



(10) **Patent No.:** US 11,962,162 B2
(45) **Date of Patent:** Apr. 16, 2024

(54) **ACCESSORY DEVICE FOR ELECTRONIC DEVICES**

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

(72) Inventors: **Bryan A. Cloyd**, San Francisco, CA (US); **Linda D. Benavente-Notaro**, Sherman Oaks, CA (US); **Chengrui Zhang**, Milpitas, CA (US); **Sara Rusignuolo**, Newport Beach, CA (US)

(73) Assignee: **Apple, Inc.**, Cupertino, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 675 days.

(21) Appl. No.: 17/147,315

(22) Filed: **Jan. 12, 2021**

(65) **Prior Publication Data**
US 2022/0094204 A1 Mar. 24, 2022

Related U.S. Application Data

(60) Provisional application No. 63/081,842, filed on Sep. 22, 2020.

(51) **Int. Cl.**
G06F 1/16 (2006.01)
A45C 11/18 (2006.01)
A45C 13/30 (2006.01)
H02J 50/10 (2016.01)
H05K 5/00 (2006.01)
H05K 7/00 (2006.01)

(52) **U.S. Cl.**
CPC ***H02J 50/10*** (2016.02); ***A45C 11/182***
(2013.01); ***A45C 13/30*** (2013.01); ***A45C***
2013/306 (2013.01); ***A45F 2200/0516***
(2013.01); ***A45F 2200/0525*** (2013.01)

(58) **Field of Classification Search**
CPC H02J 50/10; A45C 11/182; A45C 13/30;
A45C 13/306

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

| | | | | |
|--------------|------|---------|---------------|------------|
| 9,829,941 | B1 | 11/2017 | Saeidi et al. | |
| 10,838,462 | B1 | 11/2020 | Monaco et al. | |
| 10,892,625 | B1 * | 1/2021 | Franklin | A45C 15/00 |
| 2011/0301778 | A1 | 12/2011 | Liang et al. | |
| 2013/0082532 | A1 | 4/2013 | Rich et al. | |

(Continued)

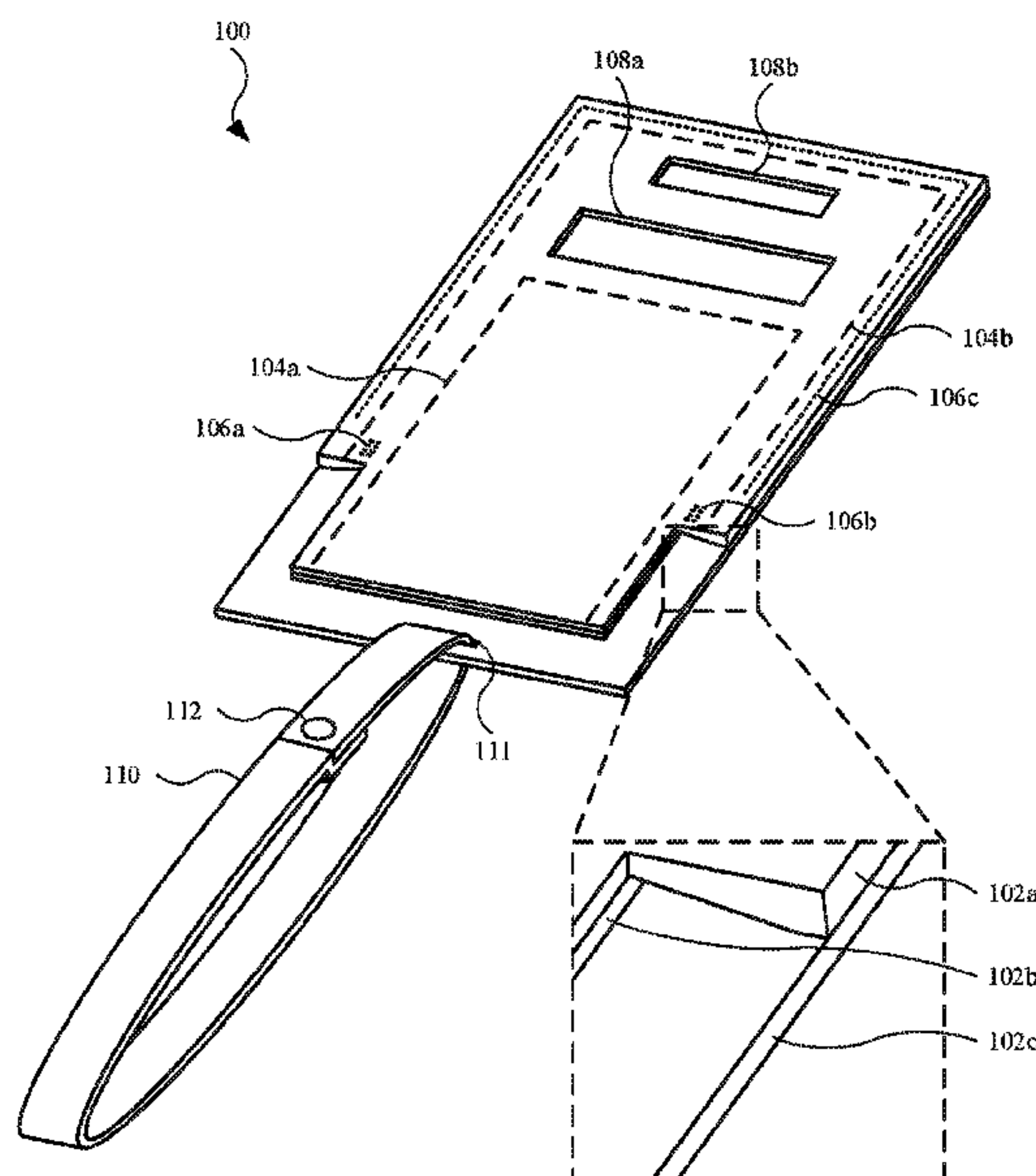
Primary Examiner — Anthony M Haughton

(74) *Attorney, Agent, or Firm* — BAKERHOSTETLER

(57) **ABSTRACT**

An accessory device is disclosed. The accessory device may include multiple pockets, or sleeves, designed to carry items, such as an electronic device and a user's personal items (e.g., credits cards, cash, etc.). The accessory device also includes a magnet embedded in a back section, with the magnet designed to align an inductive charging mechanism that can charge the electronic device's battery when the electronic device is positioned within the accessory device. To improve charging efficiency, the back section also includes a structural layer designed to keep the back section flat when the electronic device is positioned within the accessory device. The structural layer can hide/obscure the magnet and other structures. Also, the accessory device includes a wireless communication circuit that can communicate with a corresponding wireless communication circuit in the electronic device, and provide information (e.g., openings and dimensional information of the accessory device) to the electronic device.

20 Claims, 14 Drawing Sheets



(56)

References Cited

U.S. PATENT DOCUMENTS

| | | | | |
|--------------|------|---------|-----------------|--------------------------|
| 2013/0148839 | A1 * | 6/2013 | Stevinson | H04R 1/1033 381/384 |
| 2014/0085815 | A1 * | 3/2014 | Filipovic | G06F 1/163 361/679.56 |
| 2014/0128132 | A1 * | 5/2014 | Cox, III | H04B 1/3888 455/575.8 |
| 2014/0218305 | A1 * | 8/2014 | Beasley | H04M 1/04 345/169 |
| 2014/0221057 | A1 | 8/2014 | Katis et al. | |
| 2014/0236380 | A1 | 8/2014 | Alton et al. | |
| 2014/0362518 | A1 | 12/2014 | Huang et al. | |
| 2015/0043156 | A1 | 2/2015 | Jain et al. | |
| 2015/0057830 | A1 | 2/2015 | Slaby et al. | |
| 2015/0201723 | A1 | 7/2015 | Rayner et al. | |
| 2017/0026498 | A1 * | 1/2017 | Goldfain | H02J 7/342 |
| 2017/0080251 | A1 | 3/2017 | Yehezkel | |
| 2018/0020812 | A1 * | 1/2018 | Rao | A45C 13/18 320/137 |
| 2018/0176748 | A1 | 6/2018 | Kim et al. | |
| 2020/0313712 | A1 | 10/2020 | Schooley et al. | |

