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Ivanovski et al.

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(54) **MODULAR MOBILE DEVICE CASE**

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(22) Filed: **Nov. 28, 2014**

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Related U.S. Application Data

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(51) **Int. Cl.**

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G06F 1/16	(2006.01)
H05K 7/00	(2006.01)
H04M 1/02	(2006.01)
H04B 1/3816	(2015.01)
H04M 1/18	(2006.01)
H04M 1/725	(2006.01)

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

CPC ***H04M 1/0274*** (2013.01); ***H04B 1/3816*** (2013.01); ***H04B 1/3888*** (2013.01); *H04M 1/185* (2013.01); *H04M 1/72527* (2013.01)

(58) **Field of Classification Search**

USPC 455/414.1, 575.1, 575.8

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,889,498	B2	2/2011	Diebel et al.	
8,390,255	B1 *	3/2013	Fathollahi	H02J 7/0045 206/308.3
8,787,009	B2	7/2014	Wilson et al.	
9,123,935	B2 *	9/2015	Huang	H01M 10/46
2011/0199041	A1 *	8/2011	Yang	H01M 10/46 320/101
2012/0154991	A1	6/2012	Lei	
2013/0052871	A1	2/2013	Eklind	
2014/0143459	A1	5/2014	Yang	

FOREIGN PATENT DOCUMENTS

CN	202444525 U	9/2012
WO	2015022615 A2	2/2015

* cited by examiner

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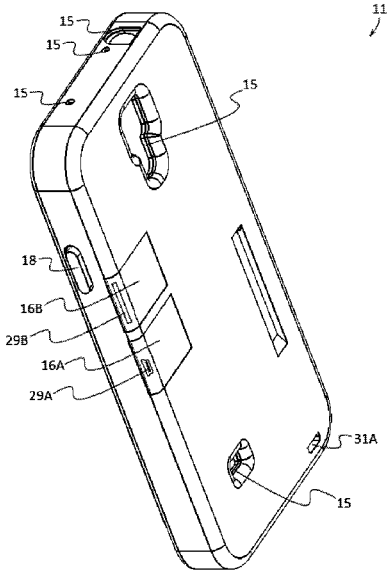
(57) **ABSTRACT**

In preferred embodiments, an expandable and modular protective mobile device case apparatus comprises a protective shell configured to receive a mobile device; a circuit board located within the protective shell said circuit board comprising a USB hub and a mode selection switch, wherein the USB hub is in electrical communication with the mode selection switch; and a male plug member in electrical communication with the mode selection switch and configured to transfer electrical signals from the mode selection switch to the mobile device.

