, **404-4**, and **406-2**) is positioned at least partially in the recess **312-2**.

[0089] FIG. **4**B also illustrates an example positioning of components of the front cover assembly **300** relative to the web structure **308** of the housing component **120**. For example, the flexible circuit elements **416** (FIG. **4**A) are positioned in respective holes **310** defined by the web structure **308**. Additionally, holes are provided where the flexible circuit structure **402** is coupled to the circuit board **410**, thus accommodating the increased thickness of the assembly in those locations. Holes **310** may also be provided where other components are positioned, such as the camera **418** and/or other components (e.g., processors, memory) that are mounted to the circuit board **410**.

[0090] FIGS. **5**A-**5**B illustrate other example locations for flexible circuit elements to couple to display and touch-sensing components of a display. For example, FIG. **5**A illustrates an example front cover assembly **500** in which flexible circuit elements **502** that conductively couple to a display component are positioned along a top side edge of the display, and flexible circuit elements **504** that conductively couple to a touch-sensing component are positioned along lateral side edges of the display (**504-1**, **504-4**) and along a bottom edge of the display (**504-2**, **504-3**). In some cases, the flexible circuit elements **504-1** and **504-4** along the lateral side edges are associated with Tx traces, and the flexible circuit elements **504-2** and **504-3** are associated with Rx traces. FIG. **5**B illustrates another example of the front cover assembly **500** in which flexible circuit elements **502** for a display component are positioned along a top side edge of the display, and flexible circuit elements **504** are positioned along a bottom edge of the display. In this example, because the lateral side edges lack flexible circuit elements coupled along those edges, the border region along the

lateral sides of the display region may be further reduced as compared to an implementation with flexible circuit elements along those edges.

[0091] FIGS. **6**A-**6**B depict partial cross-sectional views of the display portion **102**, viewed along lines **6**A-**6**A and **6**B-**6**B in FIG. **4**A. FIGS. **6**A-**6**B further illustrate the arrangement of the flexible circuit elements in the display portion **102**. As shown in FIGS. **6**A-**6**B, the display **103** may include a display component **604** (e.g., a stack of display layers for generating graphical outputs), a touch-sensing substrate **602**, and an adhesive layer **606** coupling the display **103** to the front cover **122**. The touch-sensing substrate **602** may be a transparent substrate (e.g., glass, a transparent polymer, etc.) with conductive traces along a top and bottom surface. The conductive traces along one surface may be Tx traces, while the conductive traces along the other surface may be Rx traces. The traces may be formed of a conductive (and optionally transparent) material, such as indium tin oxide (ITO), silver nanowire, conductive polymers, or another suitable material. The flexible circuit element **406-2** may be coupled to a touch-sensitive component in the display, such as a touch substrate **602**.

[0092] As shown in FIGS. **6**A-**6**B, the flexible circuit elements **406-2** and **404-3** may be coupled to opposite sides of the touch-sensing substrate **602** to allow them to conductively couple to the different traces. For example, as noted above, the flexible circuit elements **406** may be coupled to Rx traces on a first side (e.g., the top side as oriented in FIG. **6**A) of the touch-sensing substrate **602**, and the flexible circuit elements **404** may be coupled to Tx traces on a second side (e.g., the bottom side as oriented in FIG. **6**B) of the touch-sensing substrate **602**. (In other examples, the Tx and Rx traces are on the other surfaces of the touch-sensing substrate **602**.)

[0093] The flexible circuit elements may define loops to facilitate the flexible circuit elements being folded back over the back or interior side of the display **103**. For example, the flexible circuit element **406-2** (FIG. **6**A) may define a loop **620**, and the flexible circuit element **404-3** (FIG. **6**B) may define a loop **622**. The loops **620**, **622** may extend past the back or interior side of the display **103**. For example, the flexible circuit elements may have a minimum allowable bend radius to help ensure that the flexible circuit elements do not break or become damaged. Accordingly, recesses in the housing component **120**, such as the recess **312-2**, may accommodate the loops **620**, **622**. As shown in FIGS. **6**A-**6**B, the recess **312-2** may be defined in the mid-chassis **306**. For example, the mid-chassis **306** may include a plate member **610** (which may include shell layers and a core, as described with respect to FIG. **4**C), and a flange member **612**. In some cases, the flange member **612** defines the recess **312-2**. The recess **312-2** may be recessed relative to the display-facing surface of the plate member **610** (e.g., the bottom surface of the plate member **610** as oriented in FIGS. **6**A-**6**B), and/or relative to other internal structures or components of the display portion **102**. As shown, the loops **620**, **622** (and optionally other loops positioned along the same side of the display) may extend into the recess **312-2**.

[0094] While FIGS. **6**A-**6**B illustrate the flange member **612** defining the recess **312-2**, this is merely one example implementation. In some cases, the mid-chassis may be defined by a different configuration or structure (e.g., a unitary metal structure). In such cases, the recess **312-2** may be defined by a different structure or component. Further, while FIGS. **6**A-**6**B illustrate one lateral side of the display portion **102** and flexible circuit elements along that side, it will be understood that a similar configuration may be used on the other lateral side of the display portion as well.

[0095] FIG. **7**A illustrates a portion of the housing component **120** corresponding to area **7**A-**7**A in FIG. **3**. The housing component **120** includes the wall structure **304**. The wall structure **304**, or the housing component **120** more generally, defines a portion **216** of the front-facing surface of the display portion **102**, and a ledge **207** on which the front cover **122** may be positioned and/or adhered.

[0096] In some cases, a wall structure, or the housing component more generally, may define radiating portions of an antenna system for the device **100**. FIG. **7**B illustrates an example housing component **702**. Except where noted herein, the housing component **702** may be the same as the housing component **120**, and the features, structures, etc., of the housing component **120** are understood to be equally applicable to the housing component **702**.

[0097] FIG. **7**B illustrates how a portion of the housing component **702** may be electrically connected to antenna circuitry to receive and/or send wireless communication signals. For example, antenna circuitry may be connected to a first segment **704** of the housing component **702** at a first connection point **708** and a second connection point **710**. The first segment **704** of the housing component may be defined by a slot **709** (e.g., an elongated channel-like opening) formed in the housing component **702**. In some cases, the first connection point **708** is coupled to an electrical ground, and the second connection point **710** is coupled to an antenna feed (e.g., a source of an electromagnetic signal that transmits wireless signals to the first segment **704**, and/or a circuit that receives and/or analyzes an electromagnetic signal received by the first segment **704**). A conductive path **712** may be defined between the connection points **708**, **710**, corresponding to the conductive path corresponding to an electromagnetic component of a transmitted or received wireless communication signal.

[0098] A molded element **714** may be positioned in the slot **709**. The molded element **714** may be formed from a dielectric material, such as a polymer, fiber-reinforced polymer, multiple polymers, or the like. The molded element **714** may electrically isolate the first segment **704** from the rest of the housing component **702**, at least along a length of the first segment **704**. Accordingly, the molded element **714** at least partially defines the conductive path **712** and isolates the conducive path **712** to the first segment **704**, thus allowing the first segment **704** to function as an antenna.

[0099] FIG. **7**B also shows a second segment **706** that may operate as an antenna. The second segment **706** may be defined by a slot **719** formed in the housing component **702**. Similar to the discussion above with respect to the second segment **704**, antenna circuitry may be connected to the second segment **706** at a first connection point **716** and a second connection point **718**. In some cases, the first connection point **716** is coupled to an electrical ground, and the second connection point **718** is coupled to an antenna feed (e.g., a source of an electromagnetic signal that transmits wireless signals to the second segment **706**, and/or a circuit that receives and/or analyzes an electromagnetic signal received by the second segment **706**). A conductive path **720** may be defined between the connection points **716**, **718** corresponding to the conductive path corresponding to an

electromagnetic component of a transmitted or received wireless communication signal.

[0100] Molded elements **714**, **722** may be positioned in the slots **709**, **719**, respectively. The molded elements **714**, **722** may be formed from a dielectric material, such as a polymer, fiber-reinforced polymer, multiple polymers, or the like. The molded elements **714**, **722** may electrically isolate the first and second segments from the rest of the housing component **702**, at least along a length of the first and second segments. Accordingly, the molded elements **714**, **722** at least partially define the conductive paths **712**, **720** and isolate the conducive paths to their respective segments, thus allowing the first and second segments to function as antennas. The molded elements **714**, **722** may also define part of a ledge **724** on which the front cover **122** may be positioned and/or adhered.

[0101] FIG. **7**B shows an example configuration for two segments **704**, **706** defined by the housing component **120**. In some cases, additional similar segments may be included to provide additional antenna elements for the device. In some cases, the lengths of the segments **704**, **706** (and/or the lengths of the slots that at least partially define the segments **704**, **706**) may be different from one another, or may otherwise be configured to communicate using different frequencies, frequency bands, wireless communication protocols, or the like. For example, the first segment **704** may be configured to operate on a 2.4 GHz and 5 GHz frequency band (e.g., to operate as a WiFi antenna), while the second segment **706** may be configured to operate on a 2.45 GHz frequency band (e.g., to operate as a Bluetooth antenna). Other frequency bands are also contemplated.

[0102] FIGS. **8**A-**8**D illustrate additional details of the housing component **120**. In this example, the housing component **120** includes the wall structure **304** and the plate member **610**. For example, the wall structure **304** defines an opening **800**, and the plate member **610** may be positioned in the opening **800** and coupled to the wall structure **304**. The plate member **610** may correspond to or at least partially define the mid-chassis **306** (FIG. **3**). Flange members **612** may be coupled to the plate member **610**, and may also define part of the mid-chassis **306**. (As described herein, in other examples, a single piece (e.g., monolithic) housing component defines both the wall structure and the mid-chassis, and in those examples a plate member and flange members may not be used.)

[0103] The plate member **610** and the flange members **612** may be coupled to the wall structure **304**, and may provide structural rigidity to the wall structure **304**. The plate member **610** and flange members **612** may be coupled to the wall structure **304** via adhesives, mechanical fasteners, interlocking features, or other coupling techniques.

[0104] FIG. **8**B depicts a partial cross-sectional view of the housing component **120**, viewed along line **8**B-**8**B in FIG. **8**A. FIG. **8**B illustrates one example technique for coupling the plate member **610** to the flange member **612** and coupling the flange member **612** to the housing component **120**. For example, as described above, the plate member **610** includes first and second shell layers **430** (**430-1**, **430-2**), and a core **432** between the shell layers **430**. Further, channels, such as the channel **314-4**, may be defined in the core **432**. A portion of the flange member **612** may be positioned between and coupled to the shell layers **430**. For example, the shell layers **430-1** and **430-2** may be adhered to the surfaces of the flange member **612**, as shown, using an epoxy, adhesive film, cyanoacrylate, or another suitable adhesive. Instead of or in addition to adhesives, fasteners may be used to couple the shell layers **430** to the flange member **612** (e.g., screws, bolts, etc.).

[0105] To couple the flange member **612** (and thus the plate member **610**, where the plate member **610** and the flange member **612** are attached to one another), the flange member **612** may define a ledge portion **806** that overlaps and is coupled to a ledge portion **804** of the wall structure **304**. The ledge portions **804**, **806** may be adhered to one another using an epoxy, adhesive films, cyanoacrylate, or another suitable adhesive. Instead of or in addition to adhesives, fasteners may be used to couple the flange member **612** to the wall structure **304** (e.g., screws, bolts, etc.).

[0106] FIG. **8**B illustrates overlapping features (e.g., ledges) between the flange member **612** and the wall structure **304**. In some cases, the flange member **612** and the wall structure **304** define multiple distinct (e.g., localized) overlapping features in different locations to facilitate coupling between the mid-chassis and the wall structure **304**.

[0107] In areas where the flange members are not present, the plate member **610** may be coupled to the wall structure **304**. For example, as shown in FIG. **8**C, which depicts a partial cross-sectional view of the housing component viewed along line **8**C-**8**C in FIG. **8**A, at some locations the wall structure **304** may define a mounting feature **810**, and the plate member **610** may overlap and be coupled to a surface of the mounting feature **810** (e.g., via adhesive, fasteners, etc.). Additionally or alternatively, as shown in FIG. **8**D, which depicts a partial cross-sectional view of the housing component viewed along line **8**D-**8**D in FIG. **8**A, at some locations a peripheral side of the plate member **610** may abut a surface of the wall structure **304**. The plate member **610** may be adhered to the surface of the wall structure **304** (e.g., via epoxy, cyanoacrylate, or another suitable adhesive). Fasteners and/or other attachment techniques may be used instead of or in addition to adhesive.