* cited by examiner

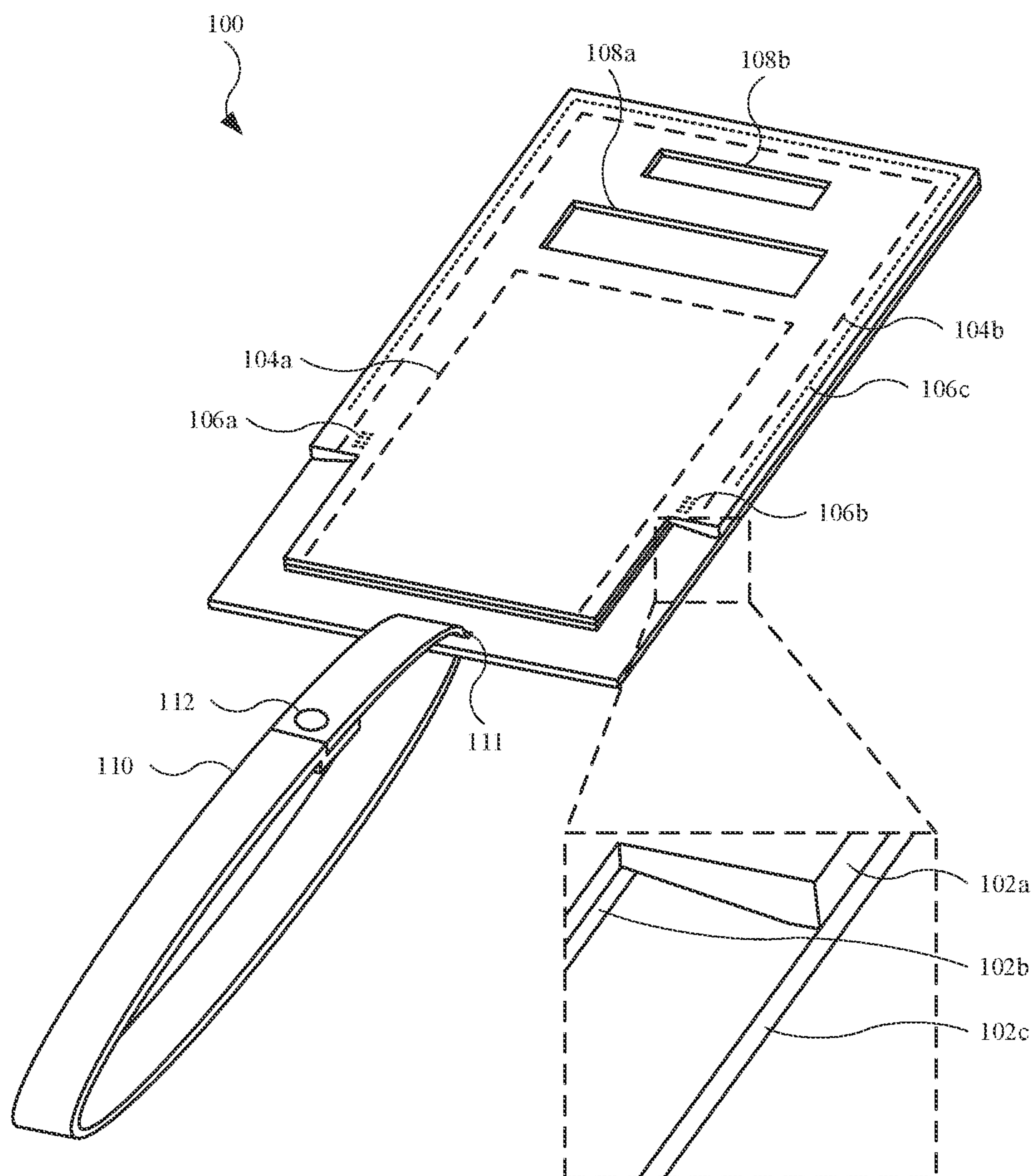


FIG. 1

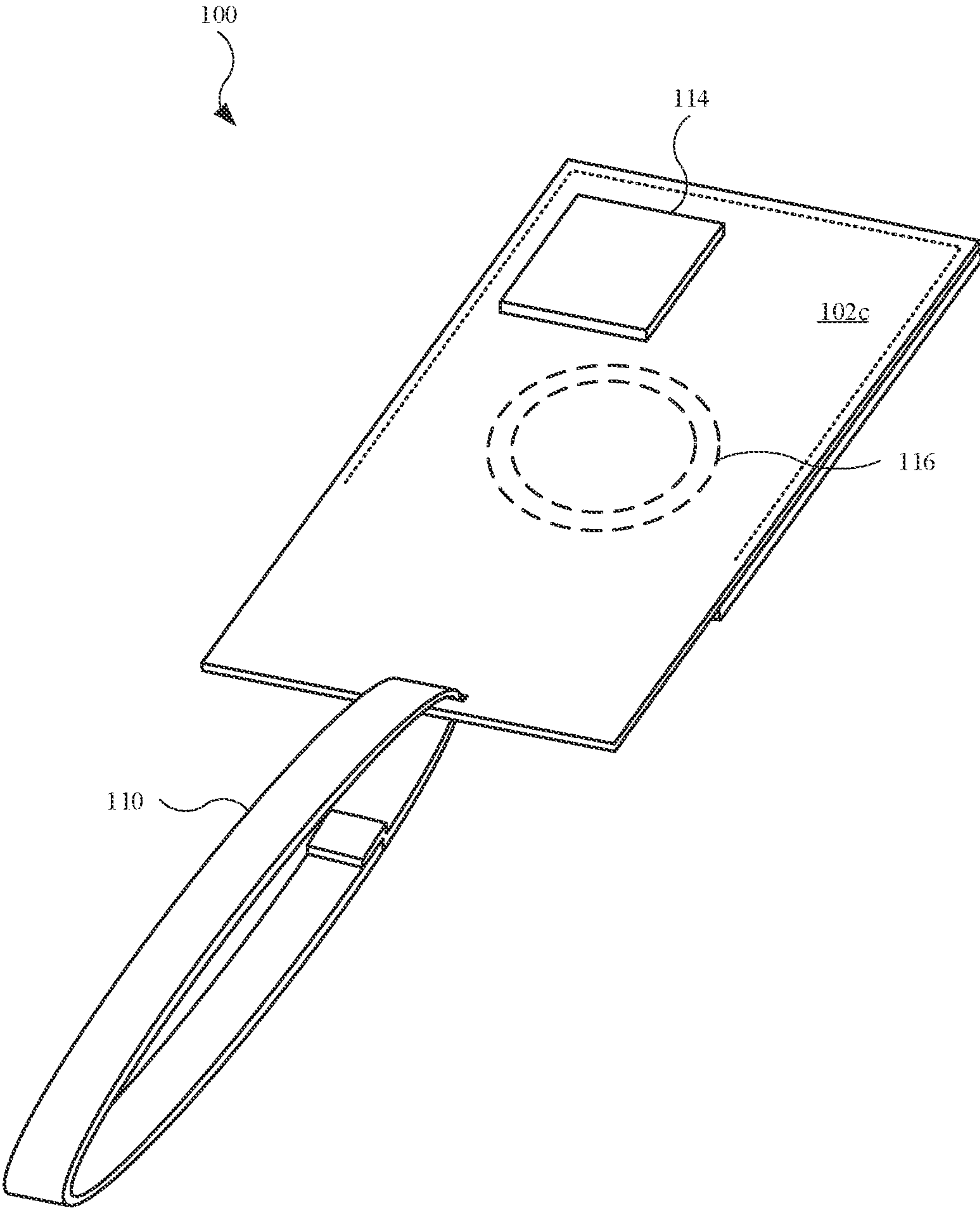


FIG. 2

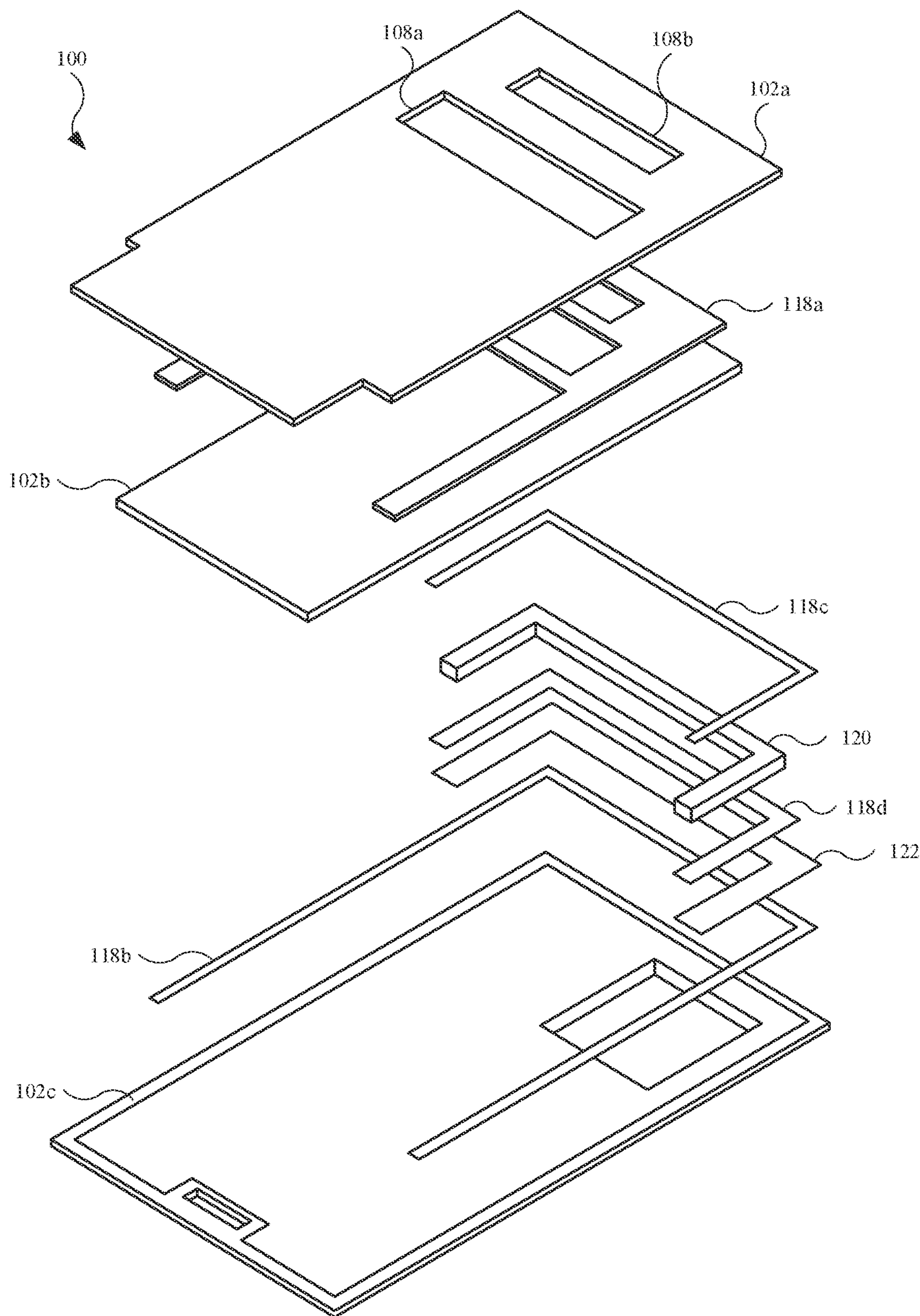


FIG. 3

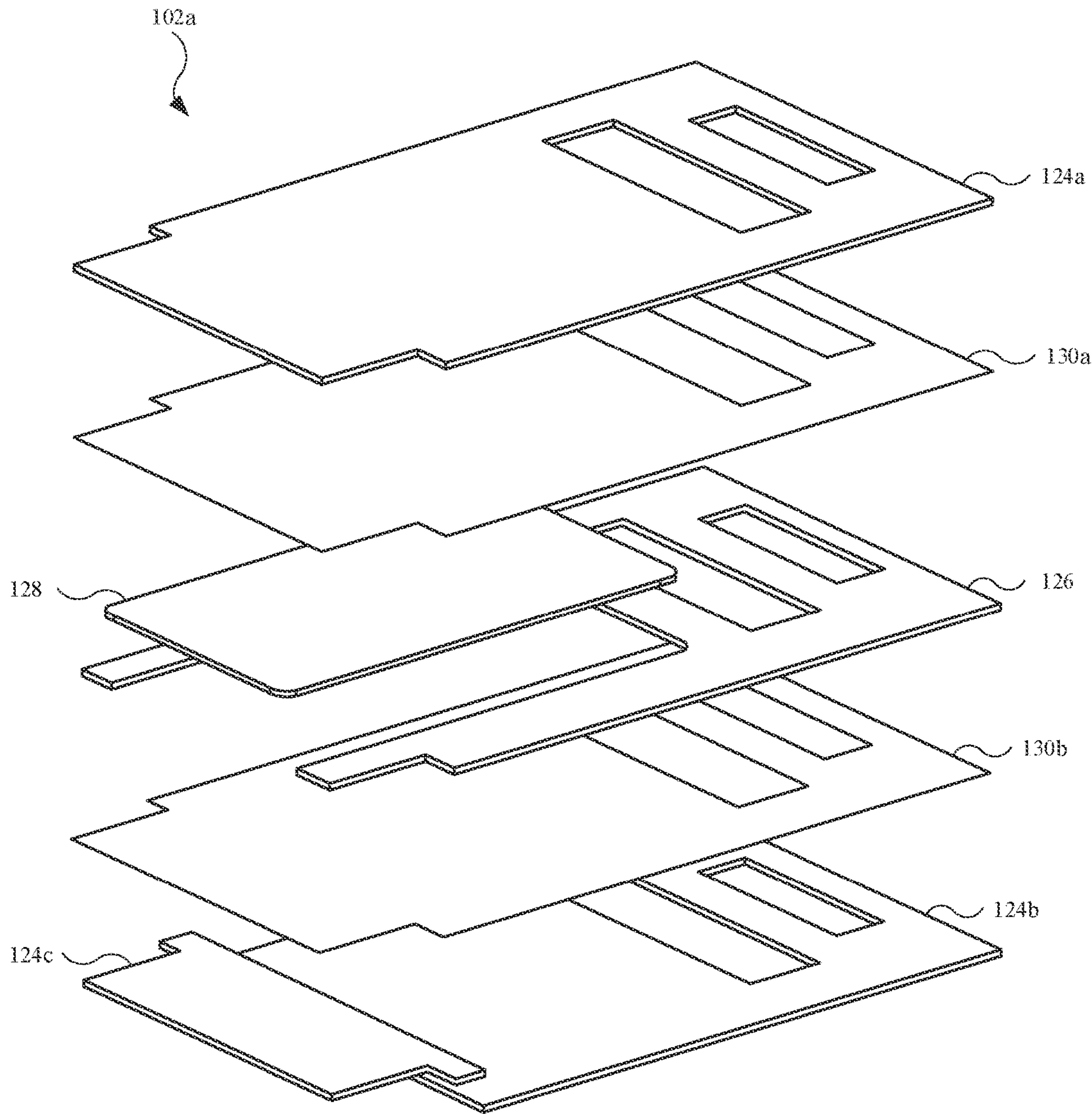


FIG. 4

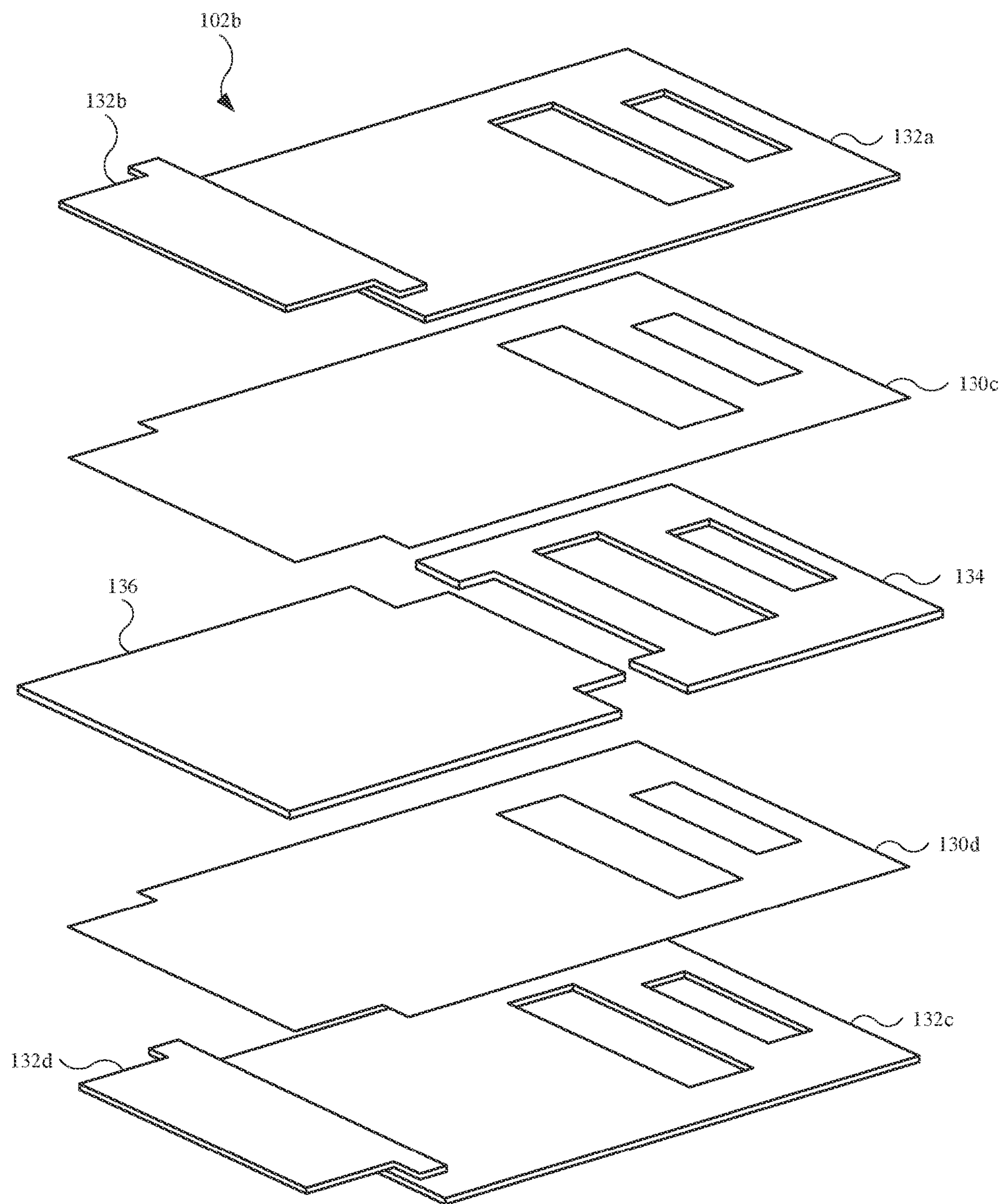


FIG. 5

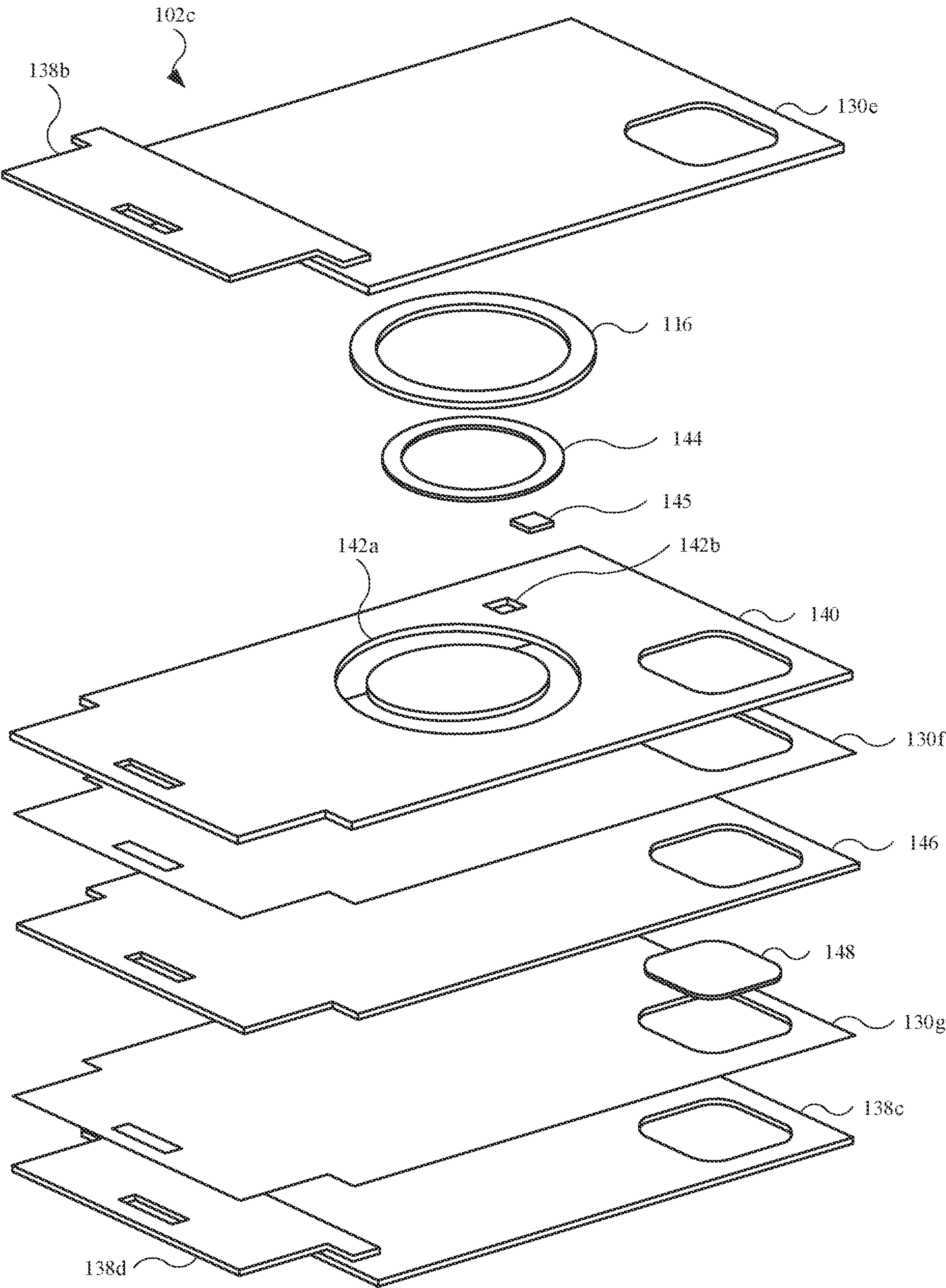