20 Claims, 17 Drawing Sheets



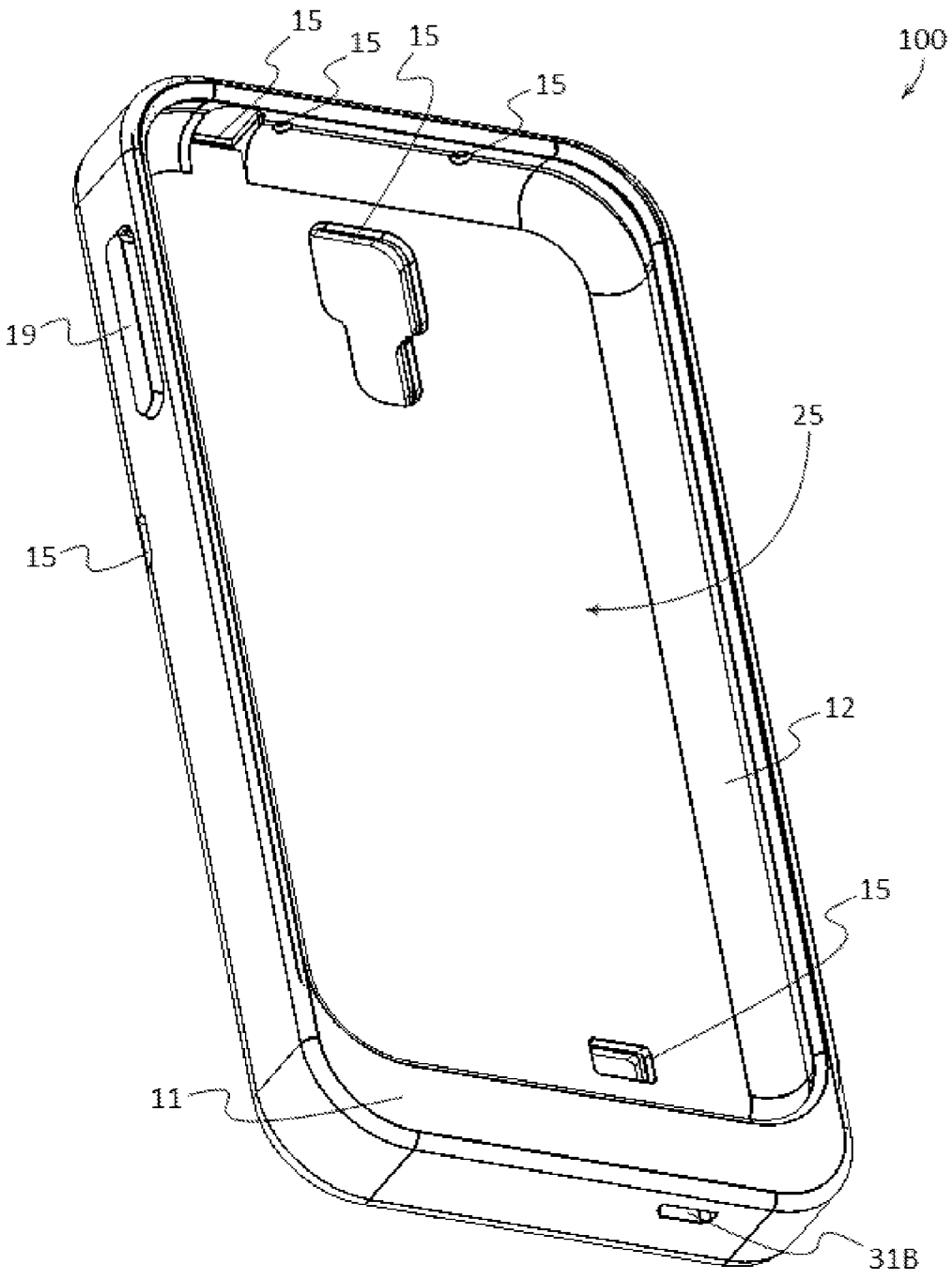