[0108] The plate member **610** may be formed from various different materials or combinations of materials. For example, the plate member **610** may include shell layers **430** and a core **432**. The shell layers **430** may be formed from a composite material, such as a fiber-reinforced polymer material (e.g., carbon-fiber reinforced polymer, aramid fiber reinforced polymer, glass-fiber reinforced polymer, ceramic-fiber reinforced polymer, etc.). The core **432** may be formed from a low-density polymer material such as a foam, or other suitable core material. In another example, the plate member (or the mid-chassis more generally) may be formed from a single sheet of material, such as a sheet of a composite material (e.g., carbon-fiber reinforced polymer, aramid fiber reinforced polymer, glass-fiber reinforced polymer, ceramic-fiber reinforced polymer, etc.). In another example, the plate member (or the mid-chassis more generally) may be formed from a sheet of metal (e.g., aluminum, steel, titanium, a metal alloy, etc.). Where flange members are used, the flange members may be formed from a composite material, such as a fiber-reinforced polymer material (e.g., carbon-fiber reinforced polymer, aramid fiber reinforced polymer, glass-fiber reinforced polymer, ceramic-fiber reinforced polymer, etc.), a polymer material (e.g., polycarbonate, acrylic, polyethylene), a metal (e.g., aluminum, steel, titanium, a metal alloy, etc.), or another suitable material.

[0109] FIG. **9**A depicts an exploded view of an example display portion **900**. The display portion **900** includes a front cover assembly **902**, a housing component **908**, and a rear cover assembly **910**. The front cover assembly **902** includes a front cover **905** (which may be an embodiment of the front cover **122**) and a display **904** (which may be an embodiment of the display **103**). The display **904** may be coupled to the front cover **905** via an adhesive (e.g., an optically clear adhesive between the display **904** and the front cover **905**), and optionally additional coupling structures such as fasteners, clips, interlocking features, or the like. The rear cover assembly **910** may include a rear cover and one or more masking layers, as described with respect to other rear cover assemblies described herein. The housing component **908**, which may be an embodiment of the housing component **120**, may define a mid-chassis **907** (e.g., a plate member or plate-like section of the housing component **908**), as well as a web structure and a wall structure, as described above. The housing component **908** may be formed from a metal (e.g., aluminum, steel, titanium, a metal alloy, etc.), a polymer material (e.g., polycarbonate, acrylic, polyethylene), a composite material (e.g., a fiber-reinforced polymer), or another suitable material.

[0110] The front cover assembly **902** also includes a mounting structure **906**. The mounting structure **906** may be adhered to the interior surface of the display **904**, and may also be coupled to the front cover **905** (e.g., via adhesive, fasteners, interlocking structures, or the like). The mounting structure **906** may be formed from metal (e.g., aluminum, steel, a metal alloy, etc.), a polymer, a composite material (e.g., a fiber reinforced polymer, etc.), or another suitable material.

[0111] The secure coupling between the mounting structure **906** and the display **904** and front cover **905** allows the mounting structure **906** to structurally couple the front cover assembly **902** to the housing component **908**, as described herein. For example, the mounting structure **906** may include an array of attachment features **912** that engage with fasteners that extend through attachment holes **914** in the housing component **908**. The attachment features **912** may be threaded bosses or holes that receive threaded fasteners. The attachment features **912** may be integrally formed with the mounting structure **906** (e.g., machined into the material of the mounting structure **906**), or they may be formed separately and attached to the mounting structure **906**. For example, separately formed attachment features **912** (e.g., threaded bosses or other structures) may be welded, brazed, soldered, adhered, or otherwise attached to the mounting structure **906**.

[0112] A set of fasteners **916** may couple the mounting structure **906** (and thus the front cover assembly **902**) to the housing component **908**. In particular, the housing component **908** may define an array of attachment holes **914**. The fasteners **916**, which may be threaded fasteners such as screws or bolts, extend through attachment holes **914** in the housing component **908** and engage with respective attachment features **912**. Thus, the mid-chassis **907** is captured between the fasteners **916** and the mounting structure **906**, such that the front cover assembly **902** is retained to the housing component **908**. In some cases, the front cover assembly **902** is also adhered to the housing component **908**. For example, the front cover assembly **902** may be adhered to the housing component **908** around a perimeter of the display **904**. The adhesive between the front cover assembly **902** and the housing component **908** may couple the front cover assembly **902** to the housing component **908**, and may define a seal between the components (e.g., to prevent or inhibit ingress of dust, liquids, or other contaminants).

[0113] As described above, the mechanical coupling between the front cover assembly **902** and the housing component **908** may result in a shear-resistant coupling between the front cover assembly **902** and the housing component **908** (e.g., a high degree of resistance to relative motion in a plane parallel to the front and/or rear surfaces of the covers). This shear-resistant coupling may impart a high degree of stiffness to the display portion **900**. The shear resistance imparted by the mechanical coupling between the front cover assembly **902** and the housing component **908** may also facilitate the use of a lower-strength adhesive between the front cover assembly **902** and the housing component **908**. This may increase repairability, as the components can be more easily removed from one another to facilitate repair and/or replacement of the device.

[0114] FIG. **9**B depicts a partial cross-sectional view of the front cover assembly **902**, viewed along line **9**B-**9**B in FIG. **9**A. FIG. **9**B depicts how the front cover assembly **902** is coupled to the housing component using the fasteners **916**. In particular, the fastener **916** (e.g., a screw) extends through the hole **914** in the mid-chassis **907** and engages the attachment feature **912**. A portion of the mid-chassis **907** is captured between fastener **916** and the mounting structure **906**, thereby attaching the front cover assembly **902** to the housing component **908**.

[0115] As described herein, a shear-resistant coupling between the housing component and the front cover assembly (and optionally the rear cover assembly) may result in a display portion with high strength and stiffness. As described herein, a shear-resistant coupling may be produced using fasteners or other engaging features that prevent or inhibit lateral movement of a front cover assembly and a housing component (e.g., pins, posts, fasteners, or other features that prevent relative movement in a plane parallel to the display surface). FIGS. **9**A-**9**B, for example, illustrate a set of fasteners that couple a front cover assembly to a housing component. FIGS. **10**A-**10**B illustrate another example technique for producing a shear-resistant coupling between a front cover assembly and a housing component.

[0116] FIG. **10**A is an exploded view of an example display portion **1000**, and FIG. **10**B is a partial cross-sectional view of the display portion **1000**, viewed along line **10**B-**10**B in FIG. **10**A. In this example, the front cover assembly includes an array of pins to engage corresponding receptacles on the housing component to inhibit shear motion between the front cover assembly and the housing component. Additionally, the display portion **1000** includes adjustable receptacles that can be adjusted to match the precise locations of an array of pins while also providing a high-tolerance coupling between the pins and receptacles.

[0117] As shown in FIG. **10**A, the display portion **1000** includes a front cover assembly **1002**, a housing component **1008**, and a rear cover assembly **1010**. The front cover assembly **1002** includes a front cover **1005** (which may be an embodiment of the front cover **122**) and a display **1004** (which may be an embodiment of the display **103**). The display **1004** may be coupled to the front cover **1005** via an adhesive (e.g., an optically clear adhesive between the display **1004** and the front cover **1005**), and optionally additional coupling structures such as fasteners, clips, inter-

locking features, or the like. The rear cover assembly **1010** may include a rear cover and one or more masking layers, as described with respect to other rear cover assemblies described herein. The housing component **1008**, which may be an embodiment of the housing component **120**, may define a plate member **1007**, as well as a web structure and a wall structure, as described above. The housing component **1008** may include or define a mid-chassis. The housing component **1008** may be formed from a metal (e.g., aluminum, steel, titanium, a metal alloy, etc.), a polymer material (e.g., polycarbonate, acrylic, polyethylene), a composite material (e.g., a fiber-reinforced polymer), or another suitable material.

[0118] The front cover assembly **1002** also includes a mounting structure **1006**. The mounting structure **1006** may be adhered to the interior surface of the display **1004**, and may also be coupled to the front cover **1005** (e.g., via adhesive, fasteners, interlocking structures, or the like). The mounting structure **1006** may be formed from metal (e.g., aluminum, steel, a metal alloy, etc.), a polymer, a composite material (e.g., a fiber reinforced polymer, etc.), or another suitable material.

[0119] The mounting structure **1006** includes an array of pins **1012** that extend from the rear-facing surface of the mounting structure **1006** and that engage with corresponding holes on the housing component **1008**. The pins **1012** may be integrally formed with the mounting structure **1006** (e.g., machined from the material of the mounting structure **1006**), or they may be formed separately and attached to the mounting structure **1006**. For example, separately formed pins **1012** may be welded, brazed, soldered, adhered, or otherwise attached to the mounting structure **1006**. The pins **1012** may include a base **1026**, which may be attached to the mounting structure **1006**.

[0120] The pins may engage adjustable coupling plates **1022** that are coupled to the housing component **1008**. For example, coupling plates **1022** may be positioned on a side of the housing component **1008** opposite to the front cover assembly **1002** and may be coupled to the housing component **1008** (e.g., via fasteners such as screws). The coupling plates **1022** may define a hole **1021** that is configured to receive a pin **1012** therein. The hole **1021** maybe formed through a protrusion or other feature of the coupling plate **1022** that extends into a hole **1020** defined through the housing component **1008**. Thus, when the front cover assembly **1002** is coupled to the housing component **1008**, the pins **1012** engage with the holes **1021** in the coupling plates **1022**, thereby forming an engagement that inhibits shear motion between the front cover assembly **1002** and the housing component **1008** (e.g., relative motion in a plane parallel to the front and/or rear surfaces of the display portion).

[0121] The coupling plates **1022** may be adjustable to accommodate slight deviations in pin location from device to device. In particular, the housing component **1008** may define recesses **1018** that receive the coupling plates **1022** therein. Further, the coupling plates **1022** may define through holes **1023**, and fasteners **1024** (e.g., screws) may extend through the through holes **1023** and into fastener holes **1032** defined in the housing component **1008**. The openings that define the recesses **1018** may be larger than the coupling plates **1022**, such that the coupling plates **1022** can move within the recesses **1018** (e.g., they can move within the recesses **1018** along a horizontal plane as oriented in FIG. **10**B). Additionally, the through holes **1023** may be larger than the shafts of the fasteners **1024**, such that the coupling plates **1022** can be moved within the recesses **1018** when the fasteners **1024** are inserted through the through holes **1023** and into the fastener holes **1032** (but before the fasteners **1024** are tightened).

[0122] The clearances that allow the coupling plates **1022** to move within the recesses **1018** may be used to tailor the exact location of each coupling plate **1022** to the exact location of the corresponding pin **1012** on the mounting structure **1006**. For example, during assembly of the display portion **1000**, the coupling plates **1022** may be positioned in the recesses **1018**. Optionally, the fasteners **1024** may be engaged with the fastener holes **1032**, but remain loose enough to allow the coupling plates **1022** to move within the recesses **1018**. The front cover assembly **1002** may then be placed into a target position relative to the housing component **1008**. For example, the front cover assembly **1002** may be positioned in a front opening of the housing component **1008** such that the front cover assembly **1002** is positioned in its target final assembly position. As the front cover assembly **1002** is positioned in the target position relative to the housing component **1008**, the pins **1012** may engage the coupling plates **1022** such that the pins **1012** force the coupling plates **1022** into proper alignment. For example, the pins **1012** may define a tapered or rounded end that enters the holes **1021** in the coupling plates **1022** even if the holes **1021** are not concentric with the pins **1012**. As the pins enter further into the holes **1021**, the contact between the surfaces of the pins **1012** and the surfaces that define the holes **1021** may shift the coupling plates **1022** horizontally (as oriented in FIG. **10**B) until the coupling plates **1022** are properly aligned (e.g., the holes **1021** are concentric with the pins). In some cases, the coupling plates **1022** are manipulated by a separate device, system, or person in order to align them relative to the pins **1012**.

[0123] Once the coupling plates **1022** are aligned (and while the pins **1012** are still engaged with the coupling plates **1022**), the fasteners **1024** are tightened to restrict further movement of the coupling plates **1022** within the recesses. Once the fasteners **1024** are tightened, the engagement between the pins **1012** and the coupling plates **1022** defines a secure shear-resistant coupling between the front cover assembly **1002** and the housing component **1008**.

[0124] In some cases, the adjustment operation for the coupling plates **1022** occurs as the front cover assembly **1002** is being attached to the housing component **1008** for final assembly. For example, an adhesive may be applied to one or both of the front cover assembly **1002** and the housing component **1008**, and the positioning of the front cover assembly **1002** on the housing component **1008** results in the front cover assembly **1002** being attached to the housing component **1008** and causes the alignment of the coupling plates **1022**.

[0125] In some cases, after the fasteners **1024** are tightened, the front cover assembly **1002** may be temporarily removed from the housing component **1008**, such as to facilitate further assembly operations. Ultimately, the front cover assembly **1002** may be coupled to the housing component **1008** (with the pins **1012** engaged with the coupling plates **1022**), and secured with adhesives, fasteners, or the like.

[0126] Once the fasteners **1024** are tightened (and optionally after the front cover assembly **1002** is attached to the

housing component **1008**), the rear cover assembly **1010** may be coupled to the housing component **1008**. The rear cover assembly **1010** may be coupled to the housing component via adhesive, fasteners, interlocking features, or the like.

[0127] FIGS. **10**A-**10**B illustrate one example configuration for adjustable shear-resistant couplings between a front cover assembly and a housing component. However, it will be understood that other configurations are also contemplated. For example, in some cases the recesses in the housing component are omitted, and the coupling plates **1022** slide along a rear or interior surface of the housing component **1008**. Further, the particular design dimensions and manufacturing tolerances of the components may be selected to achieve target performance and outcomes. For example, the positioning tolerance of the pins may be less than the maximum allowable misalignment between the pins and the coupling plates, such that any properly manufactured front cover assembly will cause the coupling plates to self-align (e.g., due to the pins being inserted into the coupling plates) when the front cover assembly is positioned in its target position on the housing component **1008**.