FIG. 6

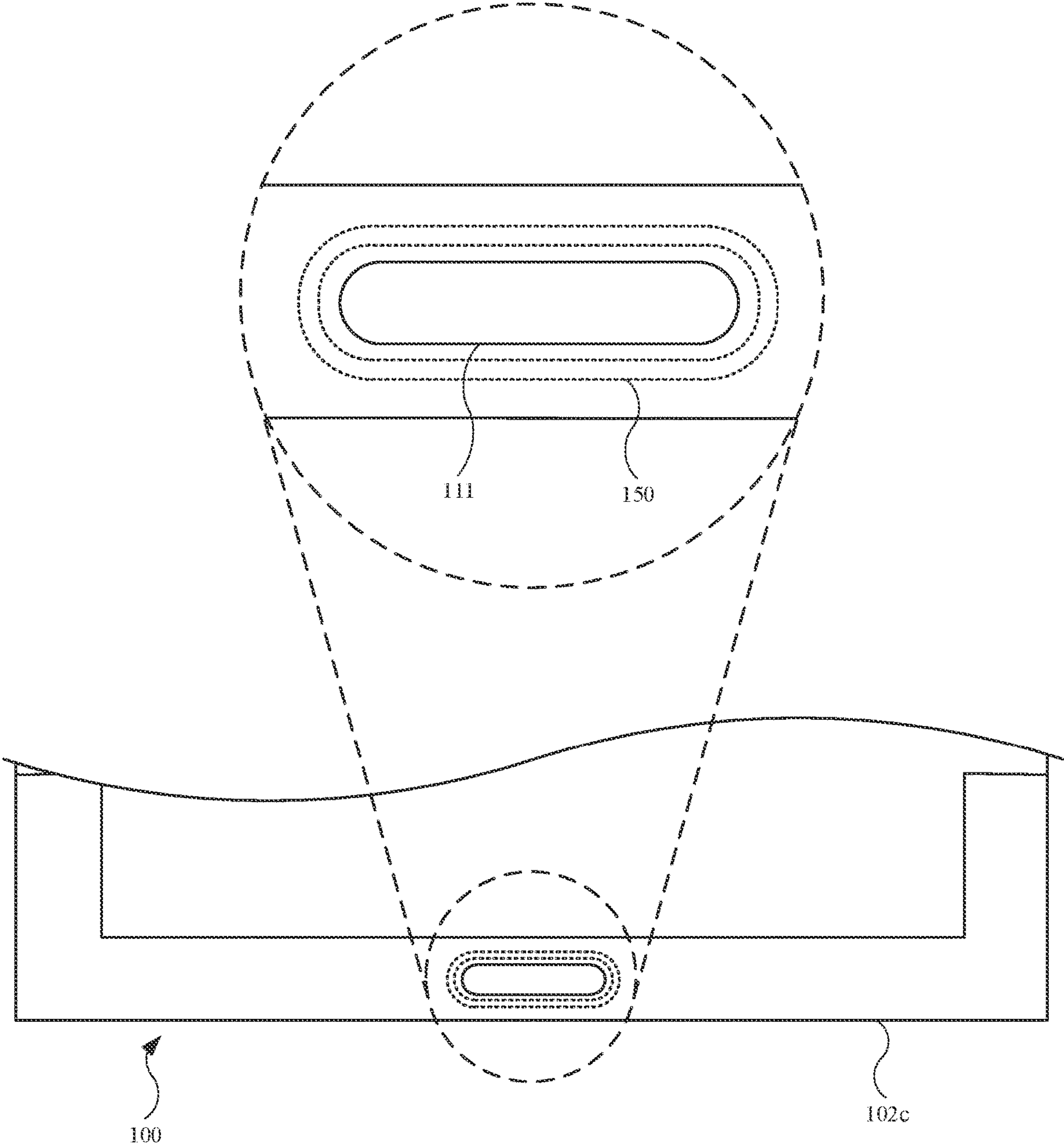


FIG. 7

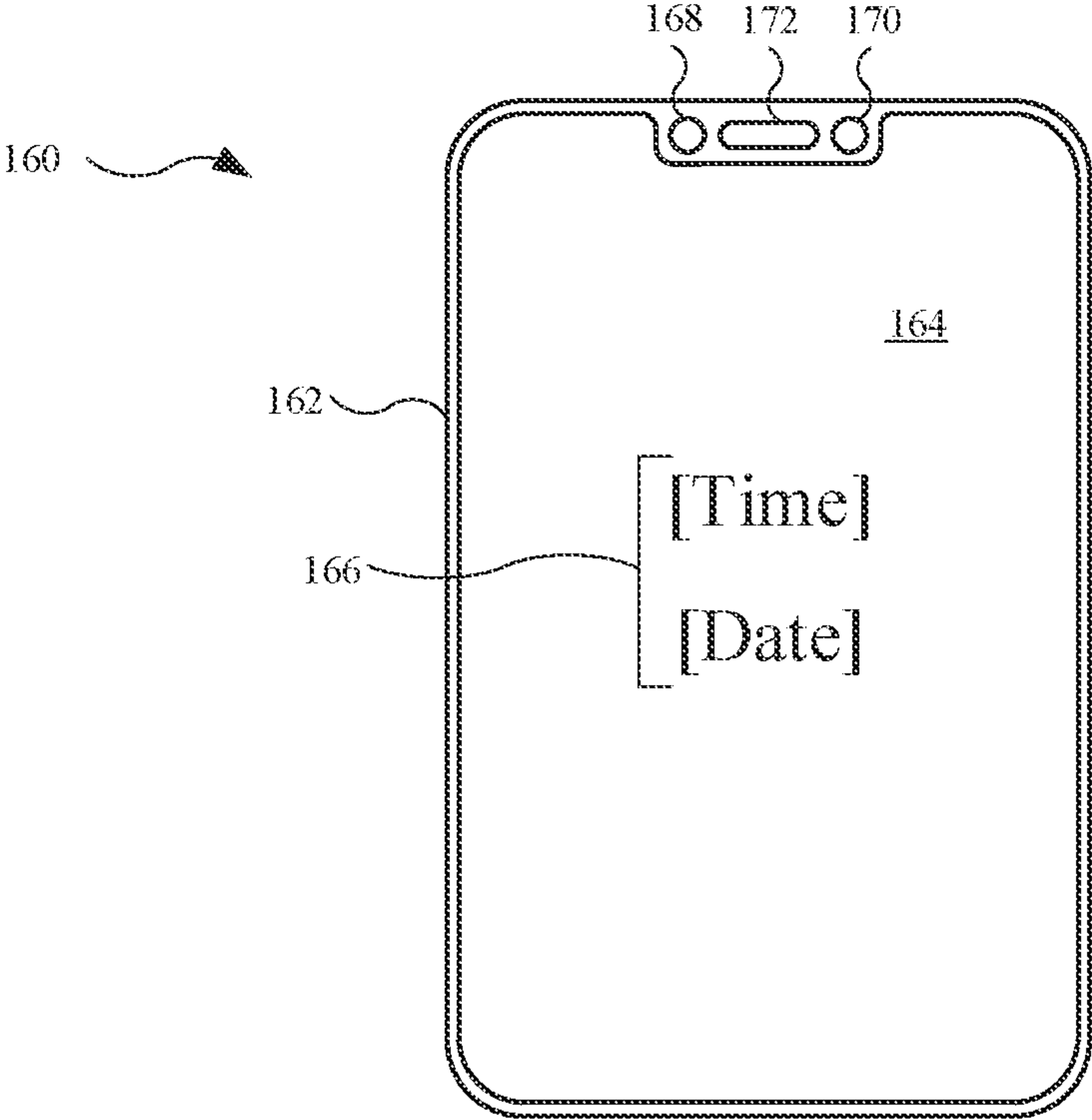


FIG. 8

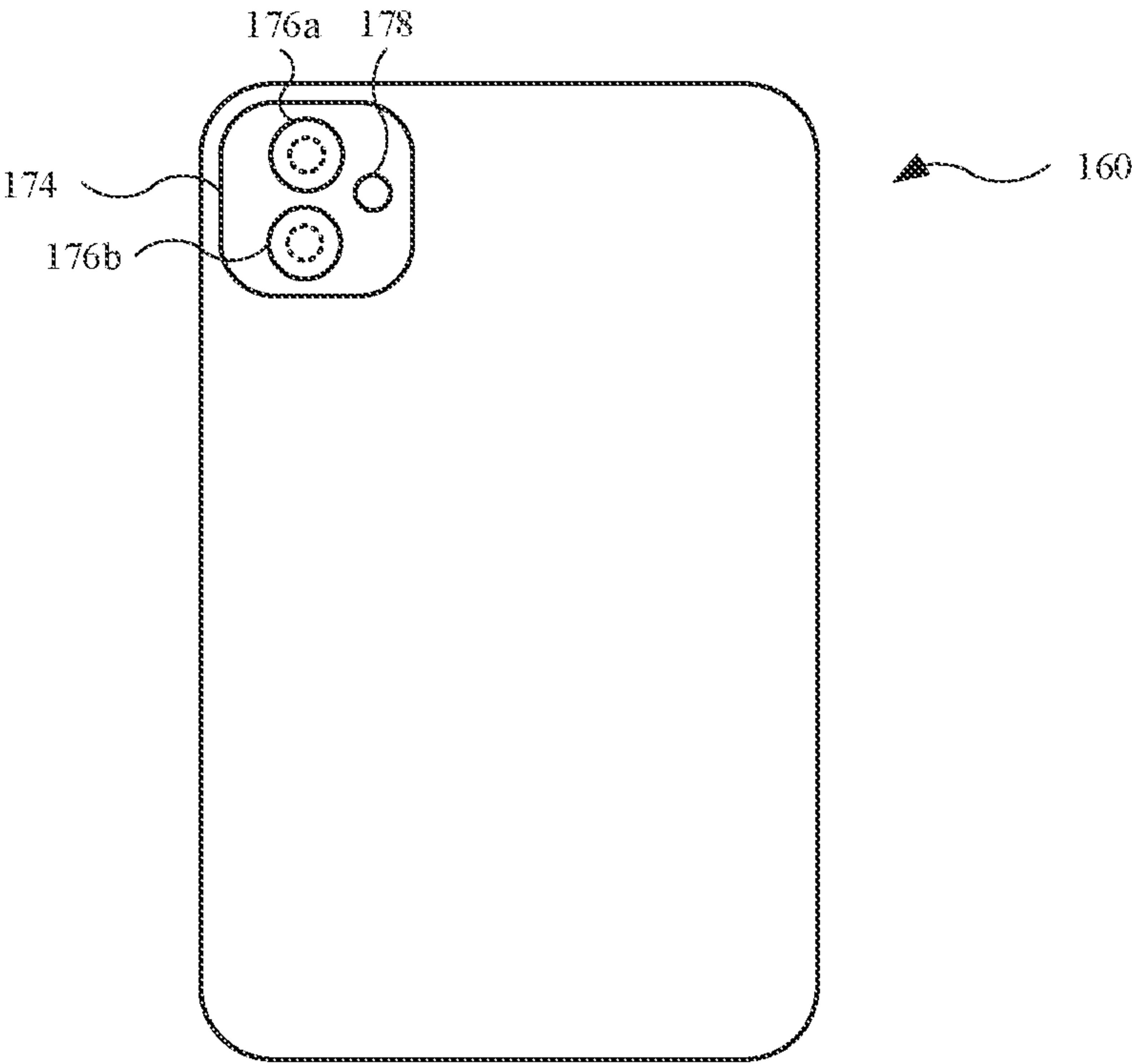


FIG. 9

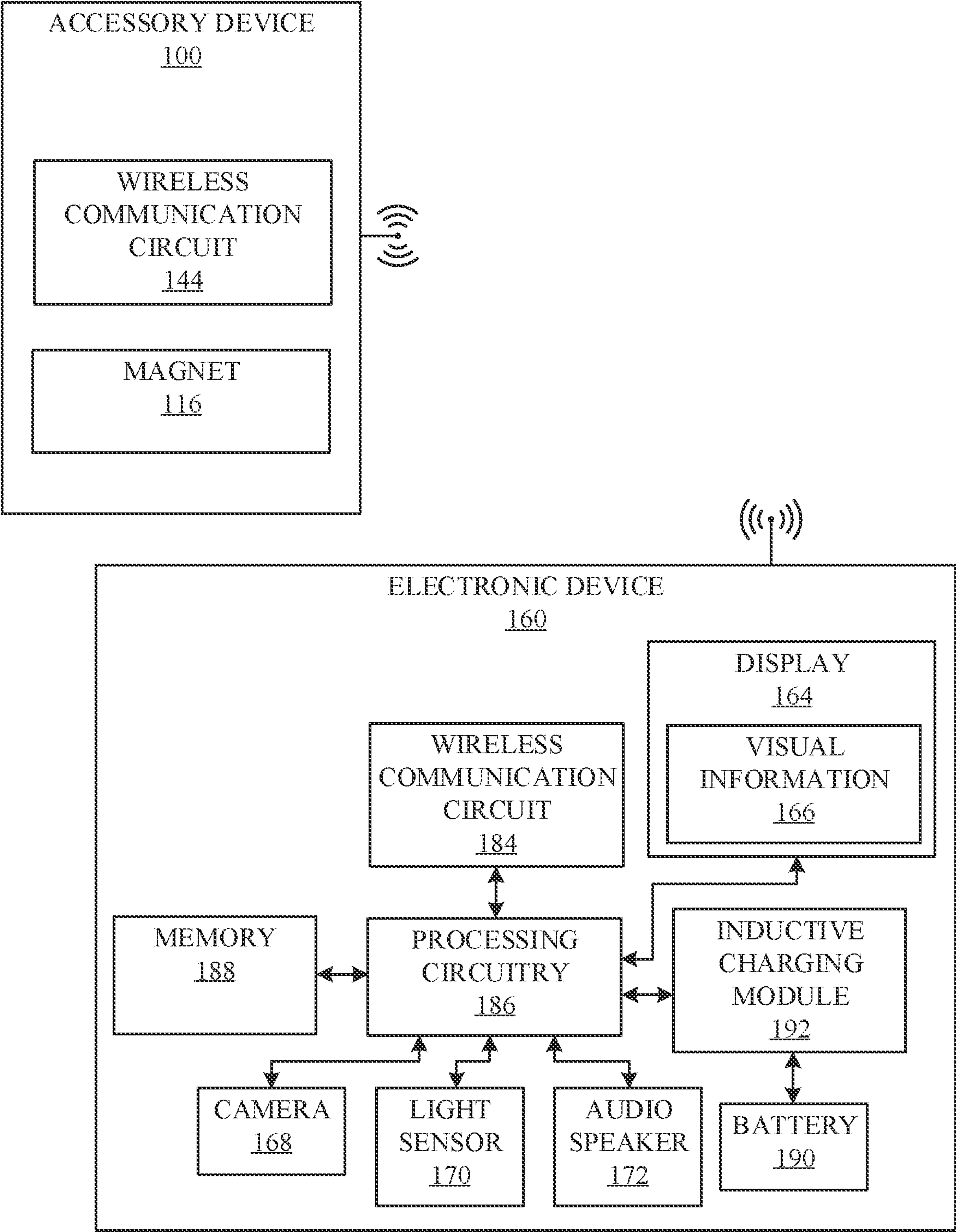


FIG. 10

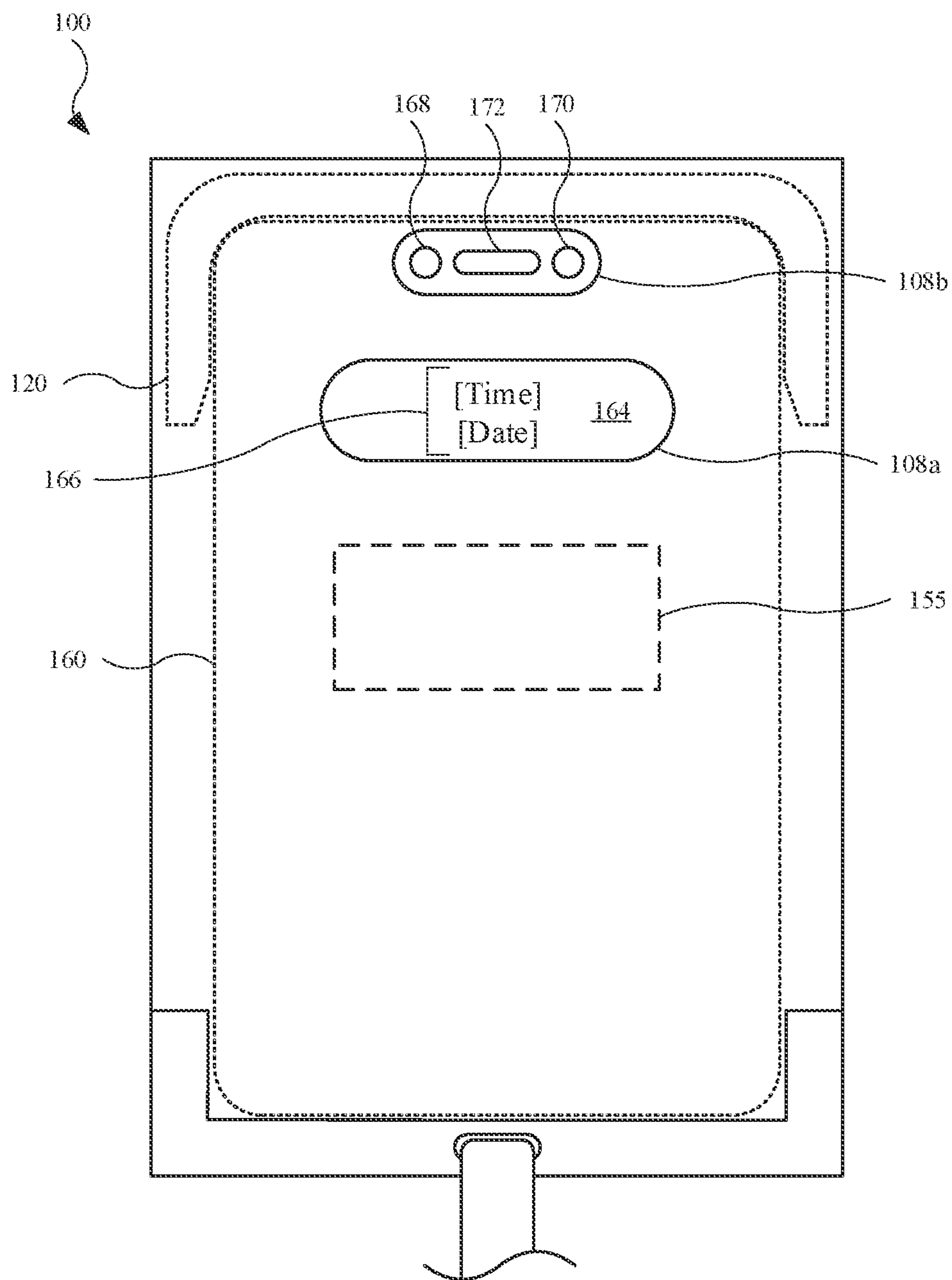


FIG. 11

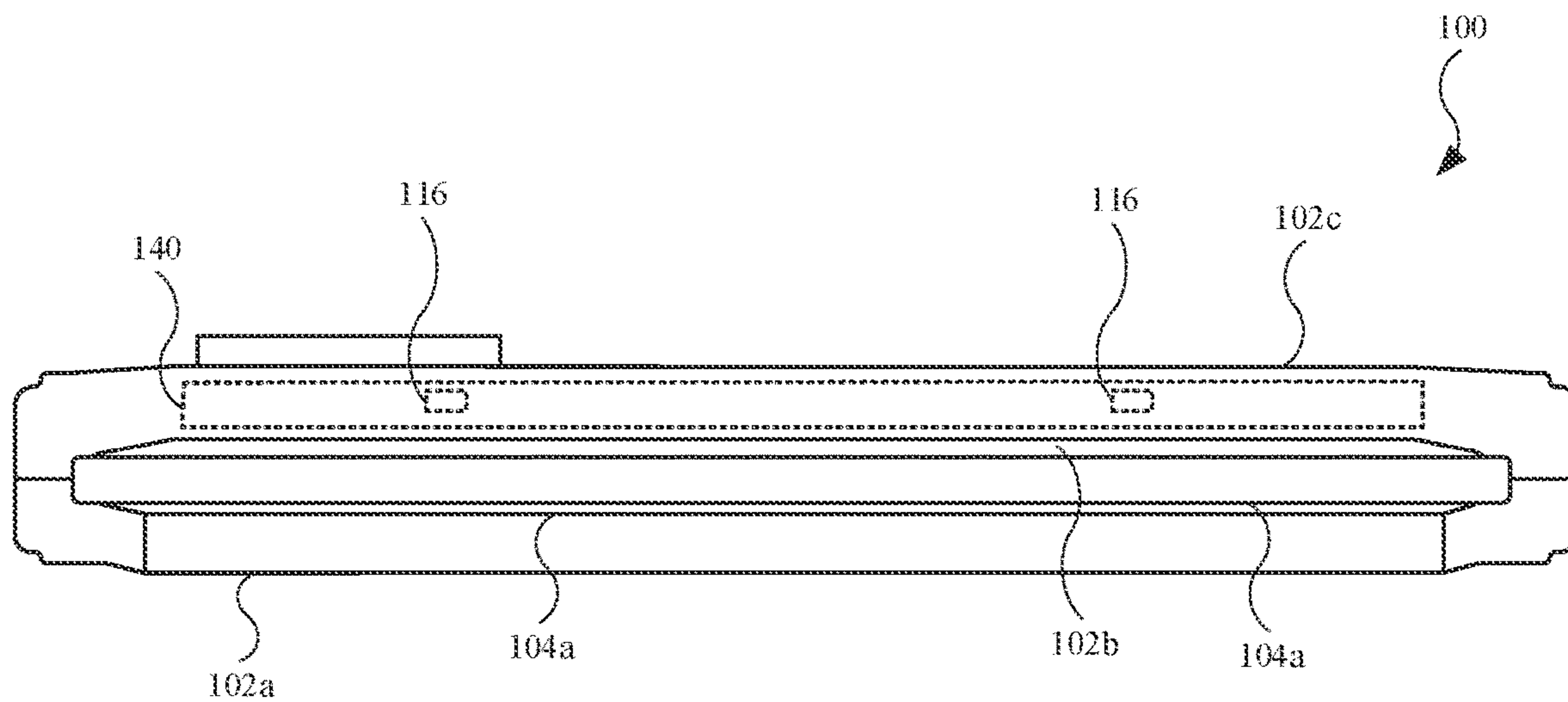


FIG. 12