FIG. 1

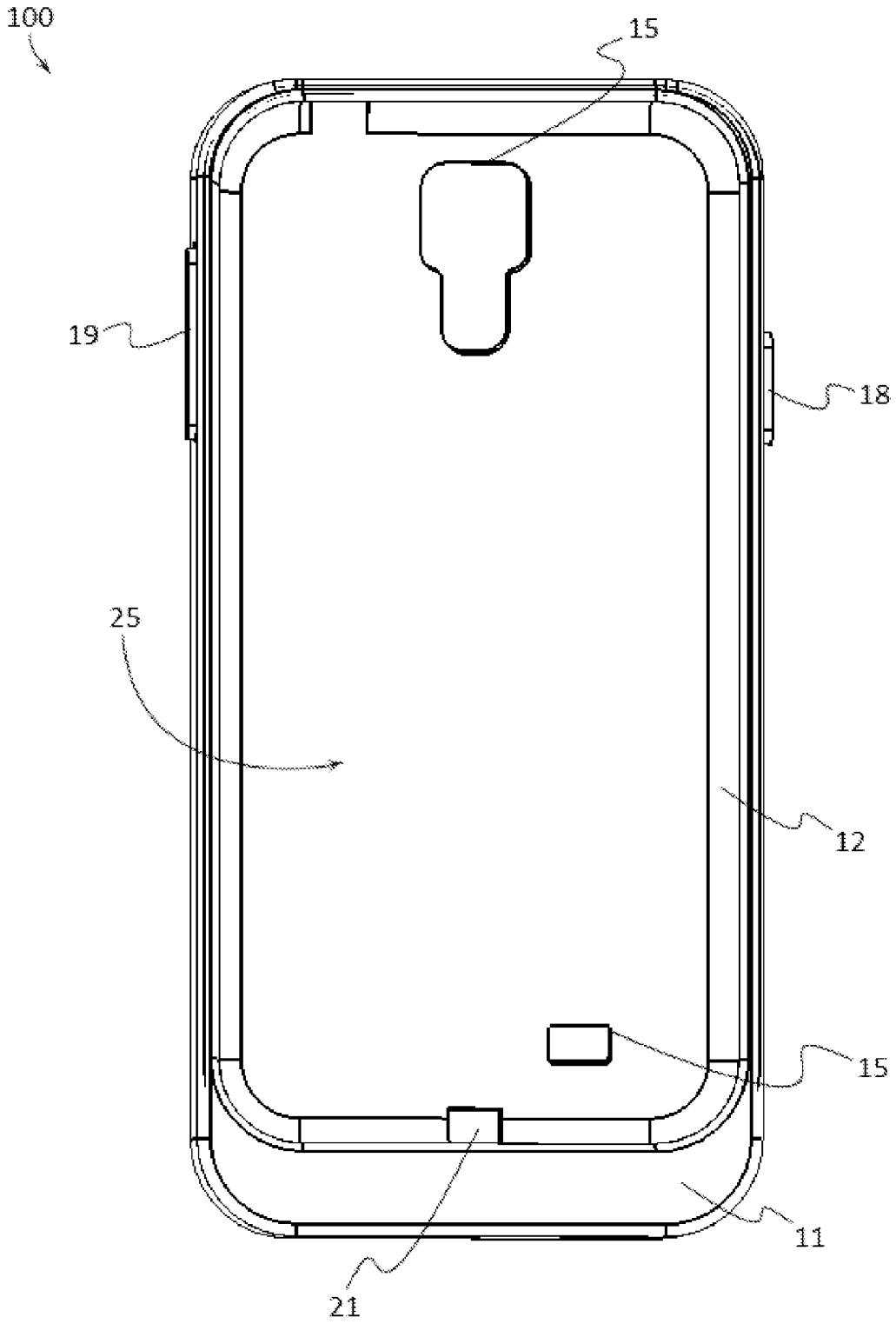


FIG. 2