[0128] As described herein, a display portion may include both front and rear covers formed from glass. For example, front and rear cover assemblies, each including a glass cover, may be positioned in openings in a housing component. The front and rear glass covers define front and rear exterior surfaces of the display portion, and may be at least partially surrounded about their peripheries by the housing component.

[0129] Attachment techniques for coupling a front cover assembly to a housing component are described, for example, with respect to FIGS. **9**A-**10**B. FIGS. **11**A-**11**B illustrate an example technique for coupling a rear cover assembly to a housing component.

[0130] FIG. **11**A depicts a partial exploded view of the display portion **102**, showing the front cover assembly **300** coupled to the housing component **120**, and the rear cover assembly **302** separate from the housing component **120**. As described above, the housing component **120** may define a mid-chassis **306**, which may be or may include a plate-like structure that is between the front cover assembly **300** and the rear cover assembly **302**. In some cases, the rear cover assembly **302** is coupled to the housing component **120** via one or more adhesives. For example, an adhesive **1102** may be positioned on the mid-chassis **306** to adhere to the rear cover assembly **302**. The plate-like structure of the mid-chassis **306** may define a relatively large surface area, and the adhesive **1102** may extend over substantially all of the plate-like structure of the mid-chassis **306**. Thus, the adhesive bond between the housing component **120** and the rear cover assembly **302** may provide a strong and secure coupling. In some cases, the adhesive bonding area, represented by the broken lines in FIG. **11**A, is greater than about 50% of the surface area of the rear surface of the rear cover assembly **302**, or greater than about 60% of the surface area of the rear surface of the rear cover assembly **302**, or greater than about 75% of the surface area of the rear surface of the rear cover assembly **302**. As described herein, an adhesive (e.g., the adhesive **204**, FIG. **2**) may also be positioned between the rear cover assembly **302** and the housing component **120** along a ledge (e.g., the ledge **205** in FIG. **2**) near the periphery of the rear cover assembly **302**. The adhesives **1102**, **204** may be different adhesives, or they may be the same adhesive. In some cases, the adhesive **204** has different physical properties than the adhesive **1102**. For example, the adhesive **204** may have better sealing properties than the adhesive **1102** (e.g., to facilitate an environmental seal along the perimeter of the rear cover assembly **302**), while the adhesive **1102** may have a higher bond strength and/or may define a more rigid coupling than the adhesive **204** (e.g., to facilitate a secure structural bond between the housing component **120** and the rear cover assembly **302**).

[0131] FIG. **11**B depicts a partial cross-sectional view of the display portion **102**, viewed along line **11**B-**11**B in FIG. **11**A. As shown in FIG. **11**B, an adhesive **1102** may be positioned between the mid-chassis **306** and the rear cover **124** of the rear cover assembly **302**. FIG. **11**B also depicts a masking structure **1104** that may be positioned on an interior surface of the rear cover **124**. While the masking structure **1104** is represented by a broken line, it will be understood that the masking structure **1104** may be continuous along the interior surface. In some cases, the masking structure **1104** may be discontinuous or otherwise define openings or regions of different composition (e.g., having more, fewer, or different masking layers as compared to other regions). Such regions may be used to define icons, logos, text, shapes, or to provide access to underlying light sources (e.g., to produce an illuminated logo region). The masking structure **1104** may be opaque in at least some regions.

[0132] The masking structure **1104** may include one or more layers of material. The materials may include ink, paint, dyes, deposited coating layers (e.g., produced via chemical vapor deposition, plasma vapor deposition, etc.), metal or metallic layers, or the like.

[0133] FIG. **12**A is an exploded view of another example display portion **1200**. The display portion **1200** includes a front cover assembly **1205**, a mounting structure **1204**, and a housing component **1202**. The front cover assembly **1205** includes a front cover **1206** and a display **1208**. The front cover **1206** may be formed from glass or another transparent material (e.g., ceramic, glass ceramic, a polymer, etc.), and may define at least a portion of the front exterior surface of the display portion **1200**. The display **1208** may be coupled to the front cover **1206** and may display graphical outputs that are visible in a display region of the front cover **1206**. The display **1208** may include various display components, such as liquid crystal display (LCD) components, light source(s) (e.g., light emitting diodes (LEDs), organic LEDs (OLEDs)), filter layers, polarizers, light diffusers, covers (e.g., glass or plastic cover sheets), circuit layers, electrode layers, and the like. The display **1208** may also include other components such as structural components that support any of the aforementioned components.

[0134] The housing component **1202** may be a unitary structure formed from a material such as metal (e.g., aluminum, steel, titanium, a metal alloy, etc.). The housing component **1202** may define a rear surface **1210** (FIG. **12**C) of the display portion **1200**, as well as a peripheral wall structure. The housing component **1202** may define a front-facing opening in which the front cover assembly **1205** may be positioned.

[0135] The mounting structure **1204** may be coupled to the housing component **1202** and may improve one or more structural characteristics of the display portion **1200**. For example, the mounting structure **1204** may increase the

stiffness of the display portion **1200**. In some cases, the mounting structure **1204** is formed from a composite material, such as a fiber-reinforced polymer (e.g., carbon-fiber reinforced polymer, aramid fiber reinforced polymer, glass-fiber reinforced polymer, ceramic-fiber reinforced polymer, etc.). In some cases, the mounting structure **1204** is formed of metal, a polymer, or another suitable material or combination of materials. The mounting structure **1204** may be coupled to the housing component **1202** via adhesives, fasteners, interlocking features, and the like.

[0136] FIG. **12**B illustrates the housing component **1202** with the mounting structure **1204** coupled thereto. In this example, the housing component **1202** defines a pattern of ribs **1203** extending from an interior surface of the housing component **1202**. The ribs **1203** may increase the stiffness and/or strength of the housing component **1202** (relative to a housing component lacking ribs **1203**). The ribs **1203** may be an integral structure of the housing component **1202** (e.g., the housing component **1202** and its ribs may be a single molded structure or machined from a single piece of metal).

[0137] The mounting structure **1204** may be coupled to the ribs **1203**. The ribs **1203** may define a standoff distance between the rear wall of the housing component **1202** and the mounting structure **1204**. The standoff distance may help improve the structural characteristics of the display portion, as it may increase the moment of inertia of the assembly (e.g., the housing component **1202** and the mounting structure **1204**), thereby increasing its stiffness.

[0138] FIG. **12**C depicts a partial cross-sectional view of the display portion **1200**, viewed along line **12**C-**12**C in FIG. **12**A. As shown, the front cover assembly **1205** is coupled to the mounting structure **1204**. For example, an adhesive may be positioned between the front cover assembly **1205** (e.g., the display **1208**) and the mounting structure **1204**. The front cover assembly **1205** may also be coupled to the housing component **1202**, such with an adhesive on a ledge, as described with respect to FIG. **2**, for example.

[0139] FIG. **13**A depicts part of the display portion **102** of the device **100**, and in particular, a portion of the display portion **102** that includes the camera **105**. As noted above, the camera **105** may capture images (e.g., still or video images) of a user, such as for videoconferencing purposes. The camera **105** may be positioned in the display portion such that it is generally aimed at a user of the device **100** when the device is in use.

[0140] As shown in FIG. **13**A, the camera may be positioned in an active display region of the display **103**. For example, the active display region may surround the camera such that graphical outputs can be produced around the entire perimeter of the camera. Thus, for example, a graphical user interface that is displayed by the display **103** may extend around the camera, even between the camera and the top side of the housing component **120**. In some cases, the graphical user interface may incorporate the camera into graphical elements of the graphical user interface. For example, the graphical user interface may display a notification region **1309** that surrounds or otherwise includes part or all of the camera **105** (and/or an associated camera window and/or mask region). The notification region **1309** may appear as a distinct graphical area within the graphical user interface (e.g., a region with a black background). Various types of information may be included in the notification region **1309**. For example, the notification region **1309** may be displayed in response to an incoming message (e.g., text message, email message, etc.), and may include a preview of the message (e.g., a name, phone number, or address of the sender, a subject of the message, a portion of the message, etc.). As another example, the notification region **1309** may be displayed in response to an application alert, and may include information from the application alert. For example, a weather application may initiate an application alert to inform the user of a forecasted weather event, and the notification region **1309** may be displayed to present information about the forecasted weather event. Due to the presence of the camera **105** in the notification region **1309**, the information displayed in the notification region may be displayed such that the graphically inactive area corresponding to the camera **105** is less perceptible. For example, the graphically inactive area corresponding to the camera **105** may be positioned where an empty space would be expected based on the arrangement of graphical outputs in the notification region **1309**.

[0141] As shown in FIG. **13**A, the device **100** may also include an indicator light **1302** positioned in a mask region **1311** that extends around the active display area of the display portion **102**. In some cases, the mask region **1311** extends around an entire periphery of the active display area. The indicator light **1302** may indicate a status of a device, system, or component of the device **100**. For example, the indicator light **1302** may be active (e.g., emitting light) when a camera and/or microphone of the device **100** is active (e.g., capturing images and/or audio or capable of capturing images and/or audio). The indicator light **1302** may include one or more color output modes to indicate the status of different devices (e.g., a first color indicates an active camera, and a second color indicates an active microphone).

[0142] FIG. **13**B depicts a partial cross-sectional view of the display portion **102**, viewed along line **13**B-**13**B in FIG. **13**A. As depicted in FIG. **13**B, the front cover **122** defines a hole **1313** in which a camera cover **1300** is positioned. The front cover **122** and camera cover **1300** together may define a cover structure. The camera cover **1300** may include a transparent material, such as glass, glass ceramic, sapphire, a transparent ceramic, a polymer, or another suitable transparent material. The hole **1313** in the front cover **122** and the camera cover **1300** may define a recess to allow greater clearance for the camera **105**, and/or to allow a thinner overall dimension for the display portion **102**. For example, the front cover **122** may have a first thickness, and the camera cover **1300** may have a second thickness that is less than the first thickness. In some cases, the camera cover **1300** is about 50% as thick as the front cover **122**, about 60% as thick as the front cover **122**, about 75% as thick as the front cover **122**, or another suitable thickness. The camera cover **1300** may be positioned in the hole **1313** such that the front surface of the camera cover **1300** is substantially flush with the front surface of the front cover **122**, resulting in a recess along the rear or interior surface of the front cover **122**. By providing the recess, the camera **105** may be positioned closer to the front cover **122** (while still providing any necessary clearance between the camera **105** and the camera window). This may allow the use of a larger camera (e.g., with better imaging capabilities) for a given display portion thickness. Alternatively, a thinner display portion may be used for a given camera size.

[0143] The thickness of the front cover **122** may be between about 0.3 mm and about 0.6 mm. The thickness of the camera window **1300** may be between about 0.15 and

about 0.3 mm. In some cases, the camera window **1300** may be about 50% of the thickness of the front cover **122**, or about 40% of the thickness of the front cover, or about 60% of the thickness of the front cover. Other relative thicknesses are also contemplated.

[0144] As described above, the camera **105** may be positioned in an active display of the display. As shown in FIG. **13**B, the display **103** may define a hole **1315** through the active area of the display. As shown in FIG. **13**B, the active area may include areas **1322** and **1323**. The hole **1315** may extend through both a display component **1308** of the display **103** and a touch-sensing component **1310** of the display **103**. (The display component **1308** and the touch-sensing component **1310** may be coupled together, such as via adhesive, or may be arranged differently than shown in FIG. **13**B, such as with the touch-sensing component **1310** between the front cover **122** and the display component **1308**.) Thus, the active areas of the display around the camera window **1300** may be both graphically active and touch-sensitive.

[0145] The camera **105** may be positioned on a substrate **1304**, and may be coupled to the display **103** (e.g., via adhesive **1307**). The camera **105** (e.g., a lens assembly of the camera) may extend through the hole **1315** in the display **103**, and into the recess defined by the camera window **1300**.

[0146] Masks may be positioned on the interior or rear surfaces of the front cover **122** and/or the camera window **1300**. The masks may be opaque such that underlying components are not visible through the transparent front cover and camera window **1300**. Masks, also referred to as masking structures, may include one or more layers of material. The materials may include ink, paint, dyes, deposited coating layers (e.g., produced via chemical vapor deposition, plasma vapor deposition, etc.), metal or metallic layers, or the like.

[0147] FIG. **13**B illustrates an example arrangement of masks on the front cover **122** and the camera window **1300**. For example, a mask **1312** may surround the hole **1313** through the front cover **122**. A mask **1316** may be positioned about the outer perimeter of the camera window **1300**. The mask **1316** may define a camera opening **1318** (e.g., a transparent region) that allows the camera **105** to receive light to capture images.