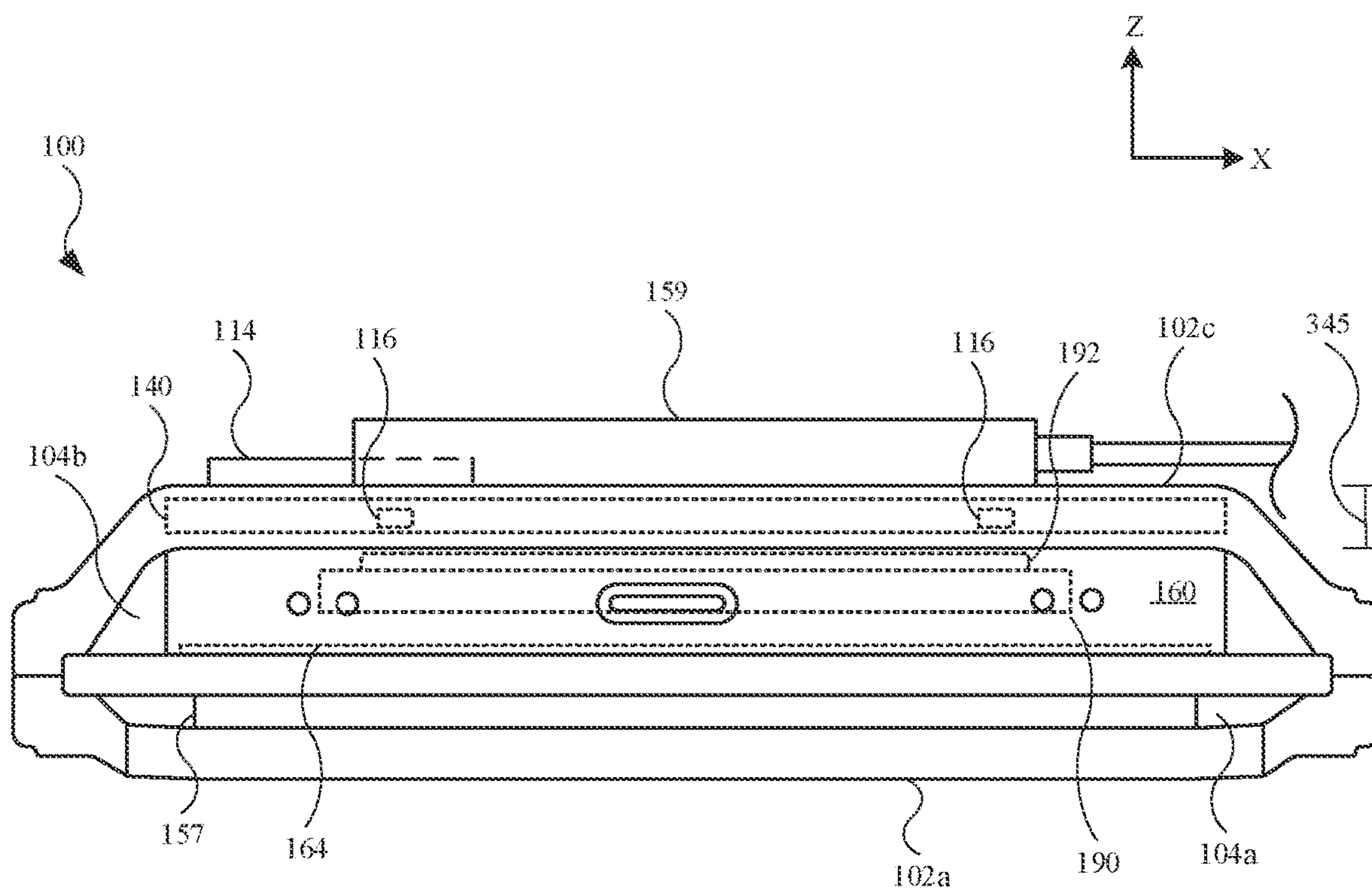


FIG. 13

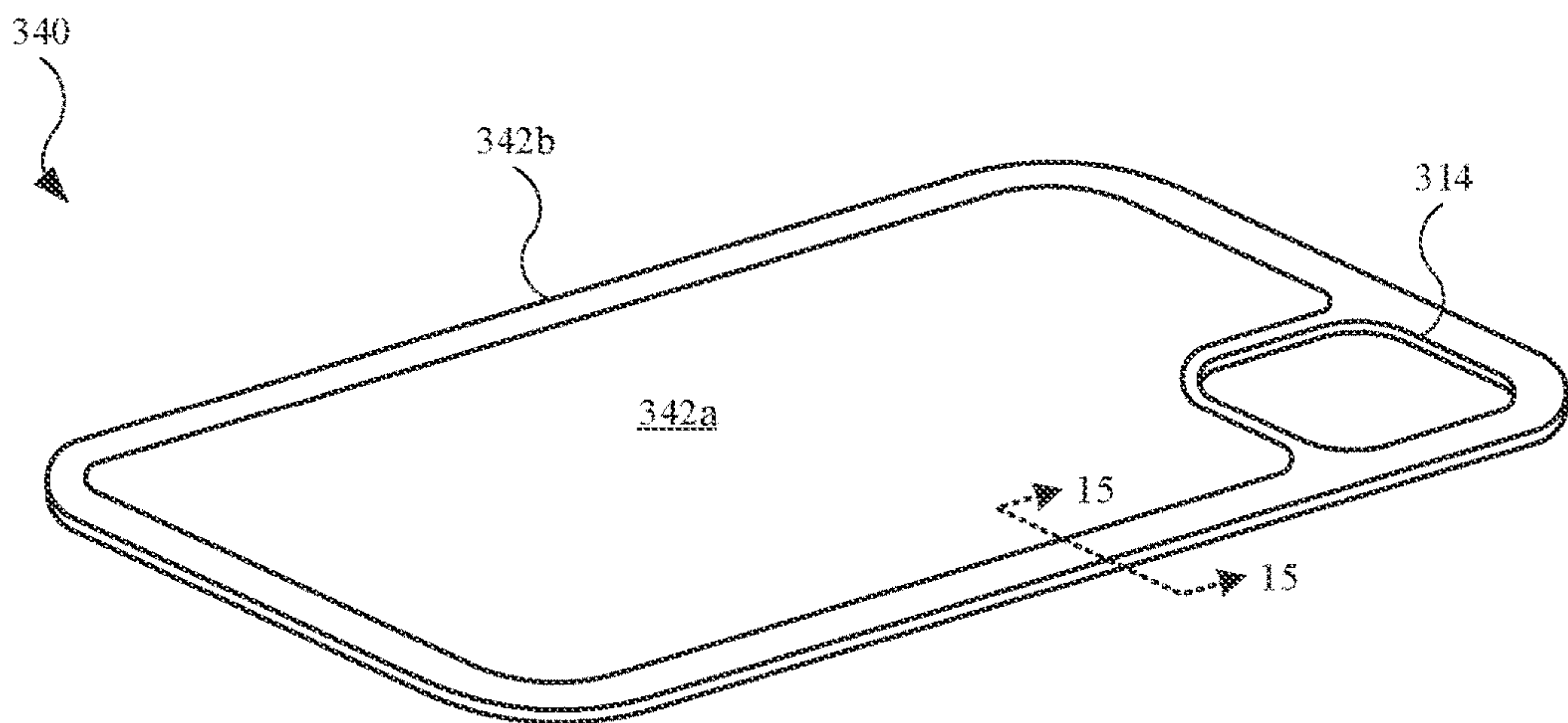


FIG. 14

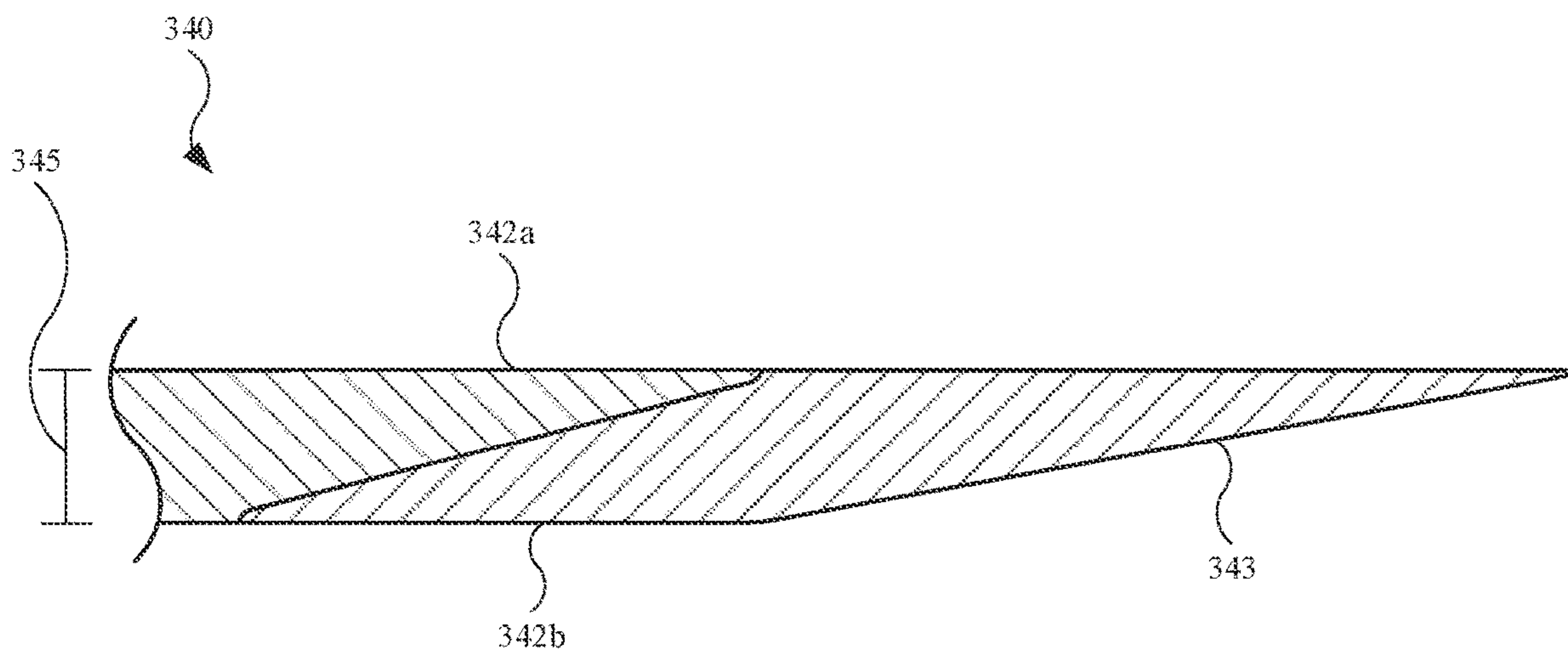


FIG. 15

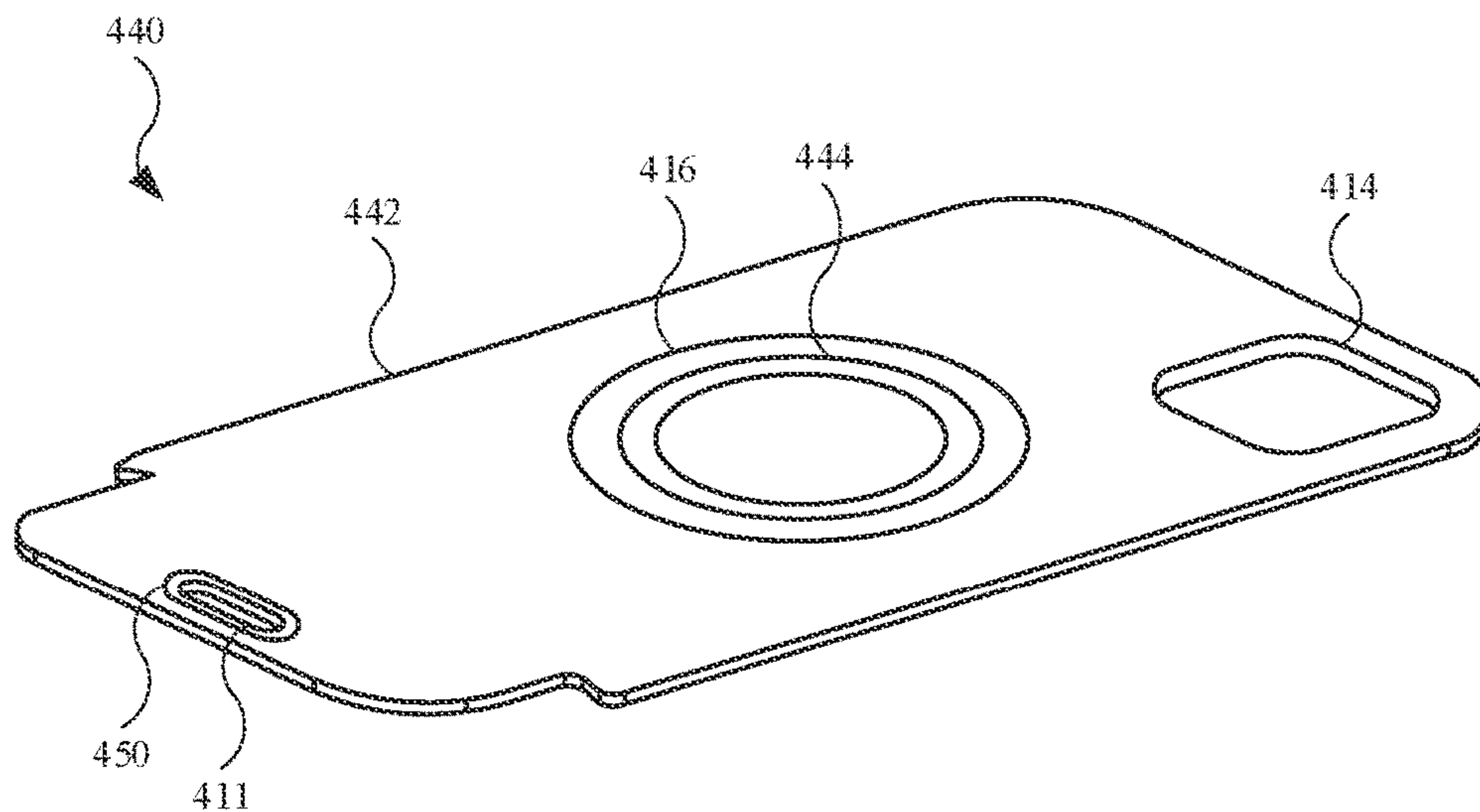


FIG. 16

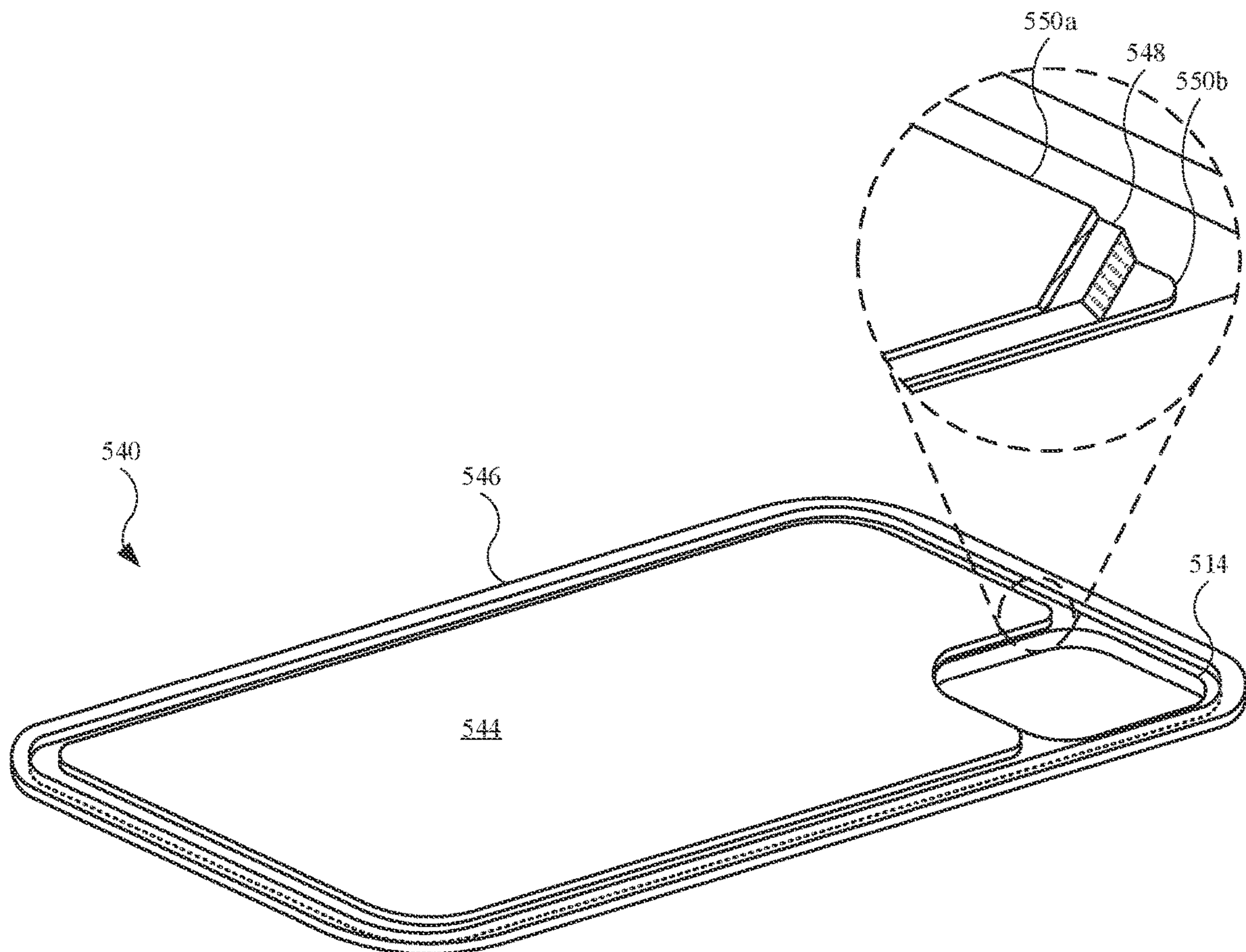


FIG. 17

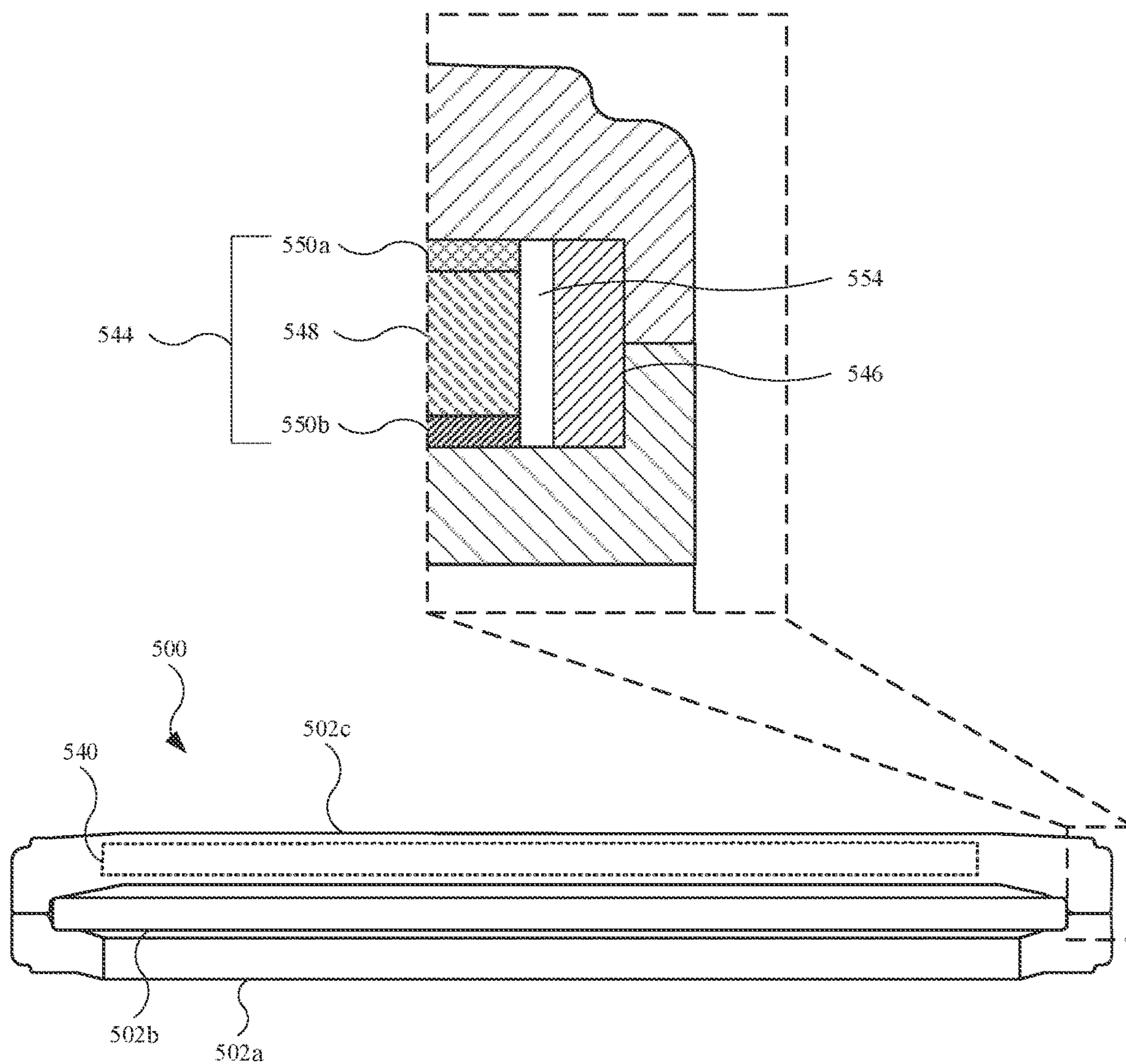


FIG. 18

ACCESSORY DEVICE FOR ELECTRONIC DEVICES

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application claims the benefit of U.S. Provisional Application No. 63/081,842, entitled "ACCESSORY DEVICE FOR ELECTRONIC DEVICES," filed Sep. 22, 2020, the content of which is incorporated herein by reference in its entirety for all purposes.