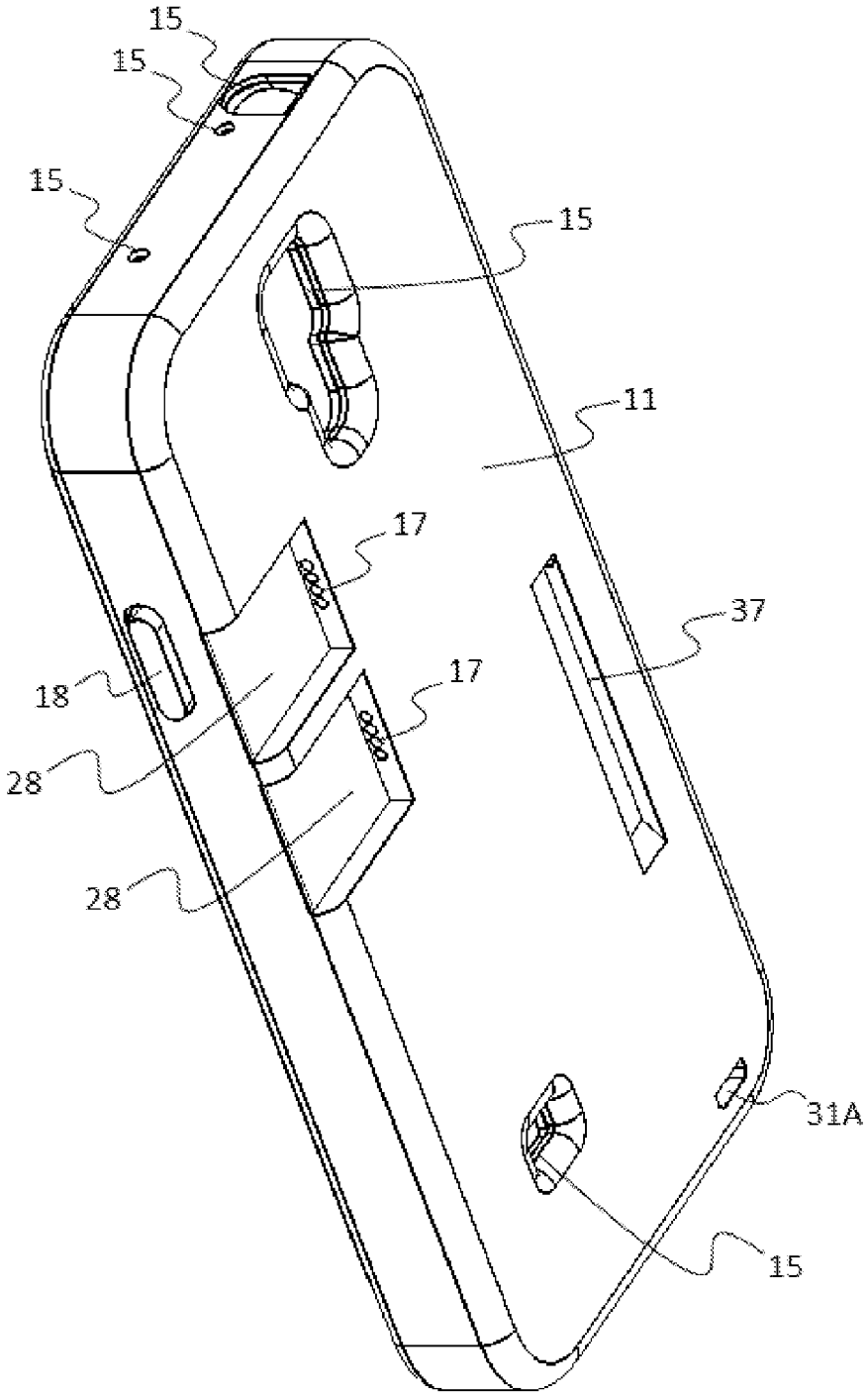


FIG. 3

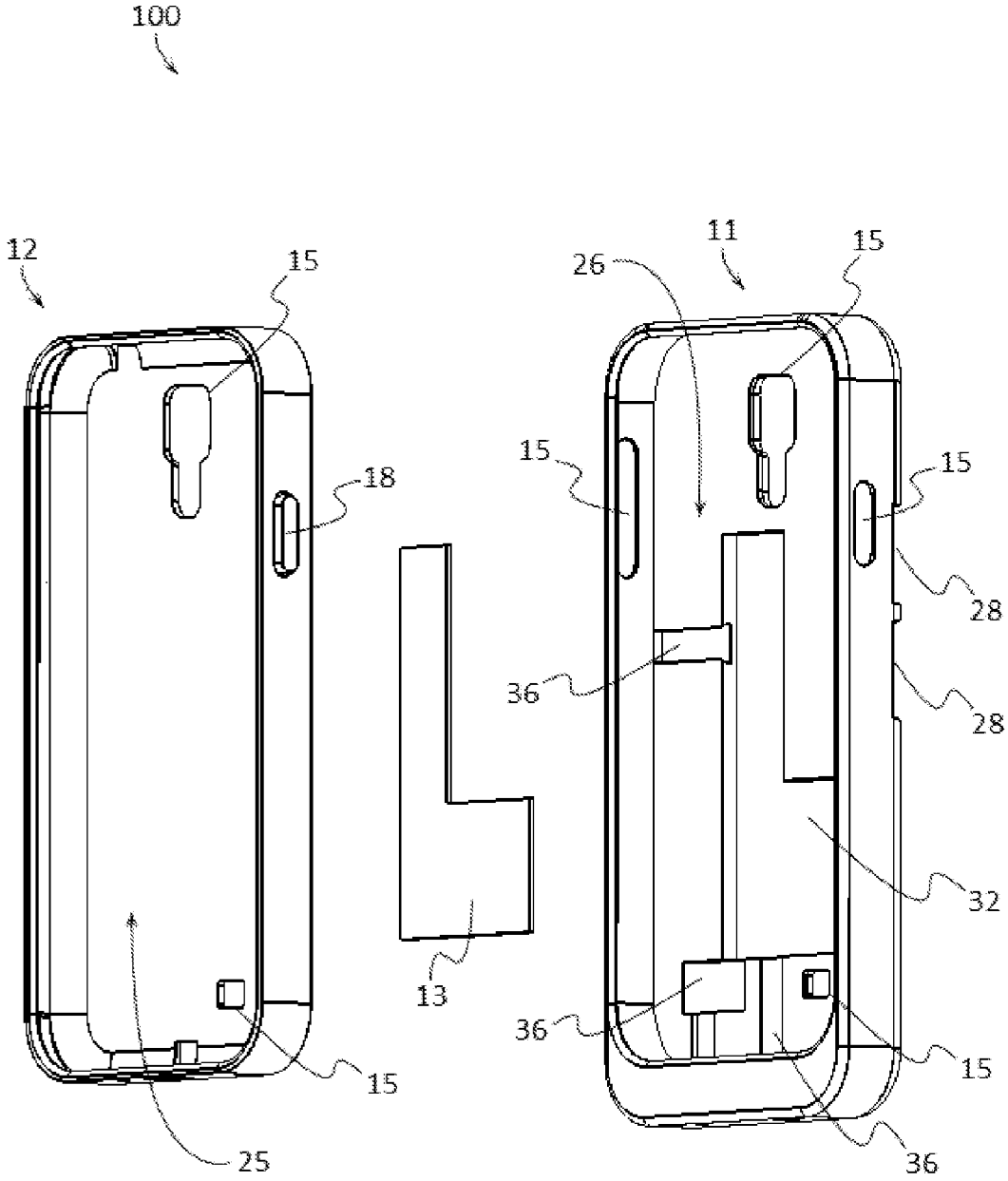