[0148] The masks **1312** and **1316** may have the same or similar appearance (e.g., color, texture, reflectivity, sheen, etc.), such that they appear to be a single mask structure. In some cases, the masks **1312** and **1316** include the same material(s). In some cases, the masks **1312** and **1316** include different materials. The masks **1312** and **1316** may occlude various internal structures of the device **100**. For example, the masks **1312** and **1316** may occlude the edges of the display **103** proximate the hole **1315**, as well as the mounting structure **1322** that couples the camera window **1300** to the front cover **122**.

[0149] The mask **1314** may define the mask region **1311** that extends around the active display area of the display portion **102**. The mask **1314** may also define a hole **1320** for the indicator light **1302** (FIG. **13**A). The indicator light **1302** may include one or more LEDs or other light emitting components. The indicator light **1302** may be coupled to the same substrate **1304** that the camera **105** is coupled to (as shown in FIG. **13**B), or it may be coupled to a separate substrate.

[0150] As described herein, a mounting structure **1322** may couple a camera window **1300** to the front cover **122**. FIG. **13**C depicts a partial cross-sectional view of the front cover assembly, viewed along line **13**C-**13**C, illustrating the mounting structure **1322**. In particular, the mounting structure **1322** may be coupled to an interior surface of the front cover **122**, and may define a ledge **1325** positioned in the hole **1313** in the front cover **122** (FIG. **13**B). In some cases, the mounting structure **1322** is adhered to the interior surface of the front cover **122** via adhesive **1324**. The camera window **1300** may be positioned in the hole **1313** and coupled to the ledge **1325** of the mounting structure **1322**. In some cases, the camera window **1300** is coupled to the ledge **1325** via adhesive **1326**. The adhesives **1324**, **1326** may be pressure sensitive adhesives (PSA), heat sensitive adhesives (HSA), adhesive films, liquid adhesives, or the like. The adhesives **1324**, **1326** may be the same or different adhesives.

[0151] The ledge **1325** may be positioned within the hole **1313** at a depth (measured from the front surface of the front cover **122**) that will result in the front surfaces of the camera window **1300** and the front cover **122** being flush (e.g., being substantially coplanar). In some cases, the adhesive **1326** is introduced in a flowable or deformable state, and the camera window **1300** is positioned in the hole **1313** with its front surface flush to the front surface of the front cover **122** while the adhesive **1326** cures or otherwise hardens. In other cases, the adhesive **1326** is pre-formed at a target thickness such that the adhesive **1326** positions camera window **1300** flush with front surface of the front cover **122** when the camera window **1300** is placed on the ledge (e.g., the thickness of the camera window **1300** plus the pre-formed adhesive **1326** is equal to the depth of the surface of the ledge **1325** in the hole **1313**). The adhesives **1324**, **1326** may be positioned on masks **1312**, **1316**, such that the adhesives are not visible through the front surfaces of the front cover **122** and camera window **1300**.

[0152] The mounting structure **1322** may define a recess **1321** into which a portion of the camera extends. For example, a portion of a lens or lens assembly may extend into the recess **1321**.

[0153] FIG. **13**D depicts another example technique for coupling a camera window to a front cover. In particular, FIG. **13**D illustrates a front cover **1332** and a camera window **1330**, which may be embodiments of the front cover **122** and camera window **1300**, respectively, and the description of the front cover **122** and camera window **1300** will be understood to apply to the front cover **1332** and camera window **1330**.

[0154] The front cover **1332** may define an angled mounting surface **1334**, and the camera window **1330** defines a corresponding angled mounting surface **1336**. The angled mounting surfaces **1334**, **1336** may have angles that allow the camera window **1330** to be positioned in the hole in the front cover **1332** from the front side of the front cover **1332**. Additionally, the angles of the angled mounting surfaces **1334**, **1336** and the size of the hole and of the camera window **1330** (and the thickness of the adhesive **1338**) may be configured so that the front surfaces of the front cover **1332** and the camera window **1330** are flush. The adhesive **1338** may be a flowable or deformable adhesive, or be a pre-formed structure (e.g., an adhesive film), and the camera window **1330** may be attached using the corresponding positioning techniques described with respect to FIG. **13**C.

In this example, a mounting structure (e.g., the mounting structure **1322**) may be omitted.

[0155] The camera window **1330**, being thinner than the front cover **1332**, may define a recess **1333** into which a portion of the camera extends. For example, a portion of a lens or lens assembly may extend into the recess **1333**.

[0156] FIG. **13**E depicts another example technique for coupling a camera window to a front cover. In particular, FIG. **13**E illustrates a front cover **1342** and a camera window **1340**, which may be embodiments of the front cover **122** and camera window **1300**, respectively, and the description of the front cover **122** and camera window **1300** will be understood to apply to the front cover **1342** and camera window **1340**.

[0157] The front cover **1342** may define an angled mounting surface **1317**, and the camera window **1340** defines a corresponding angled mounting surface **1349**. The angled mounting surfaces **1317**, **1349** have angles that allow the camera window **1340** to be positioned in the hole in the front cover **1342** from the front side of the front cover **1342**. Additionally, the angles of the angled mounting surfaces **1317**, **1349** and the size of the hole and of the camera window **1340** (and the thickness of the adhesive **1341**) may be configured so that the front surfaces of the front cover **1342** and the camera window **1340** are flush. The adhesive **1341** may be a flowable or deformable adhesive, or be a pre-formed structure (e.g., an adhesive film), and the camera window **1340** may be attached using the corresponding positioning techniques described with respect to FIG. **13**C.

[0158] The front cover **1342** may also define an additional angled mounting surface **1347**, and a mounting ring **1345** may define a corresponding angled mounting surface **1348**. The mounting ring **1345** may be coupled to the interior side of the camera window **1340**, and to the additional angled mounting surfaces **1347**, via the adhesive **1341**. The angled mounting surfaces of the front cover **1342** and the corresponding angled mounting surfaces of the camera window **1340** and the mounting ring **1345** define an interlocking structure that retains the camera window **1340** in position in the hole in the front cover **1342**. For example, when adhered together, the camera window **1340** and the mounting ring **1345** together define a recess feature, and the front cover **1342** defines a protruding feature (e.g., a faceted protrusion) that extends into the recess feature. The dimensions of the protrusion and recess features are such that a mechanical interlocking structure is defined by the combination of the angled surfaces of the front cover, mounting ring, and camera window, thereby providing resistance to a camera window being displaced from the front cover.

[0159] The mounting ring **1345** and the camera window **1340** may define a recess **1343** into which a portion of the camera extends. For example, a portion of a lens or lens assembly may extend into the recess **1343**.

[0160] FIG. **13**F depicts another example technique for coupling a camera window to a front cover. In particular, FIG. **13**F illustrates a front cover **1352** and a camera window **1350**, which may be embodiments of the front cover **122** and camera window **1300**, respectively, and the description of the front cover **122** and camera window **1300** will be understood to apply to the front cover **1352** and camera window **1350**.

[0161] In this example, the camera window **1350** defines a window portion **1353** and a mounting flange **1351**. The window portion **1353** is thinner than the front cover **1352**, as described above, such that when attached to the front cover **1352**, the camera window **1350** defines a recess **1354** into which a portion of the camera extends. For example, a portion of a lens or lens assembly may extend into the recess **1354**.

[0162] The camera window **1350** may be coupled to the front cover **1352** via the mounting flange **1351**. For example, the camera window **1350** may be adhered to the interior surface of the front cover **1352** via an adhesive **1356**. The adhesive **1356** may be a flowable or deformable adhesive, or be a pre-formed structure (e.g., an adhesive film), and the camera window **1350** may be attached using the corresponding positioning techniques described with respect to FIG. **13**C.

[0163] FIG. **13**G depicts another example technique for coupling a camera window to a front cover. In particular, FIG. **13**G illustrates a front cover **1362** and a camera window **1360**, which may be embodiments of the front cover **122** and camera window **1300**, respectively, and the description of the front cover **122** and camera window **1300** will be understood to apply to the front cover **1362** and camera window **1360**.

[0164] The camera window **1360** may be coupled to the front cover **1362** via a mounting structure **1364**. The mounting structure **1364** may be coupled to the front cover **1362** via an adhesive **1361**. The adhesive **1361** may be a flowable or deformable adhesive, or be a pre-formed structure (e.g., an adhesive film). The mounting structure **1364** may be coupled to the front cover **1362** along a butt joint (e.g., the mounting structure **1364** and the front cover **1362** may define parallel mounting surfaces that are perpendicular to the front surface of the front cover **1362**), as shown in FIG. **13**G. In other cases, the mounting structure **1364** and/or the front cover **1362** define other engagement features. For example, the mounting structure **1364** may define a mounting flange (e.g., similar to the mounting structure **1322**), or the mounting structure **1364** and the front cover **1362** may define corresponding angled surfaces (similar to the FIG. **13**D).

[0165] The camera window **1360** may be coupled to a mounting ledge **1363** of the mounting structure **1364**. For example, the camera window **1360** may be adhered to the mounting ledge **1363** via an adhesive **1365**. The adhesive **1365** may be a flowable or deformable adhesive, or be a pre-formed structure (e.g., an adhesive film), and the camera window **1360** may be attached using the corresponding positioning techniques described with respect to FIG. **13**C.

[0166] As shown in FIG. **13**G, the mounting structure **1364** may define part of a front exterior surface of the front cover assembly. The front surfaces of the front cover **1362**, the mounting structure **1364**, and the camera window **1360** may be substantially flush. The front surface of the mounting structure **1364** may define a ring around the camera window **1360** as viewed from the front of the front cover assembly.

[0167] The mounting structure **1364** and the camera window **1360** may define a recess **1367** into which a portion of the camera extends. For example, a portion of a lens or lens assembly may extend into the recess **1367**.

[0168] As described above, a mid-chassis may define a web structure that defines holes to accommodate components of a front cover assembly. FIGS. **14**A-**14**B illustrate an example mid-chassis **1400** that defines a web structure **1402** that includes web segments **1406**, **1408** that at least partially

define a camera mounting chamber **1410** in which a camera **1420** (e.g., a front-facing camera) may be positioned.

[0169] FIG. **14**B depicts a partial cross-sectional view of a display portion **1401** that includes the mid-chassis **1400** (FIG. **14**A), a camera **1420**, a front cover **1412**, a display **1424**, and a rear cover assembly **1414**. The view of FIG. **14**B corresponds to a view along line **14**B-**14**B in FIG. **14**A. The web segments **1406**, **1408** may extend from the front cover assembly **1413** (e.g., from the display **1424** or another component or layer of a front cover assembly **1413**) to the rear cover assembly **1414**. By extending from the front cover assembly **1413** to the rear cover assembly **1414**, the web segments **1406**, **1408** may define a fixed height camera mounting chamber **1410** that prevents or inhibits compressive forces applied to the display portion **1401** from being transferred to the camera **1420**. For example, compressive forces, such as from a user attempting to close a computer by pushing the display portion **1401** down against the base portion, may be transferred through the web segments **1406**, **1408**, rather than being imparted to the camera **1420**. In some cases, the web segments **1406**, **1408** have a greater height (e.g., the vertical dimension, as depicted in FIG. **14**B) than other segments of the web structure **1402**. For example, other web segments may not extend from the front cover assembly **1413** to the rear cover assembly **1414**.

[0170] FIG. **15**A is an exploded view of another example display portion **1500**, which may be an embodiment of the display portion **102**, **1000**, **1200**, or any other display portion described herein. The display portion **1500** includes a front cover assembly **1502** and a housing component **1514**. The front cover assembly **1502** includes a front cover **1504** and a display **1506**. The front cover **1504** may be formed from glass or another transparent material (e.g., ceramic, glass ceramic, a polymer, etc.), and may define at least a portion of the front exterior surface of the display portion **1500**. The display **1506** may be coupled to the front cover **1504** and may display graphical outputs that are visible in a display region of the front cover **1504**. The display **1506** may include various display components, such as liquid crystal display (LCD) components, light source(s) (e.g., light emitting diodes (LEDs), organic LEDs (OLEDs)), filter layers, polarizers, light diffusers, covers (e.g., glass or plastic cover sheets), circuit layers, electrode layers, and the like. The display **1506** may also include other components such as structural components that support any of the aforementioned components.

[0171] The display portion **1500** may include a front-facing sensor region **1508**, which may include a first sensing system **1510** and a second sensing system **1512**. The first sensing system **1510** may be an ambient light sensing system, and the second sensing system **1512** may be a camera. One or both of the sensing systems may be replaced with an output system, such as a flash, illuminator module, or the like. Other example systems that may be included in the front-facing sensor region **1508** include biometric sensing systems (e.g., face recognition systems, fingerprint recognition systems), proximity sensing systems, three-dimensional gesture recognition systems, and the like.

[0172] The housing component **1514** may be a unitary structure formed from a material such as metal (e.g., aluminum, steel, titanium, a metal alloy, etc.). The housing component **1514** may define a rear surface of the display portion **1500**, as well as a peripheral wall structure. The housing component **1514** may define a front-facing opening in which the front cover assembly **1502** may be positioned.