FIELD

The following description relates to accessory devices. In particular, the following description relates to an accessory for carrying a portable electronic device as well as other personal items (e.g., credit cards). When the accessory device carries the electronic device, the accessory device can communicate with the electronic device, allowing the electronic device to adjust display features in accordance with features of the accessory device. The accessory device can also promote wireless charging of the electronic device, while hiding/obscuring the structural features (e.g., magnets, structural layers) used to enhance wireless charging efficiency.

BACKGROUND

Accessory devices can be used to hold/carry electronic devices. Accessory devices can come in a variety of colors and materials to suit user preferences.

SUMMARY

In one aspect, an accessory device for a portable electronic device is described. The accessory device may include a first section that includes an opening. The accessory device may further include a second section coupled with the first section. The first section and the second section may define a first pocket. The accessory device may further include a third section coupled with the second section. The second section and the third section may define a second pocket configured to receive the portable electronic device. The accessory device may further include a wireless communication circuit configured to send information to the portable electronic device when the portable electronic device is disposed in the second pocket. The information may correspond to the opening, such as a size, shape, and/or location of the opening in the first section.

In another aspect, an accessory device for a portable electronic device is described. The accessory device may include a first section that includes an opening. The accessory device may further include a second section covered by the first section. The first section and the second section may define a first pocket. The accessory device may further include a third section covered by the second section. The second section and the third section may define a second pocket configured to receive the portable electronic device. The second pocket can be separate from the first pocket. The third section may include a magnet configured to magnetically couple with and align an inductive charging unit that charges the portable electronic device when the portable electronic device is disposed in the second pocket. The third section may further include a wireless communication circuit

configured to send information to the portable electronic device. The information may include a location of the opening.

In another aspect, an accessory device for a portable electronic device is described. The accessory device may include a first section that includes an opening. The accessory device may further include an adhesive layer. The accessory device may further include a second section coupled with the first section by the adhesive layer. The first section, the second section, and the adhesive layer may define a first pocket. The accessory device may further include a third section covered by the second section. The second section and the third section may define a second pocket configured to receive the portable electronic device. The third section may include a capping layer. The third section may further include a structural layer coupled with the capping layer. In some embodiments, the third section maintains a planar section, based on the capping layer and the structural layer, when the portable electronic device is located in the second pocket.

Other systems, methods, features and advantages of the embodiments will be, or will become, apparent to one of ordinary skill in the art upon examination of the following figures and detailed description. It is intended that all such additional systems, methods, features and advantages be included within this description and this summary, be within the scope of the embodiments, and be protected by the following claims.

BRIEF DESCRIPTION OF THE DRAWINGS

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:

FIG. 1 illustrates a front isometric view of an embodiment of an accessory device;

FIG. 2 illustrates a rear isometric view of the accessory device shown in FIG. 1, showing additional features of the accessory device;

FIG. 3 illustrates an exploded view of the accessory device, showing the sections of the accessory device as well as additional features of the accessory device;

FIG. 4 illustrates an exploded view of the section (i.e., top section) of the accessory device, showing several features of the section;

FIG. 5 illustrates an exploded view of the section (i.e., middle section) of the accessory device, showing several features of the section;

FIG. 6 illustrates an exploded view of the section (i.e., bottom section) of the accessory device, showing several features of the section;

FIG. 7 illustrates a plan view of the accessory device, showing a reinforcement feature surrounding the opening;

FIG. 8 illustrates a plan view of an electronic device suitable for use with accessory devices described herein;

FIG. 9 illustrates an alternate plan view of an electronic device shown in FIG. 8, showing additional features of the electronic device;

FIG. 10 illustrates a schematic view of the accessory device and the electronic device, in accordance with some described embodiments;

FIG. 11 illustrates a plan view of the electronic device positioned within the accessory device;

FIG. 12 illustrates a side view of the accessory device;

FIG. 13 illustrates a side view of the accessory device shown in FIG. 12, showing the accessory device carrying several objects;

FIG. 14 illustrates an isometric view of an alternate embodiment of a structural layer, showing the structural layer having multiple materials;

FIG. 15 illustrates a cross sectional view of the structural layer shown in FIG. 14, taken along line 15-15, showing additional features of the structural layer;

FIG. 16 illustrates an isometric view of an alternate embodiment of a structural layer, showing the structural layer having multiple embedded materials;

FIG. 17 illustrates an isometric view of an alternate embodiment of a structural layer, showing the structural layer having several modular sections; and

FIG. 18 illustrates a side view of an alternate embodiment of an accessory device, showing the accessory device integrating the structural layer shown in FIG. 17.

Those skilled in the art will appreciate and understand that, according to common practice, various features of the drawings discussed below are not necessarily drawn to scale, and that dimensions of various features and elements of the drawings may be expanded or reduced to more clearly illustrate the embodiments of the present invention described herein.

DETAILED DESCRIPTION

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.

In the following detailed description, references are made to the accompanying drawings, which form a part of the description and in which are shown, by way of illustration, specific embodiments in accordance with the described embodiments. Although these embodiments are described in sufficient detail to enable one skilled in the art to practice the described embodiments, it is understood that these examples are not limiting such that other embodiments may be used, and changes may be made without departing from the spirit and scope of the described embodiments.

The following disclosure relates to accessory devices for use with portable electronic devices, including mobile wireless communication devices (e.g., smartphones, tablet computing devices). Accessory devices described herein include multiple pockets, or openings, one of which is designed to receive a portable electronic device, while another is designed to receive, for example, a user's personal items such as credit cards and cash. Accessory devices described herein may come in a variety of sizes, with pockets having sizes and shapes corresponding to those of the portable electronic device and the personal items.

Additionally, accessory devices described herein are designed to communicate information to the portable electronic device. In this regard, the accessory device includes wireless communication circuitry (e.g., near-field communication, or NFC, circuitry) that can communicate with similar circuitry in the portable electronic device. The communication may occur when the portable electronic device and the accessory device are in relatively close proximity to each other, including when the portable electronic device is positioned in the accessory device. In some exemplary

embodiments, the wireless communication circuitry of the accessory device can provide information related to the accessory device. The information can be used by the portable electronic device to identify the accessory device and some of its features, such as a location of an opening (or openings) in a section of the accessory device. As a result, the portable electronic device can present, on a display, visual information on the display at a location corresponding to the opening such that the visual information is viewable through the opening. In addition, once the accessory device is known, the portable electronic device may also receive information related to the thickness and material makeup of the accessory device. In this manner, a portable electronic device having wireless (inductive) charging capabilities can more accurately and reliably determining charging characteristics, such as the time required to charge an internal battery of the portable electronic device, as the portable electronic device can account for the thickness and material makeup through which a magnetic field from an (external) inductive charging mechanism will pass to induce a current and charge the internal battery.

Traditional accessory devices are generally not modified to enable, or at least promote, efficient wireless charging when a portable electronic device is positioned therein. However, accessory devices described herein may include a structural layer, or stiffening layer, that includes one or more relatively rigid layers designed to promote a flat, or planar, back section of the accessory device. As a result, a portable electronic device disposed in the accessory device can be more efficiently charged by an external wireless charging mechanism through the back section of the accessory device, as opposed to an accessory device with that back section that is bowed or otherwise curved (i.e., not flat) due to the insertion of the portable electronic device. In order to further promote/enable wireless charging, the back section of the accessory device may include a magnet designed to magnetically couple with the external wireless charging mechanism. The magnet not only provides an alignment between an inductive transmitting coil of the external wireless charging mechanism and an inductive transmitting coil of the portable electronic device, but also maintains the external wireless charging mechanism against the back section of the accessory device, thereby increasing the charging efficiency. Moreover, in order to hide or obscure the magnet, the magnet may be embedded in the structural layer. As a result, at least some of the features and complexities are not viewable by the user of the accessory device, which can enhance the overall aesthetic appearance of the accessory device.

These and other embodiments are discussed below with reference to FIGS. 1-18. However, those skilled in the art will readily appreciate that the detailed description given herein with respect to these Figures is for explanatory purposes only and should not be construed as limiting.

FIG. 1 illustrates a front isometric view of an embodiment of an accessory device 100. Accessory device 100 is designed to carry and support portable electronic devices, including smartphones and tablet computing devices, as non-limiting examples. Additionally, accessory device 100 is designed to carry/hold a user's personal items, such as credit cards, hotel cards, cash, etc., as non-limiting examples. In this regard, accessory device 100 may include multiple sections coupled together. For example, as shown in the enlarged view, accessory device 100 includes a section 102a, a section 102b, and a section 102c. Sections 102a, 102b, and 102c may be referred to as a first section, a second section, and a third section, respectively. Additionally, sec-

5

tions **102a** and **102c** may be referred to as a front (or top) section and back (or rear or bottom) section, respectively, while section **102b** may be referred to as a middle section. Sections **102a**, **102b**, and **102c** define pockets (or sleeves or cavities) for a user's personal items. For example, sections **102a** and **102b** define a pocket **104a** for a user's credit cards, cash, etc., while sections **102b** and **102c** define a pocket **104b** for a portable electronic device. Pockets **104a** and **104b** are shown as dotted lines, and will be further shown and described below. The defined areas for pockets **104a** and **104b** may be at least partially obscured. However, as shown, pocket **104a** may be defined in part by stitching **106a** and stitching **106b**, which may couple sections **102a** and **102b** together, and pocket **104b** may be defined in part by stitching **106c**, which may couple sections **102a** and **102c** together. Several adhesive layers (not shown in FIG. 1) may also define the size and shape of pockets **104a** and **104b**.

Although a portable electronic device (not shown in FIG. 1) may be substantially covered by accessory device **100** when the portable electronic device is inserted into pocket **104b**, accessory device **100** is nonetheless designed to promote user interaction with the portable electronic device. For example, section **102a** may include an opening **108a** and an opening **108b**. In some embodiments, opening **108a** renders a region of a display of the portable electronic device at least partially visible, and as a result, the display can present visual information viewable through opening **108a**. This will be shown and described in further detail below. In some embodiments, opening **108b** renders input and output mechanisms (e.g., camera(s), sensor(s), and/or audio speaker(s)) of the portable electronic device unobscured/unobstructed, and as a result, the portable electronic device can use the input and output mechanisms based on the opening **108b** while being positioned in accessory device **100**.

Also, a strap **110** may extend from accessory device **100**. Strap **110** is sized and shaped to fit around a user's appendage (e.g., wrist or forearm) thus providing another means for carrying accessory device **100** by the user. In some embodiments, strap **110** is permanently coupled with accessory device **100**. In the embodiment shown in FIG. 1, strap **110** passes through an opening **111** in section **102c**, and can be removed from accessory device **100** by interacting with a button **112**. Although not shown, section **102a** may further include cosmetic enhancements, such as paint or ink (as non-limiting examples), located around openings **108a** and **108b**, as well as other locations. These cosmetic enhancements may also be applied to a perimeter of sections **102b** and **102c**.

FIG. 2 illustrates a rear isometric view of accessory device **100** shown in FIG. 1, showing additional features of accessory device **100**. As shown, section **102c** may include a protrusion **114** (or recess when viewed, for example, in FIG. 1) that extends from a surface of section **102c**. Protrusion **114** is designed to accommodate a camera assembly of the portable electronic device. In this manner, section **102c** may remain flat or planar (or at least substantially flat or planar) when accessory device **100** receives the portable electronic device. Additional features in section **102c** may also promote a flat/planar surface of section **102c**, thereby maintaining the section **102c** as a planar section. This will be discussed below.

Section **102c** may further include a magnet **116**. In some embodiments, magnet **116** can magnetically couple with an external accessory suitable for use with the portable electronic device (when the portable electronic device is disposed in accessory device **100**). For example, magnet **116** can be designed to magnetically couple with a wireless

6

(inductive) charging mechanism that can inductively charge a battery of the portable electronic device, even when the portable electronic device is disposed in accessory device **100**. Moreover, magnet **116** is positioned in section **102c** in a location corresponding to that of the wireless (inductive) receiving coil of the portable electronic device (when the portable electronic device is disposed in accessory device **100**). As shown, magnet **116** includes a circular magnet. However, other shapes are possible.

Also, in some embodiments, magnet **116** is a flexible magnet formed from a relatively thin magnetic element, or a combination of several (modular) magnetic elements.

FIG. 3 illustrates an exploded view of accessory device **100**, showing sections **102a**, **102b**, and **102c**, as well as additional features of accessory device **100**. When accessory device **100** is assembled, section **102a** is stacked over section **102b**, and section **102b** is stacked over section **102c**. In addition to stitching (shown in FIG. 1), sections **102a**, **102b**, and **102c** are held together by additional materials. For example, accessory device **100** includes an adhesive layer **118a** that adhesively secures regions of sections **102a** and **102b** together. Adhesive layer **118a** may include openings (not fully shown) that include a size, shape, and corresponding location as those of openings **108a** and **108b** such that adhesive layer **118a** does not obstruct openings **108a** and **108b**. Moreover, adhesive layer **118a** may define in part pocket **104a** (shown in FIG. 1). Additionally, accessory device **100** includes an adhesive layer **118b** that adhesively secures regions of sections **102a** and **102c** together.