FIG. 4

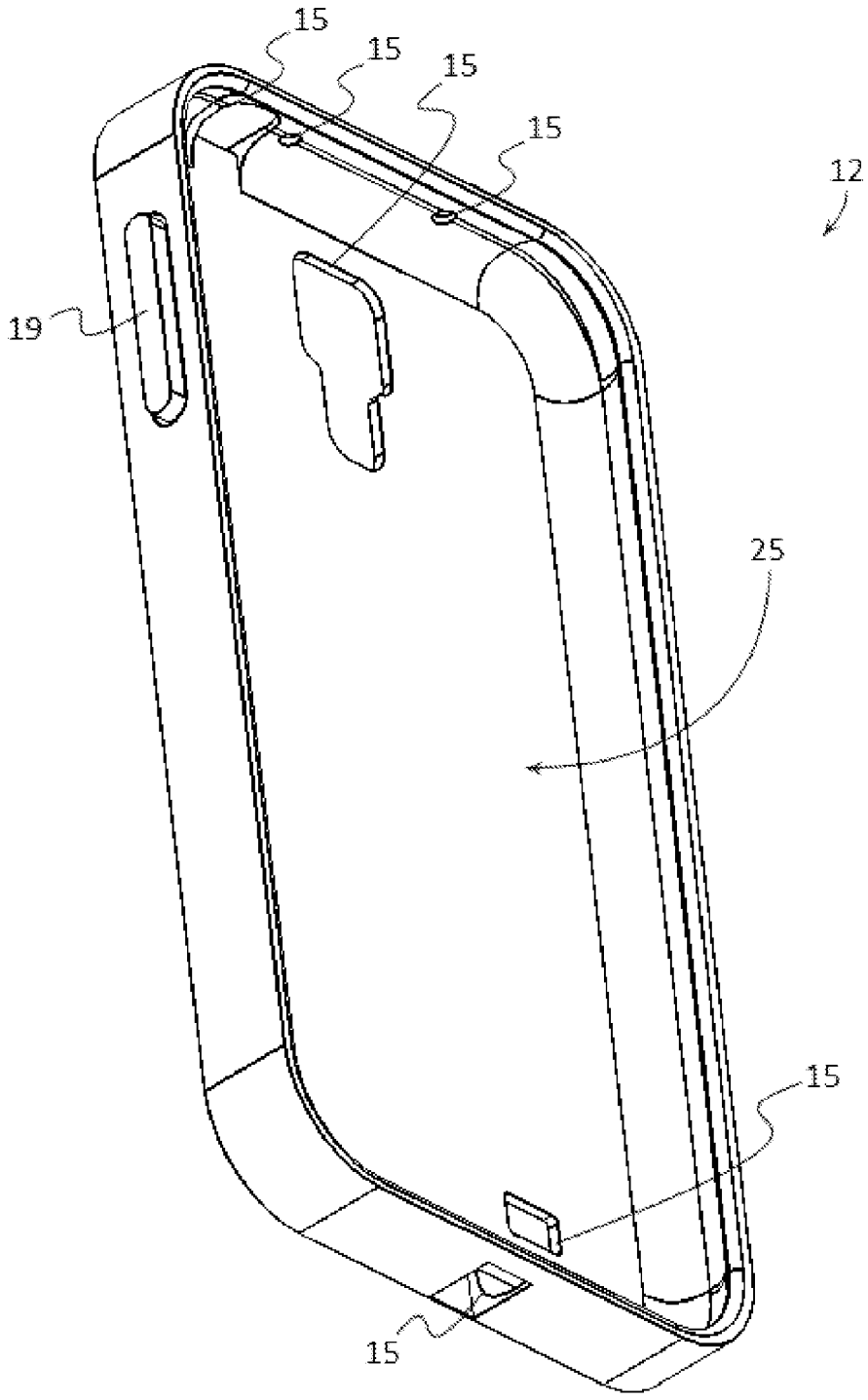