[0173] The housing component **1514** may define mounting surfaces **1516** to which the front cover assembly **1502** may be attached. For example, the front cover assembly **1502** may be attached to the mounting surfaces **1516** via one or more adhesives, as described herein. In some cases, the front cover assembly **1502** is coupled to the housing component **1514** by adhesives that contact interior surfaces of the display **1506** (e.g., instead of or in addition to coupling to the front cover **1504**). By adhering to the interior surface of the display **1506** (e.g., rather than a peripheral region of the interior surface of the front cover **1504**), the size of the graphically inactive borders around the display region of the display may be reduced, as the display **1506** can extend into the area that would otherwise be reserved for adhering to the front cover **1504**.

[0174] The housing component **1514** may also define a rear wall **1520** that defines at least a portion of (and optionally all of) a rear side of the display portion **1500**. The rear wall **1520** may also define a bottom surface of a cavity **1518** in the housing component **1514**. The cavity **1518** may be surrounded on substantially all sides by the mounting surfaces **1516**. The cavity **1518** may provide weight reduction to a unitary part and may provide clearance for other components, such as stiffeners, foams, display components, electronics, and the like. The housing component **1514** may also define a cavity **1524**, which may provide clearance for components of the display portion **1500**.

[0175] In some cases, the housing component **1514** may include one or more ribs, such as the rib **1522**. The rib **1522** may partially define the cavities **1518**, **1524**, and may define a boundary between the cavities. Ribs may also define portions of the mounting surfaces (e.g., the mounting surface **1516**), and as such, portions of the front cover assembly **1502** (and more particularly the display **1506**) may be adhered to or otherwise coupled to the mounting surfaces defined by the ribs.

[0176] FIG. **15**B is a partial cross-sectional view of the display portion **1500**, viewed along line **15**B-**15**B in FIG. **15**A. FIG. **15**B illustrates an example coupling between the front cover assembly **1502** and the housing component **1514**. The display **1506** is coupled to the front cover **1504**, such as via adhesive **1526** (e.g., an optically clear adhesive). The display **1506** is also coupled to the mounting surfaces **1516** via adhesive structure **1534**. The adhesive structure **1534** may be or may include a pressure sensitive adhesive (PSA), heat sensitive adhesive (HSA), a flowable adhesive (e.g., an epoxy), adhesive tape, or the like. In some cases, the adhesive structure **1534** includes multiple layers and/or materials, such as a compliant (e.g., foam) core with adhesives along the top and bottom surfaces of the core. The adhesive structure **1534** may be configured to conform to a variable gap size. For example, a flowable adhesive may be positioned between the display **1506** and the mounting surface **1516**, and the front cover assembly **1502** may be positioned at a target position relative to the housing component **1514** (e.g., so that the front surface of the front cover **1504** is flush with the wall of the housing component **1514**). The flowable adhesive may conform to the gap (including accounting for any variations in the distance between the mounting surface **1516** and the front cover **1504**) and cure or otherwise harden within the defined space.

[0177] Because the display **1506** (and not the front cover **1504**) is adhered to the mounting surface **1516**, the display **1506** may extend further towards the perimeter of the front cover **1504** than may be possible or practical in implementations where the front cover **1504** is adhered to the mounting surface. More particularly, by bonding directly to the display **1506**, it is not necessary to provide a bonding surface on the periphery of the front cover **1504** itself. In some cases, the display **1506** extends to within a target distance from the perimeter of the front cover **1504**. The target distance may be less than about 10 mm, less than about 5 mm, less than about 4 mm, less than about 3 mm, less than about 2 mm, or less than about 1 mm. In some cases, the display extends fully to the perimeter of the front cover **1504**.

[0178] The display **1506** may include various components, such as a substrate **1532** (e.g., glass), liquid crystal display (LCD) components, light source(s) (e.g., light emitting diodes (LEDs), organic LEDs (OLEDs)), filter layers, polarizers, light diffusers, covers (e.g., glass or plastic cover sheets), circuit layers, electrode layers, and the like. The display **1506** may also include outer layer(s) **1530**. The outer layer(s) **1530** may include an ink or other opaque material that is bonded to the display **1506**. In some cases, the outer layer(s) **1530** extend along an entire or substantially an entire surface of the display **1506** (and may thus define all or part of the rear- or interior-facing surface of the display **1506**). In some cases, the adhesive **1534** is adhered directly to the outer layer(s) **1530**. In some cases, the outer layer(s) **1530** are removed or absent from some locations along the interior surface of the display **1506** to allow the adhesive **1534** to contact underlying layers or materials.

[0179] In some cases, the outer layer(s) **1530** include graphite layers. The graphite layers may be configured to provide thermal regulation to the display **1506**, such as by absorbing and/or distributing heat from the display **1506**. In some cases, where the adhesive **1534** is configured to bond to the display **1506**, the graphite may be absent, such that the adhesive **1534** bonds to materials and/or components other than graphite. For example, the graphite material may define a pattern that includes spaces (e.g., holes, notches, etc.) where underlying materials and/or components are exposed to allow the adhesive **1534** to bond directly to the underlying materials and/or components.

[0180] The display portion **1500** may also include a gasket **1537**, which may be an embodiment of the gasket **202**. The gasket may be positioned between the outer periphery of the front cover **1504** and a lip or flange portion of the housing component **1514**. The gasket **1537** may protrude past the front exterior surface of the front cover **1504**, and may prevent or reduce the likelihood of the front cover **1504** contacting a base portion. The gasket **1537** may also prevent or inhibit the peripheral sides of the front cover **1504** from contacting the surrounding lip or flange portion of the housing component **1514**. The gasket **1537** may be formed from a polymer material, and may provide a degree of compliance between the various structures and components that it contacts and/or is positioned between. The gasket **1537** may be bonded directly to the side surface (and optionally a portion of the front surface) of the front cover **1504**. In some cases, the gasket **1537** is overmolded on the front cover **1504**.

[0181] FIG. **15**C is a partial cross-sectional view of the display portion **1500**, viewed along line **15**C-**15**C in FIG. **15**A. In some areas of the front cover assembly **1502**, it may not be feasible to bond directly to the display **1506**. For example, as shown in FIG. **15**C, the display **1506** may include a first circuit element **1536** (e.g., a flexible circuit board) that extends from an edge of the display **1506** and couples to a second circuit element **1540** (e.g., a circuit board). The first circuit element **1536** may conductively couple components of the display **1506** (e.g., electrode layers, light emitting diodes, circuit layers, etc.) to the second circuit element **1540**. The first circuit element **1536** may form a loop where it exits the display **1506** and couples to the second circuit element **1540**. At those locations, there may not be a suitable surface on the display **1506** to bond to the housing component **1514**. In such locations, adhesive **1538** may bond to the housing component **1514** and to the front cover **1504**. The front cover **1504** may include a mask structure (e.g., ink, one or more films, layers, etc.) along the interior surface at the location of the adhesive **1538**. The adhesive **1538** may bond to the mask structure, and the mask structure may prevent the adhesive **1538** from being visible through the front cover **1504**.

[0182] As described above, the housing component **1514** may define cavities or recesses, such as the recess **1524**, to provide clearances to accommodate components of the front cover assembly **1502**. FIG. **15**C illustrates the flexible circuit element **1536** extending into the cavity **1524**.

[0183] The adhesive **1538** may be the same adhesives as the adhesive **1534** shown in FIG. **15**B. In some cases, the adhesives **1534**, **1538** are different regions of a single, contiguous adhesive structure. For example, the adhesives **1534**, **1538** may define a continuous that extends around the entire periphery of the front cover assembly **1502** to attach the front cover assembly **1502** to the housing component **1514**.

[0184] FIGS. **15**D-**15**F are partial cross-sectional views of the display portion **1500**, viewed along line **15**D-**15**D in FIG. **15**A, illustrating example configurations of the housing component **1514**. In particular, in some cases, the display portion **1500** may include components that at least partially fill and/or cover cavities in the housing component **1514**. Such components may provide structural advantages, such as by improving the stiffness, strength, rigidity, or other structural property (as compared to a cavity without a filling or cover, for example). Such components may also provide additional surface area between the front cover assembly **1502** and the housing component **1514** to accommodate additional adhesive to bond the front cover assembly **1502** to the housing component **1514**.

[0185] FIG. **15**D illustrates the housing component **1514** with a cover member **1542** extending over the cavity **1518**. The cover member **1542** may be a metal, polymer, composite, or any other suitable material. The cover member **1542** may be secured to the housing component **1514** via adhesives, fasteners (e.g., screws, bolts, rivets, etc.), welding, soldering/brazing, or the like. As noted above, the cover member **1542** may provide structural rigidity and/or strength to the housing component **1514**. Further, adhesive **1543** may be positioned on the cover member **1542** to bond to an interior side of the display **1506**, as described above. The adhesive **1543** that is used between the cover member **1542** and the display **1506** may be a flowable adhesive, an adhesive film, or the like. The adhesive **1543** may extend over the mounting surface of the housing member (e.g., the adhesive **1534**, FIG. **15**B, may be part of the adhesive **1543**).

In other examples, the adhesive **1534** and the adhesive **1543** may be discontinuous (e.g., formed of different adhesives and/or different adhesive components).

[0186] FIG. **15**E illustrates the housing component **1514** with a fill material **1544** within the cavity **1518** and the cover member **1542** extending over the cavity **1518**. The fill material **1544** may be configured to provide structural rigidity and/or strength to the housing component **1514**. The fill material **1544** may be a sheet-like material (e.g., a single sheet of a polymer foam), or it may define distinct structural features and/or shapes, such as a rib structure, honeycomb, or the like. The fill material **1544** may be formed from or include any suitable material, such as polymer, foam, composite, metal, or the like. The fill material **1544** may be secured to the housing component **1514** via adhesives, fasteners (e.g., screws, bolts, rivets, etc.), welding, soldering/brazing, or the like.

[0187] The cover member **1542** may be a metal, polymer, composite, or any other suitable material. The cover member **1542** may be secured to the housing component **1514** (and optionally the fill material **1544**) via adhesives, fasteners (e.g., screws, bolts, rivets, etc.), welding, soldering/brazing, or the like. As noted above, the cover member **1542** may provide structural rigidity and/or strength to the housing component **1514**. Further, adhesive **1543** may be positioned on the cover member **1542** to bond to an interior side of the display **1506**, as described above. The adhesive **1543** that is used between the cover member **1542** and the display **1506** may be a flowable adhesive, an adhesive film, or the like. The adhesive **1543** may extend over the mounting surface of the housing member (e.g., the adhesive **1534**, FIG. **15**B, may be part of the adhesive **1543**). In other examples, the adhesive **1534** and the adhesive **1543** may be discontinuous (e.g., formed of different adhesives and/or different adhesive components).

[0188] FIG. **15**F illustrates the housing component **1514** with a fill material **1546** within the cavity **1518**. In this example, the cover member **1542** is omitted, and the fill material **1546** defines an exposed surface. The display may be adhered to the exposed surface of the fill material.

[0189] The fill material **1546** may be configured to provide structural rigidity and/or strength to the housing component **1514**. The fill material **1546** may be a sheet-like material (e.g., a single sheet of a polymer foam), or it may define distinct structural features and/or shapes, such as a rib structure, honeycomb, or the like. The fill material **1546** may be formed from or include any suitable material, such as polymer, foam, composite, metal, or the like. The fill material **1546** may be secured to the housing component **1514** via adhesives, fasteners (e.g., screws, bolts, rivets, etc.), welding, soldering/brazing, or the like. As noted above, adhesive **1543** may be positioned on the fill material **1546** to bond to the interior side of the display **1506**, as described above. The adhesive **1543** that is used between the fill material **1546** and the display **1506** may be a flowable adhesive, an adhesive film, or the like. The adhesive **1543** may extend over the mounting surface of the housing member (e.g., the adhesive **1534**, FIG. **15**B, may be part of the adhesive **1543**). In other examples, the adhesive **1534** and the adhesive **1543** may be discontinuous (e.g., formed of different adhesives and/or different adhesive components).

[0190] While FIGS. **15**D-**15**F illustrate an adhesive **1543** that extends along the cavity cover/fill, such adhesive is optional. In cases where the adhesive **1543** is omitted, the adhesive **1534** around the periphery of the front cover assembly **1502** may attach the front cover assembly **1502** to the housing component **1514**, as described above.

[0191] The adhesives that are used to attach the front cover assembly **1502** to the housing component **1514** may be configured to allow detachment of the front cover assembly **1502** from the housing component **1514** under certain circumstances. For example, the adhesives may be configured so that their bond strength weakens when exposed to heat. The front cover assembly **1502** may have a mode in which it can produce heat specifically to weaken the adhesive. Such mode may be accessed by a technician in order to replace or repair components. Heat may also be provided by an external source. In some cases, the adhesives may be configured so that their bond strength weakens when exposed to an electrical field or electrical signal. In such cases, the front cover assembly **1502** may have a mode in which it can produce the electrical field or electrical signal specifically to weaken the adhesive. Such mode may be accessed by a technician in order to replace or repair components. The electrical field or signal may also be provided by an external source.

[0192] FIG. **16**A is a detail view of area **16**A-**16**A in FIG. **15**A, showing the front-facing sensor region **1508**. As noted above, the front-facing sensor region **1508** may include a first sensing system **1510** and a second sensing system **1512**. The first sensing system **1510** may be an ambient light sensing system, and the second sensing system **1512** may be a camera. One or both of the sensing systems may be replaced with an output system, such as a flash, illuminator module, or the like. Other example systems that may be included in the front-facing sensor region **1508** include biometric sensing systems (e.g., face recognition systems, fingerprint recognition systems), proximity sensing systems, three-dimensional gesture recognition systems, and the like.