While sections **102b** and **102c** define a pocket (not shown in FIG. 3) for a portable electronic device, accessory device **100** may include additional structural elements designed to align the portable electronic device. For example, accessory device **100** may include a collar **120**, or alignment structure, designed to align the portable electronic device. Collar **120** defines a three-dimensional structure designed to wrap around and engage multiple sides of the portable electronic device. In this regard, collar **120** is designed to align the portable electronic device such that the aforementioned visual information presented on the display of the portable electronic device is consistently aligned with opening **108a** in section **102a**, and also the input and output mechanisms of the portable electronic device are consistently aligned with opening **108b** in section **102a**. Collar **120** may include a polymer material (as a non-limiting example). Generally, collar **120** may include any material that is durable enough to resist some compression forces provided by the portable electronic device, while also not damaging the portable electronic device.

In order to secure collar **120**, accessory device **100** may include an adhesive layer **118c** designed to adhesively secure collar **120** with section **102b**. Accessory device **100** may further include an adhesive layer **118d** designed to adhesively secure collar **120** with a structural layer **122**. Structural layer **122** may include a woven fabric, such as taffeta (as a non-limiting example).

FIG. 4 illustrates an exploded view of section **102a** of accessory device **100**, showing several features of section **102a**. As shown, section **102a** includes a layer **124a**, a layer **124b**, and a layer **124c**. Layers **124a**, **124b**, and **124c** generally define the exterior of section **102a**. Layers **124a**, **124b**, **124c** may include aesthetic materials, such as leather, synthetic leather, or microfiber (as non-limiting layers). In some embodiments, layers **124a** and **124c** include leather and layer **124b** includes microfiber.

Section **102a** may also include relatively rigid layers, as compared to layers **124a**, **124c**, and **124c**. For example,

section **102a** may include a structural layer **126**, or filler, designed to provide structural support. Structural layer **126** may include a flexible but durable material, such as thermoplastic polyurethane (“TPU”), as a non-limiting example. Further, section **102a** may include a shunt **128** formed from a metal or other material designed to absorb a magnetic field generated from, for example, a magnet external to accessory device **100** (shown in FIG. **1**). As a result, shunt **128** can protect personal items, such as credit cards and hotel cards, from damage. As shown, structural layer **126** includes a cut out (not labeled) with a size and shape corresponding to that of shunt **128**. In this manner, structural layer **126** and shunt **128** may be co-planar when assembled. In order to secure structural layer **126** and shunt **128**, section **102a** includes an adhesive layer **130a** to secure structural layer **126** and shunt **128** to layer **124a**, and an adhesive layer **130b** to secure structural layer **126** and shunt **128** to layers **124b** and **124c**. It should be noted that several layers include openings, and thus define, in part, openings **108a** and **108b** (shown in FIG. **1**).

FIG. **5** illustrates an exploded view of section **102b** of accessory device **100**, showing several features of section **102b**. As shown, section **102b** includes a layer **132a**, a layer **132b**, a layer **132c**, and a layer **132d**. Layers **132a**, **132b**, **132c**, and **132d** generally define the exterior of section **102b**. Layers **132a**, **132b**, **132c**, and **132d** may include aesthetic materials, such as leather, synthetic leather, or microfiber (as non-limiting layers). In some embodiments, layers **132a** and **132c** include microfiber, and layers **132b** and **132d** include leather.

Section **102b** may also include relatively rigid layers, as compared to layers **132a**, **132b**, **132c** and **132d**. For example, section **102b** may include a structural layer **134**, or filler, designed to provide structural support. Structural layer **134** may include a flexible but durable material, such as TPU, as a non-limiting example. Further, section **102b** may include a shunt **136** formed from a metal or other material designed to absorb a magnetic field from, for example, a portable electronic device or magnet **116** (shown in FIG. **2**). As a result, shunt **136** can protect personal items, such as credit cards and hotel cards, from damage. As shown, structural layer **134** includes a cut out (not labeled) with a size and shape corresponding to a region of shunt **136**. In this manner, structural layer **134** and shunt **136** may be co-planar when assembled. In order to secure structural layer **134** and shunt **136**, section **102b** includes an adhesive layer **130c** to secure structural layer **134** and shunt **136** to layers **132a** and **132b**, and an adhesive layer **130d** to secure structural layer **134** and shunt **136** to layers **132c** and **132d**. It should be noted that several layers include openings, and thus define, in part, openings **108a** and **108b** (shown in FIG. **1**).

FIG. **6** illustrates an exploded view of section **102c** of accessory device **100**, showing several features of section **102c**. As shown, section **102c** includes a layer **138a**, a layer **138b**, a layer **138c**, and a layer **138d**. Layers **138a**, **138b**, **138c**, and **138d** generally define the exterior of section **102c**. Layers **138a**, **138b**, **138c**, and **138d** may include aesthetic materials, such as leather, synthetic leather, or microfiber (as non-limiting layers). In some embodiments, layers **138a** and **138c** include microfiber, and layers **138b** and **138d** include leather.

Section **102c** may also include relatively rigid layers, as compared to layers **138a**, **138b**, **138c** and **138d**. For example, section **102c** may include a structural layer **140** (also referred to as a stiffening layer or a filler) designed to provide structural support. Structural layer **140** may include a flexible but durable material, such as TPU, as a non-

limiting example. Further, structural layer **140** may include several variations, which will be shown and described below. Moreover, structural layer **140** may represent an assembly of two or more layers. As shown, structural layer **140** may include several openings, such as an opening **142a**. Opening **142a** is designed to receive magnet **116** as well as a wireless communication circuit **144**. Structural layer **140** may include a thickness equal to or greater than that of the combination of magnet **116**, and may include a thickness equal to or greater than that of wireless communication circuit **144**.

In addition to magnetically coupling with, and aligning, an external inductive charging mechanism, magnet **116** can be used as a triggering magnet that initiates an information transfer, or read, event of wireless communication circuit **144** by the portable electronic device. In this regard, magnet **116** can generate a unique magnetic field vector that can be detected by a portable electronic device (not shown in FIG. **6**). Moreover, the unique magnetic field vector can be distinguished, by the portable electronic device, from other magnets. As a result, accessory device **100**, which carries magnet **116**, can be uniquely identified by a portable electronic device. As an optional alternative, structural layer **140** may include an opening **142b** that receives a magnet **145** used as a triggering magnet.

Wireless communication circuit **144** may include a near-field communication (“NFC”) circuit, as a non-limiting exemplary circuit. Wireless communication circuit **144** is designed to transmit information to the portable electronic device. For example, wireless communication circuit **144** may transmit information related to accessory device **100**, such as a serial number or a code used by the electronic device to identify accessory device **100** and subsequently obtain information related to accessory device **100**, such as the size, shape, and/or location of openings **108a** and **108b** (shown in FIG. **1**). In this manner, when the portable electronic device is positioned in accessory device **100**, the portable electronic device can present visual information on the display in a location corresponding the location of opening **108a**. Furthermore, due in part to the portable electronic device having information related to the size, shape and location of opening **108a**, the portable electronic device can present visual information on the display that is within a perimeter defined by opening **108a**. Also, the portable electronic device, having information related to the size, shape, and location of opening **108b**, can determine which input and output mechanisms (e.g., camera(s), sensor(s), and/or audio speaker(s)) can be used while the portable electronic device is positioned in accessory device **100**. In other words, the portable electronic device can determine whether any input and output mechanisms are covered by accessory device **100**.

Section **102c** may further include a capping layer **146**, or cap, designed to provide additional support and rigidity to structural layer **140**. Further, section **102c** may include a reinforcement layer **148** designed to provide additional support to protrusion **114** (shown in FIG. **2**). Further, in order to secure structural layer **140** (and features positioned with openings **142a** and **142b** of structural layer **140**), section **102c** includes an adhesive layer **130e** to secure structural layer **140** to layers **138a** and **138b**. Also, an adhesive layer **130f** can secure structural layer **140** to capping layer **146**. Further, an adhesive layer **130g** can secure capping layer **146** to layers **138c** and **138d**, as well as to reinforcement layer **148**. It should be noted that several layers include openings and protruding features, and thus

define opening **111** (shown in FIG. 1) and protrusion **114** (shown in FIG. 2), respectively.

FIG. 7 illustrates a plan view of accessory device **100**, showing a reinforcement feature **150** surrounding opening **111**. As shown in the enlarged view, reinforcement feature **150** is embedded in section **102c** and is positioned around a perimeter of opening **111**. Reinforcement feature **150** is designed to protect section **102c** against breaking or ripping at, or near, opening **111** when a force is applied to opening **111**. For example, when strap **110** is secured with accessory device **100** using opening **111**, a user may pull on strap **110**, thereby causing a force to opening **111** capable of tearing section **102c**. However, reinforcement feature **150** can protect the integrity of opening **111** against such a force.

In some embodiments, reinforcement feature **150** includes a strand of material wrapped/looped several times around opening **111**. Further, in some embodiments, reinforcement feature **150** is integrated with section **102c**. For example, reinforcement feature **150** may be integrated with structural layer **140** (shown in FIG. 6) by a lamination process. Also, in some embodiments, reinforcement feature **150** is formed from a synthetic fiber spun from liquid-crystal polymer. Other materials are possible. For instance, in some embodiments, reinforcement feature **150** is formed from a metal ring.

Accessory device **100**, and other accessory devices described herein, are designed for use with portable electronic devices. FIGS. 8 and 9 show and describe an electronic device **160** with which accessory device **100** can be used.

FIG. 8 illustrates a plan view of electronic device **160** suitable for use with accessory devices described herein. Electronic device **160** may include a smartphone or a tablet computing device, as non-limiting examples. As shown, electronic device **160** includes a housing **162**, or enclosure, and a display **164** coupled with housing **162**. Display **164**, which may include a display commonly known in the art for mobile device displays, is designed to present visual information **166**. As shown, visual information **166** includes date and time information. However, visual information **166** may include a variety of other textual information, as well as still images and/or motion (video) images.

Additionally, electronic device **160** may include a camera **168** designed to capture images that are external to electronic device **160**. Electronic device **160** may further include a light sensor **170** designed to detect and determine light intensity, and provide light intensity to processing circuitry (not shown in FIG. 8) of electronic device **160**, which can be used to, for example, determine whether display **164** is covered and subsequently whether to deactivate display **164**. Also, electronic device **160** may include an audio speaker **172** designed to emit acoustical energy in the form of audible sound. Camera **168**, light sensor **170**, and audio speaker **172** are exemplary input and output mechanisms of electronic device, and the number (and order/position) of these mechanisms may vary in other embodiments.

FIG. 9 illustrates an alternate plan view of electronic device **160** shown in FIG. 8, showing additional features of electronic device **160**. The back/rear side of electronic device **160** is shown. At this location, electronic device **160** may include a protruding feature **174** in which several features are located. For instance, at protruding feature **174**, electronic device **160** may include a camera **176a** and camera **176b**. Although cameras **176a** and **176b** are shown, the number of cameras may vary. Additionally, electronic device **160** may include light source **178**, which may include

a flash light source, that provides additional light during an image capturing event by camera **176a** or camera **176b**.

FIG. 10 illustrates a schematic view of accessory device **100** and electronic device **160**, in accordance with some described embodiments. Accessory device **100**, as well as other accessory devices described herein, includes features designed to communicate and provide information to electronic device **160**. For example, accessory device **100** includes wireless communication circuit **144** that can transmit information to electronic device **160**. The information transmitted by wireless communication circuit **144** may include, for example, a serial number or model number that defines a unique identifier of accessory device **100**. As a result, electronic device **160** can determine the size, shape, and location of the openings (e.g., openings **108a** and **108b**, shown in FIG. 1) of accessory device **100**, as well as the thickness and material makeup of section **102c** (shown in FIG. 1) of accessory device **100**. Alternatively, the information transmitted by wireless communication circuit **144** may include the information related to the size, shape, and location of the openings (e.g., openings **108a** and **108b**) of accessory device **100**, as well as the thickness and material makeup of section **102c** of accessory device **100**. In other words, the identifier information may not be required when the characteristics of accessory device **100** are directly transmitted.

The information transmitted by wireless communication circuit **144** can be received by wireless communication circuit **184** located in electronic device **160**. In some embodiments, wireless communication circuit **144** and wireless communication circuit **184** each include NFC circuitry, which includes memory and an antenna for transmission/receiving capabilities of information stored on the memory. In some embodiments (not shown in FIG. 10), accessory device **100** includes a memory circuit that stores the aforementioned information, and is accessible by wireless communication circuit **144**. Wireless communication circuit **144** and wireless communication circuit **184** may each represent other forms of communication circuitry, such as BLUETOOTH® circuitry.

When accessory device **100** and electronic device **160** are within sufficient proximity to each other (e.g., when electronic device **160** is positioned/disposed within accessory device **100**), wireless communication circuit **144** and wireless communication circuit **184** can exchange information through an authentication protocol, or “handshake,” to determine whether accessory device **100** can transmit information to electronic device **160**. Subsequent confirming authentication, wireless communication circuit **144** can transmit the aforementioned information related to accessory device **100**. Wireless communication circuit **184** can provide the information to processing circuitry **186** (representing at central processing unit, or CPU, and graphics processing unit, or GPU) of electronic device **160**.

Processing circuitry **186** can access memory **188** of electronic device **160** and find the identification information on a look-up table, for example, associated with various accessory devices. Once the identification is matched with accessory device **100**, processing circuitry **186** can subsequently receive characteristics and features (stored on memory **188**) of accessory device **100**. Alternatively, processing circuitry **186** can send the identification information to a remote location, such as a server (including a cloud-based storage network) to retrieve information related to accessory device **100**. Also, in some embodiments, wireless communication circuit **184** of electronic device **160** receives, directly from wireless communication circuit **144**,

11

information related to the size, shape, and location of the openings (e.g., openings **108a** and **108b**, shown in FIG. 1), and the thickness and material makeup of section **102c** (shown in FIG. 1) of accessory device **100**, and accordingly.

When processing circuitry **186** determines the characteristics and features of accessory device **100**, electronic device **160** can operate in a manner consistent with the characteristics and features of accessory device **100**. For example, processing circuitry **186** can receive information related to opening **108a** (shown in FIG. 1), including the size, shape, and location of opening **108a**. As a result, processing circuitry **186** can instruct display **164** to present visual information **166** in a location corresponding to opening **108a**, as the remaining region of display **164** may be covered by accessory device **100**. Moreover, the instructions provided by processing circuitry **186** can prompt display **164** to change the size of visual information **166** (e.g., smaller font size) to ensure visual information **166** is fully viewable through opening **108a** and not obstructed by accessory device **100**. This will be exemplified below.

Electronic device **160** can modify additional operations when electronic device **160** determines/identifies accessory device **100**, including characteristics and features of accessory device **100**. For example, once accessory device **100** is identified by electronic device **160**, electronic device **160** receives information that accessory device **100** includes magnet **116**. Moreover, electronic device **160** receives information related to thickness and material(s) that define section **102c** (shown in FIG. 2) of accessory device **100**. In this manner, during a wireless (inductive) charging event, processing circuitry **186** can more reliably and accurately estimate the charging time for an inductive charging module **192** (that includes an inductive receiving coil) of electronic device **160** to complete a charge of a battery **190** of electronic device **160**. As a result, the user does not need to remove electronic device **160** from accessory device **100** to perform a wireless charge of battery **190**, and can receive, from electronic device **160**, reliable estimated time to charge battery **190**.