FIG. 5

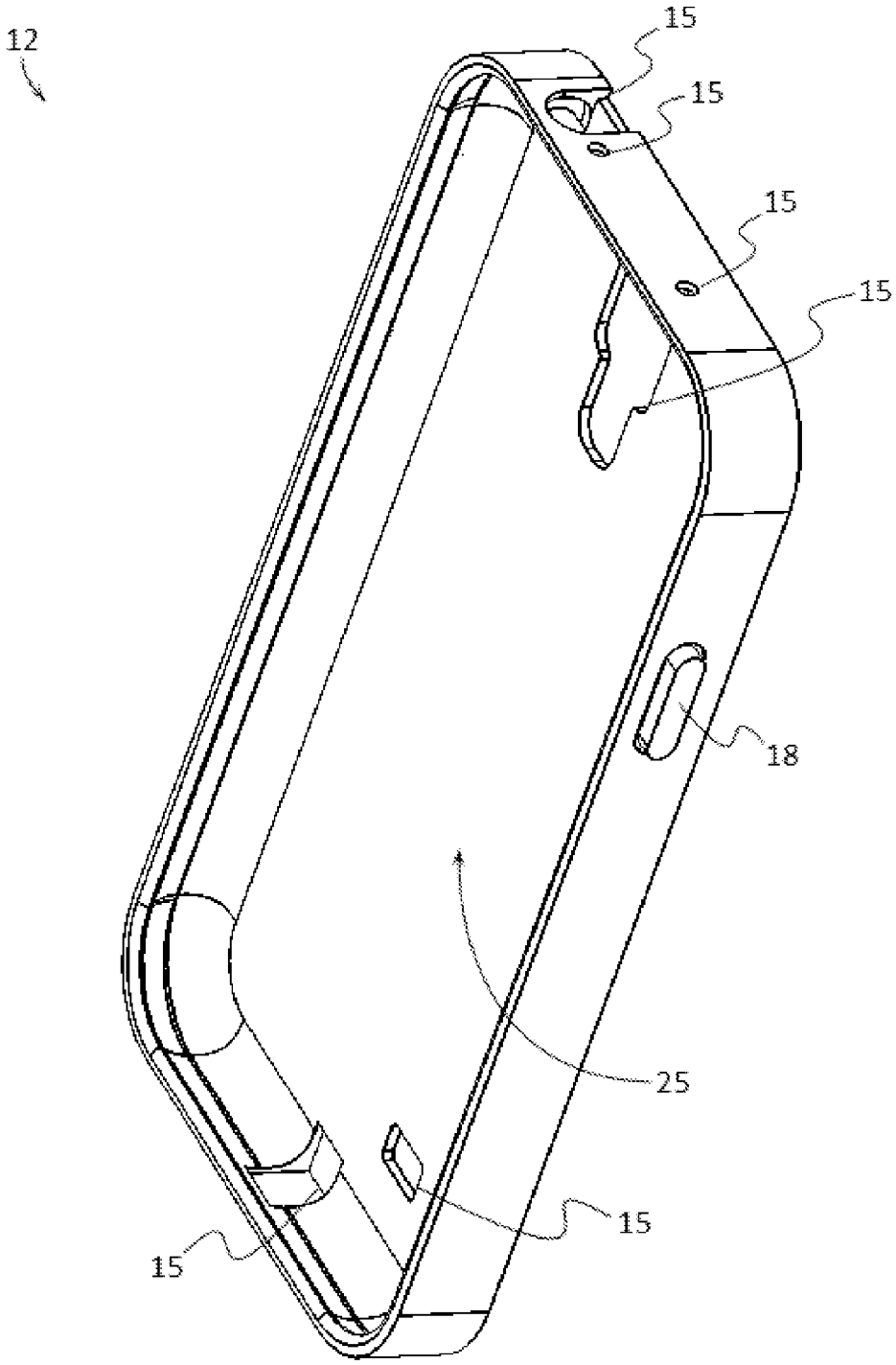


FIG. 6