[0193] The front-facing sensor region **1508** may be surrounded by an active area of the display **1506**. For example, the front-facing sensor region **1508** may be positioned in and/or aligned with a hole formed through the active area of the display **1506**, such that the front-facing sensor region **1508** is surrounded by active (e.g., graphic-producing) display regions. In examples where the display is touch-sensitive or otherwise includes touch-sensing functionality, the front-facing sensor region **1508** may also be surrounded by touch-sensitive regions of the display. Examples of graphics that may be displayed near or around a front-facing sensor region are described with respect to the display portion **102** in FIG. **13**A, and such discussion applies to the display portion **1500** as well.

[0194] In such cases, the display **1506** may be configured with at least an optically transmissive region with which the front-facing sensor region **1508** may be aligned (and through which the front-facing sensor region **1508** may receive and/or emit light). The optically transmissive region may correspond to or be defined by one or more holes formed through display components. For example, a hole may be defined through a display substrate, electrode layers, polarizers, light diffusers, support layers, masking layers, and the like. In some cases, the optically transmissive region may correspond to or be defined by the omission or lack of material in a certain area. For example, materials or components such as electrodes, conductive traces, LCD pixels, OLED pixels, or the like, may be omitted from an area to result in an optically transmissive region (e.g., an electrode

layer may omit electrodes in the area of the front-facing sensor region **1508** to define an optically transmissive region).

[0195] As shown in FIG. **16**A, the border **1602** defines the region where the active display area **1600** ends (e.g., where pixels or other graphic-producing elements are not present or are not visible). A masking structure **1604** (such as an ink) may be positioned on the front cover **1504** (e.g., on an interior surface of the front cover **1504**) and may visually define the front-facing sensor region **1508** and may occlude the visibility of underlying components (e.g., a hole formed through the display **1506**). The masking structure **1604** may define a hole to provide optical access for the front-facing sensor region **1508**. In some cases, one or more coatings are provided on the front cover **1504** in the hole defined by the masking structure **1604**, as described herein (e.g., an infrared-transmissive, visually-opaque coating).

[0196] FIG. **16**B is a partial cross-sectional view of the display portion **1500**, viewed along line **16**B-**16**B in FIG. **16**A. As shown in FIG. **16**B, a hole **1606** is defined through the display **1506** to provide optical access for the second sensor system **1512**. In this example, the second sensor system **1512** is a front-facing camera. The second sensor system **1512** may include a camera module **1616**, which may include a lens, an image sensor, and associated circuitry and/or other components to capture images (e.g., video and/or still images). The camera module **1616** may be coupled to a carrier **1632**, which may be a housing component, a circuit board, or the like. The second sensor system **1512** may be coupled to a processing system (e.g., a processor) that is configured to analyze captured images and recognize gestures (e.g., hand waves, human movements, etc.). Such gestures may be used to control device operations, such as to launch, close, or change applications, scroll or move displayed graphics, control a cursor, or any other suitable device function.

[0197] At least a portion of the camera module **1616** may extend into the hole **1606** formed through the display **1506**. By positioning the camera module **1616** at least partially in the hole **1606**, a display portion may be made thinner than might otherwise be possible. In some cases, the camera module **1616** contacts the front cover **1504**, while in other examples (as shown in FIG. **16**B), the camera module **1616** is set apart from the front cover **1504**. Where the camera module **1616** contacts the front cover, the camera module **1616** may be configured so that the interaction with the front cover positions components of the camera module **1616** (e.g., lenses, image sensors, etc.) at a target position relative to the front cover **1504**.

[0198] In order to secure the camera module **1616** in position relative to the hole **1606**, the camera module **1616** may be coupled to the display. For example, the camera module **1616** may be attached to a bracket **1614**. The bracket **1614** may be formed from metal, polymer, or another suitable material, and the camera module **1616** may be attached to the bracket **1614** using adhesive, fasteners, interlocking structures, or the like.

[0199] An attachment plate **1610** may be coupled to the display **1506** along an interior surface of the display to define a structural mount for the bracket **1614**. The attachment plate **1610** may be coupled to the display via adhesive **1612**, such as a PSA, adhesive film, or the like. The attachment plate **1610** may be formed from or include metal, polymer, a composite, or other suitable material. The attachment plate **1610** may define a rigid mounting surface to which the bracket **1614** (and thus the camera module **1616**) may be coupled while preventing or inhibiting damage to the display **1506** itself.

[0200] The bracket **1614** may be coupled to the attachment plate **1610**, such as via adhesive **1618**. As described herein, the attachment plate **1610** and/or the bracket **1614** may include alignment features that define the position of the bracket **1614** (and thus the camera module **1616**) relative to the hole **1606**. The adhesive **1618** may be configured to position the camera module **1616** at a predetermined position relative to the front cover **1504**. For example, the adhesive **1618** may have a predetermined thickness that is configured to position the camera module **1616** at the predetermined position. As another example, the adhesive **1618** may be a flowable adhesive, and the camera module **1616** may be held at the predetermined position, relative to the front cover **1504**, while the adhesive at least partially cures, thereby fixing the position of the camera module **1616**.

[0201] A coating material **1608** may be applied to the exposed sides of the display **1506** in the through hole **1606**. The coating material **1608** may be opaque or optically occlusive to prevent or inhibit light from the display from leaking from the side of the display and into the hole **1606**, where it could interfere with the operation of the camera module **1616**. The coating material **1608** may be an ink, adhesive, or other suitable material that blocks or inhibits light. The coating material **1608** may also form a barrier against contaminants (e.g., dirt, dust, liquids, etc.) from entering the display stack through the exposed sides. The coating material **1608** may be positioned below the masking structure **1611**, such that the coating material **1608** is not visible through the front cover **1504**. A coating material **1620** may also be positioned on the peripheral sides of the display. The coating material **1620** may provide a barrier against contaminants from entering the display stack through the exposed peripheral sides. More particularly, the peripheral sides of the display may be more likely to encounter contaminants due to its proximity to the seam between the front cover **1504** and the housing component **1514**. Accordingly, the barrier function of the coating material **1620** may help prevent damage to the display **1506**. The coating material **1620** may be the same or a different material as the coating material **1608**. In some cases, the coating material **1620** may be a different material, and may not be opaque, as light leakage from the peripheral sides of the display may not be detrimental to the operation of the device.

[0202] FIG. **16**C is a partial cross-sectional view of the display portion **1500**, viewed along line **16**C-**16**C in FIG. **16**A. FIG. **16**C illustrates an example configuration of the first sensing system **1510**. In the example shown, the first sensing system **1510** may be an ambient light sensing system that is configured to determine one or more parameters of ambient light around a device (e.g., a light intensity, color, brightness, etc.). The device may perform operations based on the determined parameters, such a changing a brightness of a display output, changing a color balance of a display output, initiating a sleep or wake mode of the device, or the like.

[0203] In the example configuration shown in FIG. **16**C, there is no physical hole formed through the display **1506** (though in other examples a physical hole similar to the hole

1606 is provided, or the hole **1606** may extend over both the first and second sensing systems). Rather, the first sensing system **1510** may receive and/or emit light through one or more display components. As described above, the certain materials and/or components may be omitted from the display in the region above the first sensing system **1510** (e.g., electrodes, conductive traces, LCD pixels, OLED pixels, etc.) to improve optical transmission through the display **1506**.

[0204] In some cases, a coating **1630** may be positioned over the first sensing system **1510** in the front-facing sensor region **1508**. The coating **1630** may be a visually opaque coating that is transmissive in one or more other wavelengths (e.g., infrared). The particular wavelengths in which the coating **1630** is transmissive may be selected based on the optical sensing function of the first sensing system **1510**. For example, the first sensing system **1510** may be configured to sense infrared radiation, and as such the coating **1630** may be visually opaque but transmissive to infrared light. In some cases, the coating **1630** and the masking structure **1611** have a similar visual appearance along the front of the front cover assembly, such that the boundary between the coating **1630** and the masking structure **1611** is not readily visually distinguishable.

[0205] As noted, the first sensing system **1510** may an ambient light sensor. The ambient light sensor may include a sensor module **1628**, which may include a lens or window, a light sensor, and associated circuitry and/or other components to detect and/or determine properties of ambient light. The sensor module **1628** may be coupled to a carrier **1632**, which may be a housing component, a circuit board, or the like. The carrier **1632** and the carrier **1622** may be separate components, or different portions of a single component. The first sensor system **1510** may be coupled to a processing system (e.g., a processor) that is configured to analyze signals received by the sensor module **1628** (e.g., a light sensitive element), and control device operations in response to the signals (e.g., to change screen brightness, color, etc., as described above).

[0206] In order to secure the sensor module **1628** in position relative to the front-facing sensor region **1508**, the sensor module **1628** may be coupled to the display **1506**. For example, the sensor module **1628** may be attached to the bracket **1614**, which is in turn coupled to the attachment plate **1610**, as described above with respect to FIG. **16**B. Moreover, the positioning of the sensor module **1628** relative to the front cover may be performed in the manner described above with respect to the camera module **1616**. While FIGS. **16**B-**16**C illustrate both the camera module **1616** and the sensor module **1628** coupled to the same bracket **1614**, in other examples, each module may be associated with a separate bracket. Also, separate attachment plates may be provided for the separate modules.

[0207] As described with respect to FIGS. **16**B-**16**C, sensing systems may be coupled to the interior side of a display, such as via adhesives, fasteners, etc. In such cases, the back of the sensing systems (e.g., the side facing away from the front cover **1504**) may be set apart from an interior surface of the housing component **1514** (or other component of the display portion **1500**). In other examples, sensing systems may be coupled to or otherwise in contact with the housing component **1514**, instead of or in addition to the display.

[0208] FIG. **16**D is a partial cross-sectional view of the display portion **1500**, viewed along line **16**B-**16**B in FIG. **16**A, showing an alternative mounting arrangement for the second sensing system **1512**. This alternative arrangement may also be implemented for the first sensing system **1510** or any other sensing system.

[0209] As shown in FIG. **16**D, the carrier **1622** is coupled to an interior surface of the housing component **1514**, and is not securely attached to the display **1506** or otherwise to the front cover assembly. For example, the carrier **1622** may be coupled to the housing component **1514** with an adhesive **1624**, such as a PSA, HSA, flowable adhesive, or any other suitable adhesive. The position of the carrier **1622** and camera module **1616** relative to the housing component **1514** and the front cover **1504** may be defined in a manner similar to that described with respect to the camera module **1616** in FIG. **16**B. For example, the adhesive **1624** may be configured to position the camera module **1616** at a predetermined position relative to the housing component **1514** and the front cover **1504**. For example, the adhesive **1624** may have a predetermined thickness that is configured to position the camera module **1616** at the predetermined position. As another example, the adhesive **1624** may be a flowable adhesive, and the camera module **1616** may be held at the predetermined position, relative to the housing component **1514**, while the adhesive at least partially cures, thereby fixing the position of the camera module **1616**.

[0210] In some cases, both the adhesive **1624** and the adhesive **1618** may be used to secure the camera module **1616** (and any other sensing systems) in a target position. In such cases, the adhesives may be the same adhesive or type of adhesive (e.g., they may both be PSA films), while in other cases the adhesives may be different (e.g., one may be a flowable adhesive and the other a PSA film). Other combinations are also contemplated.

[0211] FIG. **16**E shows a partial view of an interior side of the front cover assembly **1502**, illustrating an example attachment plate **1610**. The attachment plate **1610** may define separate holes **1634**, **1636** for the sensing systems. In other examples, the attachment plate **1610** defines a single hole that is shared by multiple sensing systems. In other examples, the attachment plate **1610** defines different numbers and arrangements of holes for different components of a front-facing sensor region.

[0212] The attachment plate **1610** may also define alignment features **1633**. The alignment features **1633** engage with corresponding and/or complementary alignment features on the bracket **1614** and/or the sensor modules themselves. For example, the alignment features **1633** may be pins, posts, or other protrusions, and the complementary alignment features may be slots, holes, or other recesses that accept the alignment features **1633**. The engagement between the alignment features of the attachment plate **1610** and the bracket(s) and/or module(s) may align the modules relative to the attachment plate **1610** and position the modules in the proper location relative to the display **1506** (and the features of the display that facilitate the operation of the sensing systems, such as through-holes, coatings, maskings, and the like.

[0213] Described herein are various example devices in which a front-facing sensor region and/or camera is positioned in an active area of a display (e.g., surrounded all sides by graphic-producing display areas). Components that are positioned in the front-facing sensor region (e.g., cameras, light emitters, light receivers, etc.) may rely on optical access through the overlying front cover. In some cases,

front covers include textures, coatings, surface treatments, films, or the like, which may interfere with the transmission of light through the front cover. In one example, a front-facing exterior surface of a front cover includes a surface texture, which may help reduce glare, reflections, or otherwise improve the functionality of the display. If such a texture were positioned over the front-facing sensor region, the texture may negatively impact the operation of the front-facing optical systems. Accordingly, where a front cover includes a texture and a front-facing sensor region, the texture may be omitted in the front-facing sensor region, resulting in a front cover that has a surface texture over a graphically active display region, and no texture (e.g., a polished or smooth surface) over a front-facing sensor region.