Additionally, electronic device **160** can also determine/identify opening **108b** (shown in FIG. 1), including the size, shape, and location of opening **108b**. As a result, processing circuitry **186** can determine whether camera **168**, light sensor **170**, and/or audio speaker **172** are uncovered/unobstructed by accessory device **100**, based characteristics of opening **108b**, and subsequently maintain camera **168**, light sensor **170**, and/or audio speaker **172** in an active/operational mode (when uncovered by accessory device **100**) or in an inactive mode (when covered by accessory device **100**). Accordingly, the transmission of information by accessory device **100** to electronic device **160** allows for considerable functionality of electronic device **160** even when electronic device **160** is positioned/disposed in accessory device **100**.

FIG. 11 illustrates a plan view of electronic device **160** positioned within accessory device **100**. In this exemplary illustration, it should be noted that electronic device **160** and accessory device **100** have completed authentication and transmitted/received information through their respective wireless communication circuitry, shown and described in FIG. 10. In this regard, electronic device **160** can operate in accordance with information related to accessory device **100**. For example, visual information **166** presented on display **164** can be adjusted, i.e., relocated (i.e., presented via different pixels of display **164**) from an original position on display **164**, shown in FIG. 8 (represented by a box **155** in FIG. 11), to a location corresponding to opening **108a** of accessory device **100**. Moreover, if needed, visual informa-

12

tion **166** can further adjusted to fit within a perimeter defined by opening **108a**. For example, when visual information **166** includes textual information, the font size of the textual information can be reduced such that visual information **166** is fully within the perimeter of opening **108a**. Additionally, electronic device **160** can maintain camera **168**, light sensor **170**, and audio speaker **172** in an active/operational mode, as these devices are rendered uncovered by accessory device **100** based on opening **108b**.

While electronic device **160** obtains information related to openings **108a** and **108b**, electronic device **160** should be positioned/disposed in accessory device **100** in a consistent manner to ensure, for example, visual information **166** is consistently within the perimeter of opening **108a**. In this regard, accessory device **100** can rely upon additional structural components to ensure alignment consistency. For example, accessory device **100** includes collar **120** (also shown in FIG. 3) that wraps around multiple sides of electronic device **160**. When electronic device **160** is inserted into accessory device **100** and engaged with collar **120** (or at least aligned within accessory device **100** based on collar **120**), electronic device **160** can consistently and reliably present visual information **166** within the perimeter of opening **108a**, while camera **168**, light sensor **170**, and audio speaker **172** are also positioned consistently and reliably within the perimeter of opening **108b**.

FIG. 12 illustrates a side view of accessory device **100**. As shown, accessory device **100** is oriented upside down. Sections **102a** and **102b** combine to define pocket **104a**, while sections **102b** and **102c** combine to define pocket **104b**. Also, structural layer **140** is shown embedded in section **102c**, with magnet **116** (shown as a cross section) embedded in structural layer **140**.

Accessory device **100** is designed to receive multiple items. For example, FIG. 13 illustrates a side view of accessory device **100** shown in FIG. 12, showing accessory device **100** carrying several objects. For example, accessory device **100** can carry an object **157** (representing one or more items, such as credit cards, hotel cards, cash, etc.) in pocket **104a**, as well as electronic device **160** in pocket **104b**. Also, in order to receive object **157**, sections **102a** and **102b** can be moved apart to increase the volume defined by pocket **104a**, and sections **102b** and **102c** can be moved apart to increase the volume defined by pocket **104b**. Regarding the latter, when section **102c** is stretched, expanded, or otherwise displaced by the insertion of electronic device **160** into pocket **104b**, structural layer **140** is designed to maintain section **102c** in a flat/planar manner. For example, as shown, section **102c** is flat, having an inner and outer surfaces that are generally parallel with respect to a back surface of electronic device **160**, with the “back surface” referring to a surface opposite display **164** of electronic device **160**. Also, the inner surface of section **102c** can engage the back surface of electronic device **160**. Moreover, both structural layer **140** and capping layer **146** (shown in FIG. 6) can be parallel with respect to section **102b** when electronic device **160** is positioned in pocket **104b**.

By maintaining section **102c** in a flat/planar configuration, the likelihood of gaps or spaces between section **102c** and electronic device **160** is significantly decreased. For example, as shown in FIG. 13, the back surface of electronic device **160** engages an inner surface section **102c** such that virtually no space or gap exists between electronic device **160** and section **102c**. As a result, when an inductive charging mechanism **159** (used to charge battery **190** of electronic device **160**) is placed on section **102c**, inductive

13

charging mechanism 159 is separated from electronic device 160 only by a dimension 345, related to a thickness of section 102c, and the charging efficiency increases as relatively little or no air gaps exist between inductive charging mechanism 159 and electronic device 160. Also, the desired flat/planar configuration of section 102c is further supported by protrusion 114 that extends from section 102c, as protrusion 114 can receive protruding feature 174 (shown in FIG. 9) of electronic device 160.

To further increase charging efficiency, magnet 116 is embedded in structural layer 140 in a location corresponding to the location of inductive charging module 192 of electronic device 160. In this manner, an inductive transmitting coil of inductive charging mechanism 159 is positioned directly over, or aligned along the Z-axis (of Cartesian coordinates), with respect to an inductive receiving coil of inductive charging module 192. As a result, the induced magnetic field provided by inductive charging mechanism 159 is received by inductive charging module 192 as directly as possible while electronic device 160 is positioned in accessory device 100.

FIGS. 14-17 show and describe additional modifications and/or alternate features of a structural layer can be embedded in section 102c of accessory device 100. In other words, the structural layers shown and described in FIGS. 14-17 can substitute or modify structural layer 140 and capping layer 146 (both shown in FIG. 6), while also providing similar or enhanced benefits to accessory device 100.

FIG. 14 illustrates an isometric view of an alternate embodiment of a structural layer 340, showing structural layer 340 having multiple materials. As shown, structural layer 340 includes a material 342a and a material 342b that surrounds material 342a. Material 342a may include a relatively rigid material, as compared to the rigidity of material 342b. In other words, material 342a may include a hardness that is greater than the hardness of material 342b. For example, in some embodiments, material 342a includes a polycarbonate ("PC") or PC-TPU combination, and material 342b includes TPU, including a relatively soft TPU. As a result, material 342a can provide sufficient rigidity, thereby maintain section 102c (shown in FIG. 3) in a flat/planar configuration when electronic device 160 is positioned in accessory device 100 (as shown in FIG. 13), while material 342b, representing the sides or perimeter of structural layer 340, can flex or bend to some degree and still maintain some integrity of section 102c along the perimeter of section 102c. Also, material 342b can include a protruding feature 314 that defines in part protrusion 114 (shown in FIG. 2).

FIG. 15 illustrates a cross sectional view of the structural layer 340 shown in FIG. 14, taken along line 15-15, showing additional features of structural layer 340. As material 342a transitions to material 342b (or vice versa), structural layer 340 maintains a dimension 345, or thickness, that is consistent, despite the diagonal border defined by each of materials 342a and 342b. In some embodiments, dimension 345 is approximately in the range of 0.3 to 0.5 millimeters ("mm"). However, as material 342b extends toward an edge (and away from material 342a), material 342b decreases, based on a tapered edge 343, to a point that may be approximately in the range of 0.05 to 0.15 mm. Tapered edge 343 of material 342b may increase the overall flexibility of structural layer 340 (at a location corresponding to material 342b).

FIG. 16 illustrates an isometric view of an alternate embodiment of a structural layer 440, showing structural layer 440 having multiple embedded materials. As shown,

14

structural layer 440 includes a material 442 that generally defines a base layer of structural layer 440. Material 442 may include a synthetic rubber, such as nitrile rubber ("NBR"), as a non-limiting example. In some embodiments, material 442 is formed from a moldable material. In this manner, one or more materials can be molded into material 442 by a molding operation, including compression molding. For example, structural layer 440 may include a magnet 416, a wireless communication circuit 444, and a reinforcement feature 450 molded to material 442. As a result, structural layer 440 may form a sub-assembly that reduces manufacturing times of an accessory device (not shown in FIG. 15) that integrates structural layer 440, as magnet 416 and reinforcement feature 450 are already assembled in structural layer 440. Also, in some embodiments, reinforcement feature 450 is a metal ring that surrounds an opening 411 of structural layer 440, and provides support against tearing/ripping of structural layer 440 along opening 411. Also, material 442 can include a protruding feature 414 that defines in part protrusion 114 (shown in FIG. 2).

FIG. 17 illustrates an isometric view of an alternate embodiment of a structural layer 540, showing the structural layer 540 having several modular sections. As shown, structural layer 540 includes an assembly 544 and a border 546 surrounding assembly 544. As shown in the enlarged view, assembly 544 may include multiple layers. For example, assembly 544 may include a central layer 548 formed from a relative rigid material, such as PC. Assembly 544 may further include a capping layer 550a and a capping layer 550b surrounding central layer 548. Border 546 may include a less rigid layer, such as TPU (as a non-limiting example). Accordingly, assembly 544 may include a hardness that is greater than the hardness of border 546. Also, structural layer 540 can include a protruding feature 514 that defines in part protrusion 114 (shown in FIG. 2). Also, although not shown, assembly 544 may include a magnet similar to prior embodiments.

FIG. 18 illustrates a side view of an alternate embodiment of an accessory device 500, showing accessory device 500 integrating structural layer 540 shown in FIG. 17. Accessory device 500 may include several features shown and described for accessory device 100 (shown in FIG. 1). In this regard, accessory device 500 may include a section 502a, a section 502b, and a section 502c, with sections 502a, 502b, and 502c defining pockets (not labeled) of accessory device 500. Sections 502a and 502c may define a front section and a back section, respectively, of accessory device 500. As shown in the enlarged view, a partial cross sectional view of section 502c reveals several elements of structural layer 540 integrated with section 502c. As shown, assembly 544 (including central layer 548 and capping layers 550a and 550b) is integrated with section 502c. Further, border 546 is also integrated with section 502c and separated from assembly 544 by a gap 554. As a result, gap 554 further promotes relative movement between assembly 544 and border 546.

The various aspects, embodiments, implementations or features of the described embodiments can be used separately or in any combination. Various aspects of the described embodiments can be implemented by software, hardware or a combination of hardware and software. The described embodiments can also be embodied as computer readable code on a computer readable medium for controlling manufacturing operations or as computer readable code on a computer readable medium for controlling a manufacturing line. The computer readable medium is any data storage device that can store data which can thereafter be read by a computer system. Examples of the computer

15

readable medium include read-only memory, random-access memory, CD-ROMs, HDDs, DVDs, magnetic tape, and optical data storage devices. The computer readable medium can also be distributed over network-coupled computer systems so that the computer readable code is stored and executed in a distributed fashion.

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.

It is well understood that the use of personally identifiable information should follow privacy policies and practices that are generally recognized as meeting or exceeding industry or governmental requirements for maintaining the privacy of users. In particular, personally identifiable information data should be managed and handled so as to minimize risks of unintentional or unauthorized access or use, and the nature of authorized use should be clearly indicated to users.

What is claimed is:

1. An accessory device for a portable electronic device, the accessory device comprising:
 - a first section comprising an opening;
 - a second section coupled with the first section, the first section and the second section defining a first pocket;
 - a third section coupled with the second section, the second section and the third section defining a second pocket configured to receive the portable electronic device; and
 - a wireless communication circuit configured to send information corresponding to the opening to the portable electronic device, wherein:
 - in response to the portable electronic device being disposed in the second pocket, the first section covers a portion of a display of the portable electronic device and the opening defines an uncovered portion of the display.
2. The accessory device of claim 1, wherein the information further corresponds to a thickness of the third section.
3. The accessory device of claim 1, wherein the third section comprises a magnet configured to magnetically couple with an inductive charging mechanism.
4. The accessory device of claim 3, further comprising a structural layer disposed in the third section, wherein the magnet is embedded in the structural layer.
5. The accessory device of claim 4, wherein the third section maintains a planar surface, based on the structural layer, when the portable electronic device is disposed in the second pocket.
6. The accessory device of claim 1, wherein the first pocket is separate from the second pocket.
7. The accessory device of claim 1, further comprising:
 - a first stitch;
 - a second stitch; and
 - an adhesive layer that secures the first section with the second section, wherein the first stitch, the second stitch, and the adhesive layer define the first pocket.
8. The accessory device of claim 1, further comprising a collar disposed between the second section and the third section, the collar configured to align the portable electronic

16

device such that visual information from the portable electronic device is presented through the opening.

9. An accessory device for a portable electronic device, the accessory device comprising:

- a first section comprising an opening;
- a second section covered by the first section, the first section and the second section defining a first pocket; and
- a third section covered by the second section, the second section and the third section defining a second pocket configured to receive the portable electronic device, the second pocket separate from and the first pocket, the third section comprising:
 - a magnet configured to magnetically couple with and align an inductive charging unit that charges the portable electronic device in response to the portable electronic device being disposed in the second pocket, and
 - a wireless communication circuit configured to send information to the portable electronic device, the information comprising a characteristic of the third section.

10. The accessory device of claim 9, wherein the third section comprises a structural layer, and the magnet is embedded in the structural layer.

11. The accessory device of claim 10, wherein the structural layer comprises:

- a first material that defines a first hardness; and
- a second material that defines a second hardness that is less than the first hardness.

12. The accessory device of claim 11, wherein: the first material defines a first diagonal border, the second material defines a second diagonal border, and the first diagonal border engages the second diagonal border.

13. The accessory device of claim 12, wherein the first material comprises a first thickness, and the second material comprises a second thickness that is equal to the first thickness.

14. The accessory device of claim 9, wherein the third section comprises a protrusion configured to receive a camera of the portable electronic device.

15. An accessory device for a portable electronic device, the accessory device comprising:

- a first section comprising a first opening;
- an adhesive layer;
- a second section coupled with the first section by the adhesive layer, the first section, the second section, and the adhesive layer defining a first pocket;
- a third section covered by the second section, the second section and the third section defining a second pocket covered by the first pocket and configured to receive the portable electronic device, the third section comprising:
 - a capping layer, and
 - a structural layer coupled with the capping layer, wherein the third section maintains a planar section, based on the capping layer and the structural layer, when the portable electronic device is located in the second pocket, and
 - a second opening; and
 - a strap passing through the second opening.

16. The accessory device of claim 15, wherein the structural layer comprising:

- a first material that defines a first hardness; and
- a second material that defines a second hardness that is less than the first hardness.

17

- 17. The accessory device of claim 16, wherein the second material surrounds the first material.
- 18. The accessory device of claim 16, wherein the first material is separated from the second material by a gap.
- 19. The accessory device of claim 15, further comprising 5 a magnet embedded in the structural layer.
- 20. The accessory device of claim 19, wherein the magnet comprises a flexible magnet.

* * * * *

18