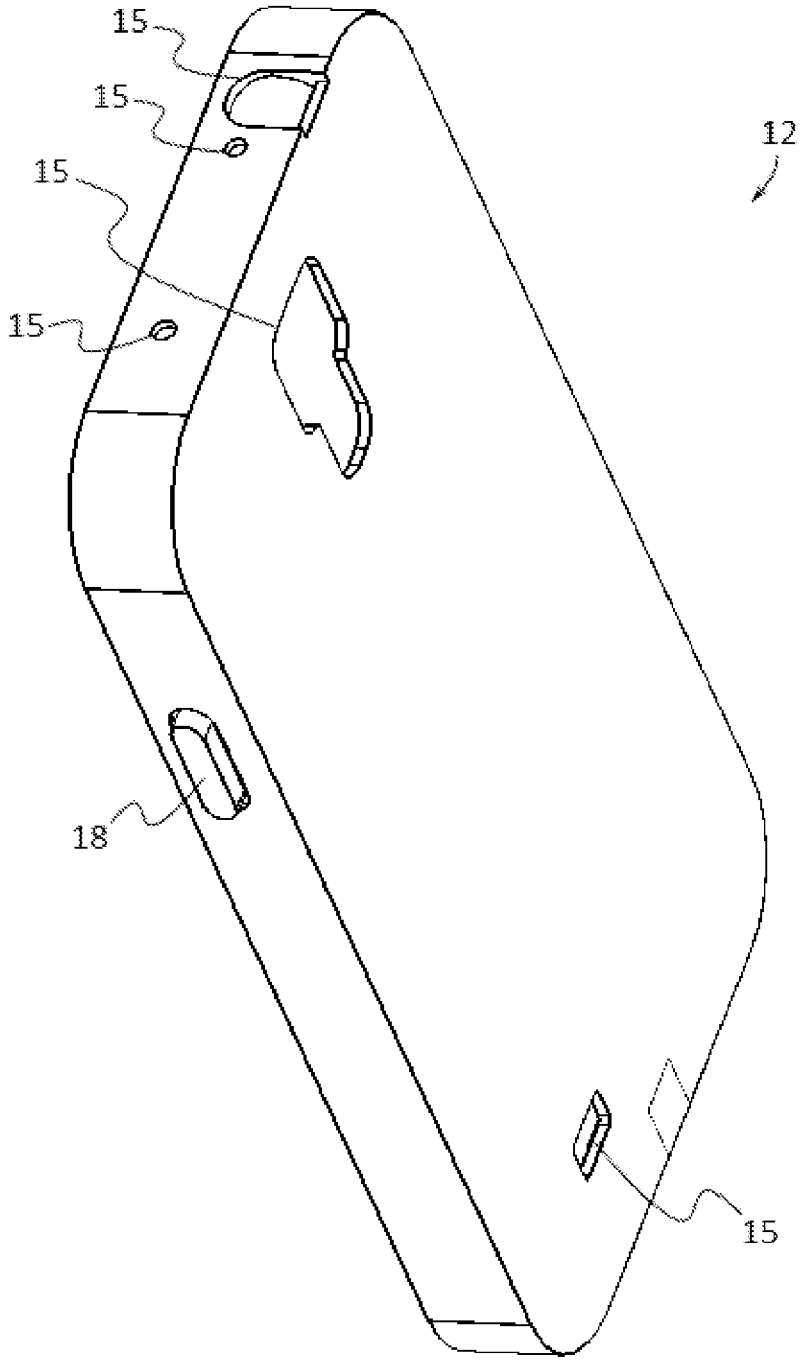


FIG. 7

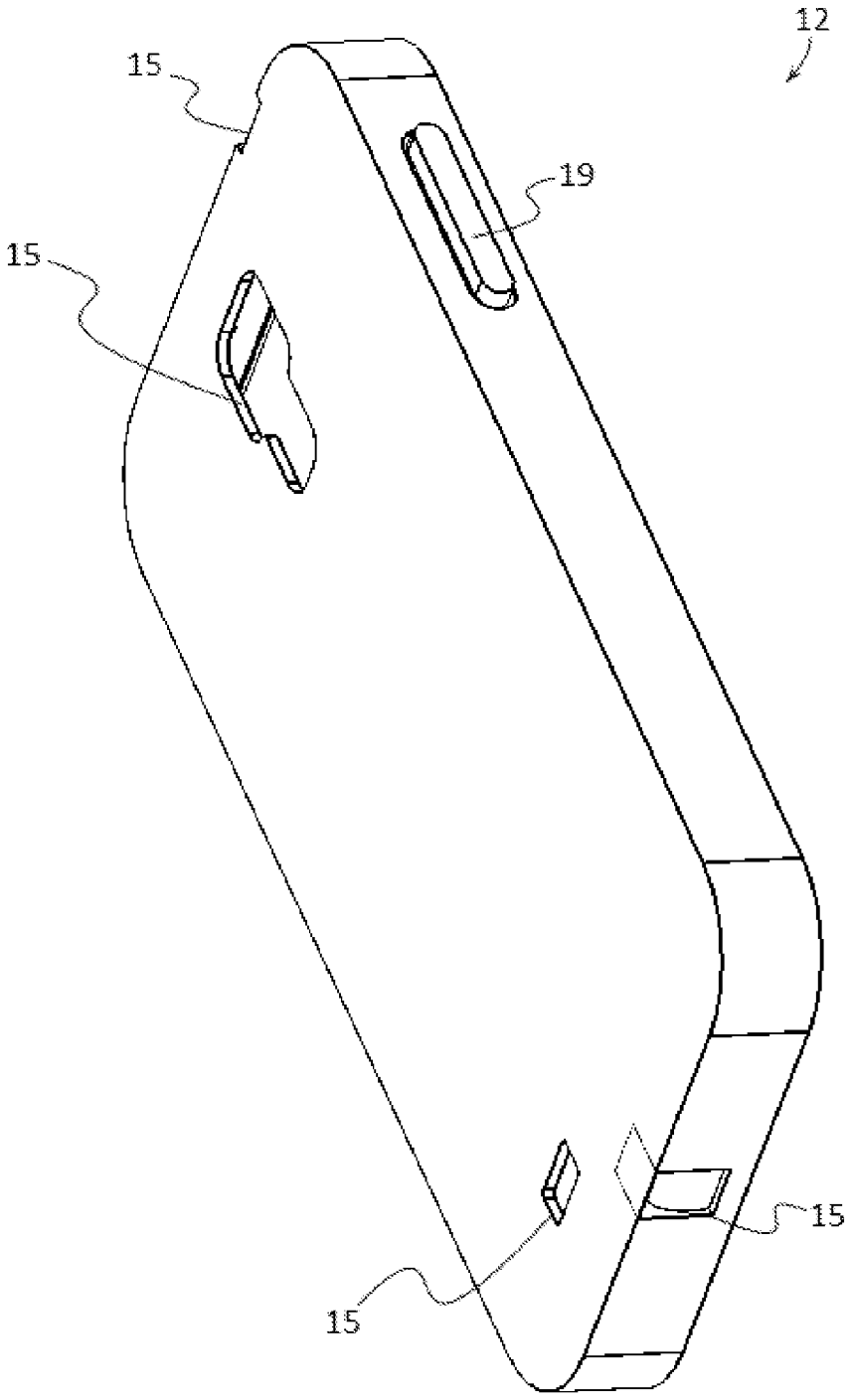