[0214] In order to produce a front cover with differently textured areas (e.g., a non-textured area in a front-facing sensor region and a textured region in a graphically active display area), a mask may be applied to a first region of an exterior surface of the front cover (e.g., a front-facing sensor region) prior to a texturing operation (e.g., an etching operation, abrasive blasting operation, etc.) to prevent the first region from becoming textured. The mask may thereafter be removed to reveal a non-textured surface (e.g., an area of the surface that has a different texture, such as a polished or substantially smooth texture that does not substantially affect transmitted light).

[0215] The non-textured surface of a front cover may have an Ra value ranging from 1 to 150 nm, 1 to 100 nm, 1 to 50 nm, 1 to 25 nm, or 1 to 20 nm. The textured surface of the front cover may have an Ra value ranging from 0 to 2.5 microns, 0 to 2 microns, 0 to 1.5 microns. Other values of the textured and non-textured surfaces may also be used.

[0216] As described herein, optical sensing systems in a display portion of an electronic device may be surrounded by graphically active areas of a display (and/or aligned with holes formed through graphically active areas of a display). For example, FIGS. **1**A, **13**A-**13**B, **15**A, and **16**A-**16**D illustrate examples in which an area of the front cover that provides access to optical sensing systems is surrounded by active areas of the display. In such cases, light from the display being propagated through the front cover (e.g., due to internal reflection) may interfere with the operation of the sensing systems. Accordingly, such devices may be configured to locally dim or deactivate portions of the display near the optical sensors when the sensors are in use. For example, when an image is being captured with a front-facing camera, an area of the display surrounding the camera window (but less than the full display) may be graphically inactive (e.g., the pixels in that area may be blank, black, unilluminated, or the like). In one particular example, a black or unilluminated area (e.g., a circle or pill-shaped region) that has a black or dark visual appearance may be displayed around the camera.

[0217] Local dimming or deactivating of graphical outputs may be performed during the duration of a sensing operation, and may or may not be visible or noticeable to an observer. For example, an ambient light measurement may be captured in less than a second, and the local dimming/deactivating may occur for less than a second (which may not be perceptible to a user). The duration of a local dimming/deactivating of graphics may be substantially equal to the duration of a sensing operation (e.g., less than about 105% of the duration of the sensing operation, less than about 110% of the duration of the sensing operation, less than about 120% of the duration of the sensing operation).

[0218] As described herein, displays may include a front-facing sensor region in which sensors (e.g., optical sensors) may be positioned. It will be understood that the components and/or systems in a front-facing sensor region or front-facing camera region need not be limited to optical sensors, and may include other components and/or systems instead of or in addition to sensors. Example components and/or systems include, without limitation, speakers, microphones, flashes, illuminator modules, biometric sensing systems (e.g., face recognition systems, fingerprint recognition systems), proximity sensing systems, three-dimensional gesture recognition systems, pressure sensors, barometric vents, and the like.

[0219] FIG. **17** depicts an example schematic diagram of an electronic device **1700**. The electronic device **1700** may be an embodiment of or otherwise represent the device **100** (or other devices described herein). The device **1700** includes one or more processing units **1701** that are configured to access a memory **1702** having instructions stored thereon. The instructions or computer programs may be configured to perform one or more of the operations or functions described with respect to the electronic devices described herein. For example, the instructions may be configured to control or coordinate the operation of one or more displays **1708**, one or more touch sensors **1703**, one or more force sensors **1705**, one or more communication channels **1704**, one or more audio input systems **1709**, one or more audio output systems **1710**, one or more positioning systems **1711**, one or more sensors **1712**, and/or one or more haptic feedback devices **1706**. Where the device **1700** is a notebook computer, the components and/or systems described with respect to FIG. **17** may be included in the base portion of the device (e.g., the base portion **104**), the display portion of the device (e.g., the display portion **102** or any other display portion described herein), or distributed between the base portion and the display portion. Components and/or systems described with respect to FIG. **17** may be part of the device components **212** (FIG. **2**).

[0220] The processing units **1701** of FIG. **17** may be implemented as any electronic device capable of processing, receiving, or transmitting data or instructions. For example, the processing units **1701** may include one or more of: a microprocessor, a central processing unit (CPU), an application-specific integrated circuit (ASIC), a digital signal processor (DSP), or combinations of such devices. As described herein, the term "processor" is meant to encompass a single processor or processing unit, multiple processors, multiple processing units, or other suitably configured computing element or elements.

[0221] The memory **1702** can store electronic data that can be used by the device **1700**. For example, a memory can store electrical data or content such as, for example, audio and video files, images, documents and applications, device settings and user preferences, programs, instructions, timing and control signals or data for the various modules, data structures or databases, and so on. The memory **1702** can be configured as any type of memory. By way of example only, the memory can be implemented as random access memory, read-only memory, Flash memory, removable memory, or other types of storage elements, or combinations of such devices.

[0222] The touch sensors **1703** may detect various types of touch-based inputs and generate signals or data that are able to be accessed using processor instructions. The touch sensors **1703** may use any suitable components and may rely on any suitable phenomena to detect physical inputs. For example, the touch sensors **1703** may be capacitive touch sensors, resistive touch sensors, acoustic wave sensors, or the like. The touch sensors **1703** may include any suitable components for detecting touch-based inputs and generating signals or data that are able to be accessed using processor instructions, including electrodes (e.g., electrode layers), physical components (e.g., substrates, spacing layers, structural supports, compressible elements, etc.), processors, circuitry, firmware, and the like. The touch sensors **1703** may be integrated with or otherwise configured to detect touch inputs applied to any portion of the device **1700**. For example, the touch sensors **1703** may be configured to detect touch inputs applied to any portion of the device **1700** that includes a display (and may be integrated with a display), such as the display **103** (or any other display described herein). The touch sensors **1703** may operate in conjunction with the force sensors **1705** to generate signals or data in response to touch inputs. A touch sensor or force sensor that is positioned over a display surface or otherwise integrated with a display may be referred to herein as a touch-sensitive display, force-sensitive display, or touchscreen.

[0223] The force sensors **1705** may detect various types of force-based inputs and generate signals or data that are able to be accessed using processor instructions. The force sensors **1705** may use any suitable components and may rely on any suitable phenomena to detect physical inputs. For example, the force sensors **1705** may be strain-based sensors, piezoelectric-based sensors, piezoresistive-based sensors, capacitive sensors, resistive sensors, or the like. The force sensors **1705** may include any suitable components for detecting force-based inputs and generating signals or data that are able to be accessed using processor instructions, including electrodes (e.g., electrode layers), physical components (e.g., substrates, spacing layers, structural supports, compressible elements, etc.), processors, circuitry, firmware, and the like. The force sensors **1705** may be used in conjunction with various input mechanisms to detect various types of inputs. For example, the force sensors **1705** may be used to detect presses or other force inputs that satisfy a force threshold (which may represent a more forceful input than is typical for a standard "touch" input). Like the touch sensors **1703**, the force sensors **1705** may be integrated with or otherwise configured to detect force inputs applied to any portion of the device **1700**. For example, the force sensors **1705** may be configured to detect force inputs applied to any portion of the device **1700** that includes a display (and may be integrated with a display), such as the display **103** (or any other display described herein). The force sensors **1705** may operate in conjunction with the touch sensors **1703** to generate signals or data in response to touch- and/or force-based inputs.

[0224] The device **1700** may also include one or more haptic devices **1706**. The haptic device **1706** may include one or more of a variety of haptic technologies such as, but not necessarily limited to, rotational haptic devices, linear actuators, piezoelectric devices, vibration elements, and so on. In general, the haptic device **1706** may be configured to provide punctuated and distinct feedback to a user of the device. More particularly, the haptic device **1706** may be adapted to produce a knock or tap sensation and/or a vibration sensation. Such haptic outputs may be provided in response to detection of touch and/or force inputs, and may be imparted to a user through the exterior surface of the device **1700** (e.g., via a glass or other surface that acts as a touch- and/or force-sensitive display or surface). The haptic device **1706** may provide haptic outputs in response to key inputs applied to a virtual (e.g., touch-screen based) keyboard. A touch-screen based keyboard may be provided on an upper surface of a base portion of a device (e.g., the base portion **104**).

[0225] The one or more communication channels **1704** may include one or more wireless interface(s) that are adapted to provide communication between the processing unit(s) **1701** and an external device. The one or more communication channels **1704** may include antennas (e.g., antennas that include or use the housing components as radiating members), communications circuitry, firmware, software, or any other components or systems that facilitate wireless communications with other devices. In general, the one or more communication channels **1704** may be configured to transmit and receive data and/or signals that may be interpreted by instructions executed on the processing units **1701**. In some cases, the external device is part of an external communication network that is configured to exchange data with wireless devices. Generally, the wireless interface may communicate via, without limitation, radio frequency, optical, acoustic, and/or magnetic signals and may be configured to operate over a wireless interface or protocol. Example wireless interfaces include radio frequency cellular interfaces (e.g., 2G, 3G, 4G, 4G long-term evolution (LTE), 5G, GSM, CDMA, or the like), fiber optic interfaces, acoustic interfaces, Bluetooth interfaces, infrared interfaces, USB interfaces, Wi-Fi interfaces, TCP/IP interfaces, network communications interfaces, or any conventional communication interfaces. The one or more communications channels **1704** may also include ultra-wideband (UWB) interfaces, which may include any appropriate communications circuitry, instructions, and number and position of suitable UWB antennas.

[0226] As shown in FIG. **17**, the device **1700** may include a battery **1707** that is used to store and provide power to the other components of the device **1700**. The battery **1707** may be a rechargeable power supply that is configured to provide power to the device **1700**. The battery **1707** may be coupled to charging systems (e.g., wired and/or wireless charging systems) and/or other circuitry to control the electrical power provided to the battery **1707** and to control the electrical power provided from the battery **1707** to the device **1700**.

[0227] The device **1700** may also include one or more displays **1708** configured to display graphical outputs. The displays **1708** may use any suitable display technology, including liquid crystal displays (LCD), organic light emitting diodes (OLED), active-matrix organic light-emitting diode displays (AMOLED), or the like. The displays **1708** may display graphical user interfaces, images, icons, or any other suitable graphical outputs. The display **1708** may correspond to the display **103** or other displays described herein.

[0228] The device **1700** may also provide audio input functionality via one or more audio input systems **1709**. The audio input systems **1709** may include microphones, trans-

ducers, or other devices that capture sound for voice calls, video calls, audio recordings, video recordings, voice commands, and the like.

[0229] The device **1700** may also provide audio output functionality via one or more audio output systems (e.g., speakers) **1710**. The audio output systems **1710** may produce sound from voice calls, video calls, streaming or local audio content, streaming or local video content, or the like.

[0230] The device **1700** may also include a positioning system **1711**. The positioning system **1711** may be configured to determine the location of the device **1700**. For example, the positioning system **1711** may include magnetometers, gyroscopes, accelerometers, optical sensors, cameras, global positioning system (GPS) receivers, inertial positioning systems, or the like. The positioning system **1711** may be used to determine spatial parameters of the device **1700**, such as the location of the device **1700** (e.g., geographical coordinates of the device), measurements or estimates of physical movement of the device **1700**, an orientation of the device **1700**, or the like.

[0231] The device **1700** may also include one or more sensors **1712** to receive inputs (e.g., from a user or another computer, device, system, network, etc.) or to detect any suitable property or parameter of the device, the environment surrounding the device, people, or things interacting with the device (or nearby the device), or the like. For example, a device may include temperature sensors, biometric sensors (e.g., fingerprint sensors, photoplethysmographs, blood-oxygen sensors, blood sugar sensors, facial recognition systems, or the like), eye-tracking sensors, retinal scanners, humidity sensors, buttons, switches, lid-closure sensors, or the like. Sensors **1712** may also include optical sensors, including cameras, ambient light sensors, proximity sensors, and the like.

[0232] The device **1700** may also include one or more input devices **1713**. An input device **1713** is a device that is configured to receive user input. The input devices **1713** may include, for example, a keyboard (touch-screen based or mechanical), a trackpad or other pointing device, a push button, a touch-activated button, a key pad, or the like. In some embodiments, the input device **1713** may provide a dedicated or primary function, including, for example, a power button, volume buttons, home buttons, scroll wheels, and camera buttons. Generally, a touch sensor (e.g., a touchscreen) or a force sensor may also be classified as an input device. However, for purposes of this illustrative example, touch sensors and force sensors are depicted as distinct components within the device **1700**.

[0233] To the extent that multiple functionalities, operations, and structures described with reference to FIG. **17** are disclosed as being part of, incorporated into, or performed by the device **1700**, it should be understood that various embodiments may omit any or all such described functionalities, operations, and structures. Thus, different embodiments of the device **1700** may have some, none, or all of the various capabilities, apparatuses, physical features, modes, and operating parameters discussed herein. Further, the systems included in the device **1700** are not exclusive, and the device **1700** may include alternative or additional systems, components, modules, programs, instructions, or the like, that may be necessary or useful to perform the functions described herein.

[0234] As described above, one aspect of the present technology is the gathering and use of data available from various sources to improve the usefulness and functionality of devices such as mobile phones. The present disclosure contemplates that in some instances, this gathered data may include personal information data that uniquely identifies or can be used to contact or locate a specific person. Such personal information data can include demographic data, location-based data, telephone numbers, email addresses, twitter IDs, home addresses, data or records relating to a user's health or level of fitness (e.g., vital signs measurements, medication information, exercise information), date of birth, or any other identifying or personal information.

[0235] The present disclosure recognizes that the use of such personal information data, in the present technology, can be used to the benefit of users. For example, the personal information data can be used to locate devices, deliver targeted content that is of greater interest to the user, or the like. Further, other uses for personal information data that benefit the user are also contemplated by the present disclosure. For instance, health and fitness data may be used to provide insights into a user's general wellness, or may be used as positive feedback to individuals using technology to pursue wellness goals.

[0236] The present disclosure contemplates that the entities responsible for the collection, analysis, disclosure, transfer, storage, or other use of such personal information data will comply with well-established privacy policies and/or privacy practices. In particular, such entities should implement and consistently use privacy policies and practices that are generally recognized as meeting or exceeding industry or governmental requirements for maintaining personal information data private and secure. Such policies should be easily accessible by users, and should be updated as the collection and/or use of data changes. Personal information from users should be collected for legitimate and reasonable uses of the entity and not shared or sold outside of those legitimate uses. Further, such collection/sharing should occur after receiving the informed consent of the users. Additionally, such entities should consider taking any needed steps for safeguarding and securing access to such personal information data and ensuring that others with access to the personal information data adhere to their privacy policies and procedures. Further, such entities can subject themselves to evaluation by third parties to certify their adherence to widely accepted privacy policies and practices. In addition, policies and practices should be adapted for the particular types of personal information data being collected and/or accessed and adapted to applicable laws and standards, including jurisdiction-specific considerations. For instance, in the US, collection of or access to certain health data may be governed by federal and/or state laws, such as the Health Insurance Portability and Accountability Act (HIPAA); whereas health data in other countries may be subject to other regulations and policies and should be handled accordingly. Hence different privacy practices should be maintained for different personal data types in each country.

[0237] Despite the foregoing, the present disclosure also contemplates embodiments in which users selectively block the use of, or access to, personal information data. That is, the present disclosure contemplates that hardware and/or software elements can be provided to prevent or block access to such personal information data. For example, in the case of advertisement delivery services, the present technology can be configured to allow users to select to "opt

in" or "opt out" of participation in the collection of personal information data during registration for services or anytime thereafter. In addition to providing "opt in" and "opt out" options, the present disclosure contemplates providing notifications relating to the access or use of personal information. For instance, a user may be notified upon downloading an app that their personal information data will be accessed and then reminded again just before personal information data is accessed by the app.

[0238] Moreover, it is the intent of the present disclosure that personal information data should be managed and handled in a way to minimize risks of unintentional or unauthorized access or use. Risk can be minimized by limiting the collection of data and deleting data once it is no longer needed. In addition, and when applicable, including in certain health related applications, data de-identification can be used to protect a user's privacy. De-identification may be facilitated, when appropriate, by removing specific identifiers (e.g., date of birth, etc.), controlling the amount or specificity of data stored (e.g., collecting location data at a city level rather than at an address level), controlling how data is stored (e.g., aggregating data across users), and/or other methods.

[0239] Therefore, although the present disclosure broadly covers use of personal information data to implement one or more various disclosed embodiments, the present disclosure also contemplates that the various embodiments can also be implemented without the need for accessing such personal information data. That is, the various embodiments of the present technology are not rendered inoperable due to the lack of all or a portion of such personal information data. For example, content can be selected and delivered to users by inferring preferences based on non-personal information data or a bare minimum amount of personal information, such as the content being requested by the device associated with a user, other non-personal information available to the content delivery services, or publicly available information.

[0240] The foregoing description, for purposes of explanation, used specific nomenclature to provide a thorough understanding of the described embodiments. However, it will be apparent to one skilled in the art that the specific details are not required in order to practice the described embodiments. Thus, the foregoing descriptions of the specific embodiments described herein are presented for purposes of illustration and description. They are not targeted to be exhaustive or to limit the embodiments to the precise forms disclosed. It will be apparent to one of ordinary skill in the art that many modifications and variations are possible in view of the above teachings. Also, when used herein to refer to positions of components, the terms above, below, over, under, left, or right (or other similar relative position terms), do not necessarily refer to an absolute position relative to an external reference, but instead refer to the relative position of components within the figure being referred to. Similarly, horizontal and vertical orientations may be understood as relative to the orientation of the components within the figure being referred to, unless an absolute horizontal or vertical orientation is indicated.

[0241] Features, structures, configurations, components, techniques, etc. shown or described with respect to any given figure (or otherwise described in the application) may be used with features, structures, configurations, components, techniques, etc. described with respect to other figures. For example, any given figure of the instant application should not be understood to be limited to only those features, structures, configurations, components, techniques, etc. shown in that particular figure. Similarly, features, structures, configurations, components, techniques, etc. shown only in different figures may be used or implemented together. Further, features, structures, configurations, components, techniques, etc. that are shown or described together may be implemented separately and/or combined with other features, structures, configurations, components, techniques, etc. from other figures or portions of the instant specification. Further, for ease of illustration and explanation, figures of the instant application may depict certain components and/or sub-assemblies in isolation from other components and/or sub-assemblies of an electronic device, though it will be understood that components and sub-assemblies that are illustrated in isolation may in some cases be considered different portions of a single electronic device (e.g., a single embodiment that includes multiple of the illustrated components and/or sub-assemblies).

What is claimed is:

1. A laptop computer comprising:
a base portion comprising a keyboard; and
a display portion flexibly coupled to the base portion and comprising:
a housing component formed of metal and defining a set of side surfaces;
a front cover assembly coupled to the housing component and comprising:
a first glass member defining at least a portion of a front exterior surface of the display portion; and
a display coupled to the first glass member; and
a rear cover assembly coupled to the housing component and comprising a second glass member defining at least a portion of a rear exterior surface of the display portion.

2. The laptop computer of claim **1**, wherein:
the first glass member defines a first portion of the front exterior surface of the display portion; and
the housing component defines a second portion of the front exterior surface of the display portion.

3. The laptop computer of claim **2**, wherein:
the second glass member defines a first portion of the rear exterior surface of the display portion; and
the housing component defines a second portion of the rear exterior surface of the display portion.

4. The laptop computer of claim **1**, wherein the rear cover assembly further comprises an opaque mask structure coupled to an interior surface of the second glass member.

5. The laptop computer of claim **1**, wherein the set of side surfaces defined by the housing component comprises:
a first side surface;
a second side surface;
a third side surface;
a first corner surface extending from the first side surface to the second side surface; and
a second corner surface extending from the second side surface to the third side surface.

6. The laptop computer of claim **1**, further comprising a touch-sensing layer positioned between the display and the first glass member.

7. A laptop computer comprising:
a base portion comprising a keyboard; and
a display portion flexibly coupled to the base portion and comprising:

a housing component defining a first opening along a front side of the housing component and a second opening along a rear side of the housing component;
a front cover assembly positioned in the first opening and coupled to the housing component, the front cover assembly comprising:
a first glass member defining a display region; and
a display coupled to the first glass member; and
a rear cover assembly positioned in the second opening and coupled to the housing component, the rear cover assembly comprising a second glass member defining at least a portion of a rear exterior surface of the display portion.

8. A laptop computer comprising:
a base portion comprising a keyboard; and
a display portion flexibly coupled to the base portion and comprising:
a front cover assembly comprising
a front cover comprising a first glass material and defining at least a portion of a front surface of the display portion; and
a display positioned below the front cover;
a rear cover comprising a second glass material and defining at least a portion of a rear surface of the display portion;
a housing component coupled to the front cover and rear cover and comprising a mid-chassis positioned between the front cover and the rear cover;
a first flexible circuit element conductively coupled to a display component of the display and extending from the display along a first side edge of the display, at least a portion of the first flexible circuit element positioned between the mid-chassis and the front cover assembly; and
a second flexible circuit element conductively coupled to a touch-sensing component of the display and extending from the display along a second side edge of the display different from the first side edge, at least a portion of the second flexible circuit element positioned between the mid-chassis and the front cover assembly.

9. The laptop computer of claim **8**, wherein the second side edge of the display is perpendicular to the first side edge.

10. The laptop computer of claim **8**, further comprising a third flexible circuit element conductively coupled to the touch-sensing component of the display and extending from the display along a third side edge of the display different from the first side edge and from the second side edge.

11. The laptop computer of claim **10**, wherein:
the first side edge of the display is a top side edge of the display; and
the second and third side edges of the display are lateral side edges of the display.

12. The laptop computer of claim **11**, wherein;
a fourth side edge of the display lacks flexible circuit elements extending therefrom; and
the fourth side edge of the display is a bottom side edge of the display.

13. The laptop computer of claim **10**, wherein:
the front cover assembly further comprises a circuit board;
the first flexible circuit element is conductively coupled to a first segment of the circuit board; and
the second and third flexible circuit elements are conductively coupled to a second segment of the circuit board, the second segment of the circuit board conductively isolated from the first segment of the circuit board.

14. A laptop computer comprising:
a base portion comprising a keyboard; and
a display portion flexibly coupled to the base portion and comprising:
a housing component;
a cover structure coupled to the housing component and comprising:
a transparent cover member having a first thickness and defining a first hole; and
a transparent camera cover having a second thickness less than the first thickness and positioned in the first hole such that a recess is defined along a rear surface of the cover structure;
a display coupled to the transparent cover member and defining a second hole extending through an active display region of the display; and
a camera having a lens assembly extending through the second hole and into the recess.

15. The laptop computer of claim **14**, wherein:
the transparent cover member comprises glass; and
the transparent camera cover comprises sapphire.

16. The laptop computer of claim **14**, wherein the second thickness is less than or equal to half of the first thickness.

17. The laptop computer of claim **14**, wherein:
the laptop computer further comprises a mounting structure adhered to an interior surface of the transparent cover member, the mounting structure defining a ledge positioned in the first hole; and
the transparent camera cover is adhered to the ledge of the mounting structure.

18. The laptop computer of claim **14**, wherein the display is configured to produce a graphical output in the active display region that surrounds the transparent camera cover.

19. The laptop computer of claim **14**, further comprising:
a first opaque mask positioned along an interior surface of the transparent cover member and defining a first mask region around the first hole; and
a second opaque mask positioned along an interior surface of the transparent camera cover and defining a second mask region around a transparent window portion of the transparent camera cover.

20. A laptop computer comprising:
a base portion comprising a keyboard; and
a display portion flexibly coupled to the base portion and comprising:
a housing component comprising:
a first wall portion defining a first side exterior surface of the display portion;
a second wall portion defining a second side exterior surface of the display portion opposite to the first side exterior surface; and
a mid-chassis extending between the first wall portion and the second wall portion and defining an array of attachment holes;
a front cover assembly positioned along a first side of the mid-chassis and comprising:
a transparent cover member defining at least part of a front surface of the display portion;
a display positioned below the transparent cover member; and

a mounting structure positioned below the display and comprising an array of attachment features;

a set of fasteners, each fastener of the set of fasteners extending through a respective attachment hole of the array of attachment holes and engaging with a respective attachment feature of the array of attachment features; and

a rear cover assembly positioned along a second side of the mid-chassis and defining at least part of a rear surface of the display portion.

21. The laptop computer of claim **20**, wherein the housing component is a unitary metal structure defining the mid-chassis, the first wall portion, and the second wall portion.

22. The laptop computer of claim **20**, wherein:

the housing component comprises a wall structure formed of metal and defining the first wall portion and the second wall portion; and

the mid-chassis is coupled to the wall structure.

23. The laptop computer of claim **22**, wherein the mid-chassis comprises a fiber-reinforced polymer sheet.

24. The laptop computer of claim **20**, wherein:

the fasteners of the set of fasteners are threaded fasteners; and

the attachment features of the array of attachment features are threaded bosses.

25. The laptop computer of claim **20**, wherein:

the mounting structure comprises a metal plate; and

the attachment features of the array of attachment features are welded to the mounting structure.

26. A laptop computer comprising:

a base portion comprising a keyboard; and

a display portion flexibly coupled to the base portion and comprising:

a housing component defining:

a first wall portion defining a first exterior surface of the display portion;

a second wall portion defining a second exterior surface of the display portion opposite to the first exterior surface; and

a composite mid-chassis structure coupled to the first wall portion and the second wall portion and extending between the first wall portion and the second wall portion;

a front cover assembly coupled to a front side of the housing component and comprising:

a first glass member defining at least a portion of a front exterior surface of the display portion; and

a display coupled to the first glass member; and

a rear cover assembly coupled to a rear side of the housing component and comprising a second glass member defining at least a portion of a rear exterior surface of the display portion.

* * * * *