FIG. 8

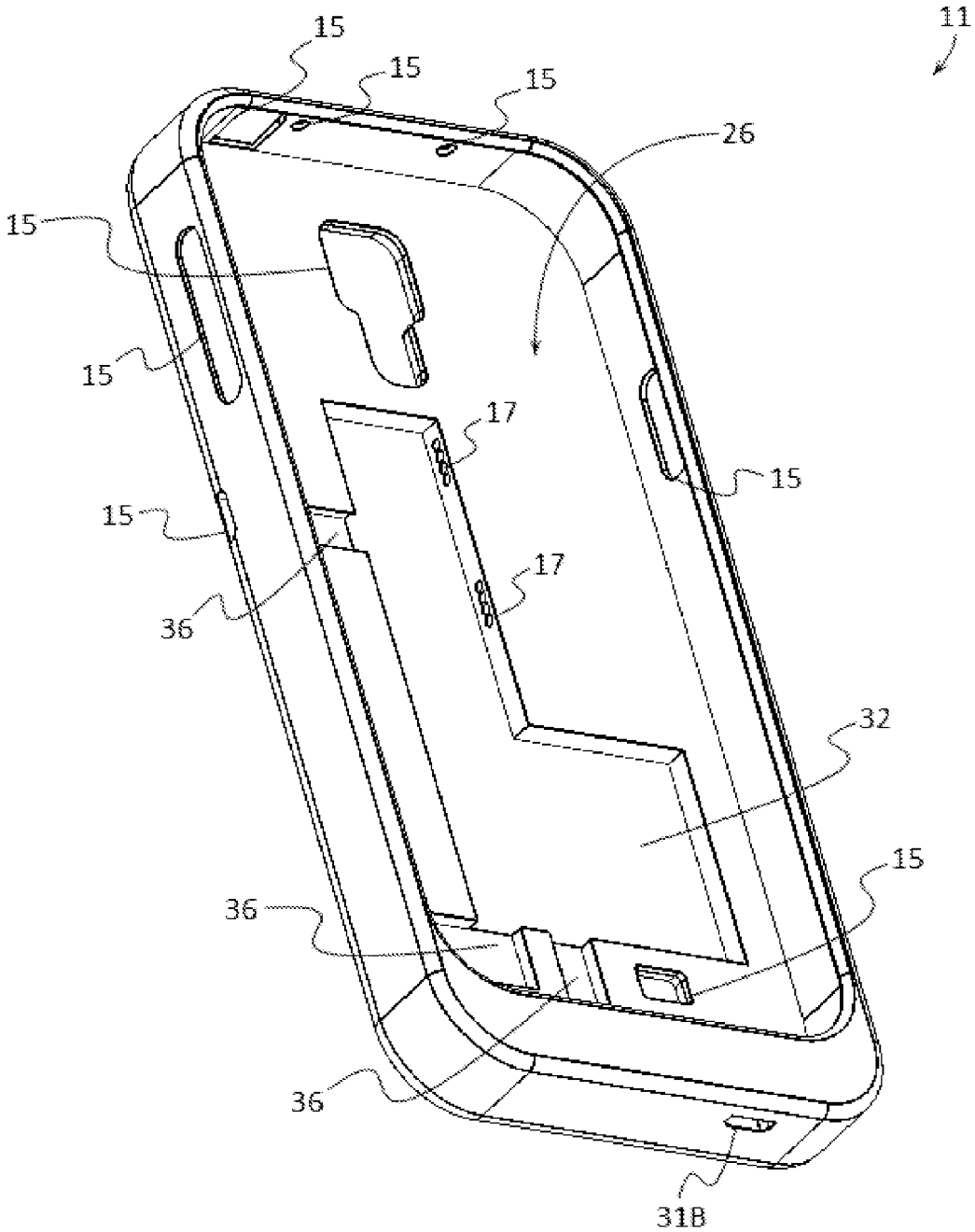


FIG. 9

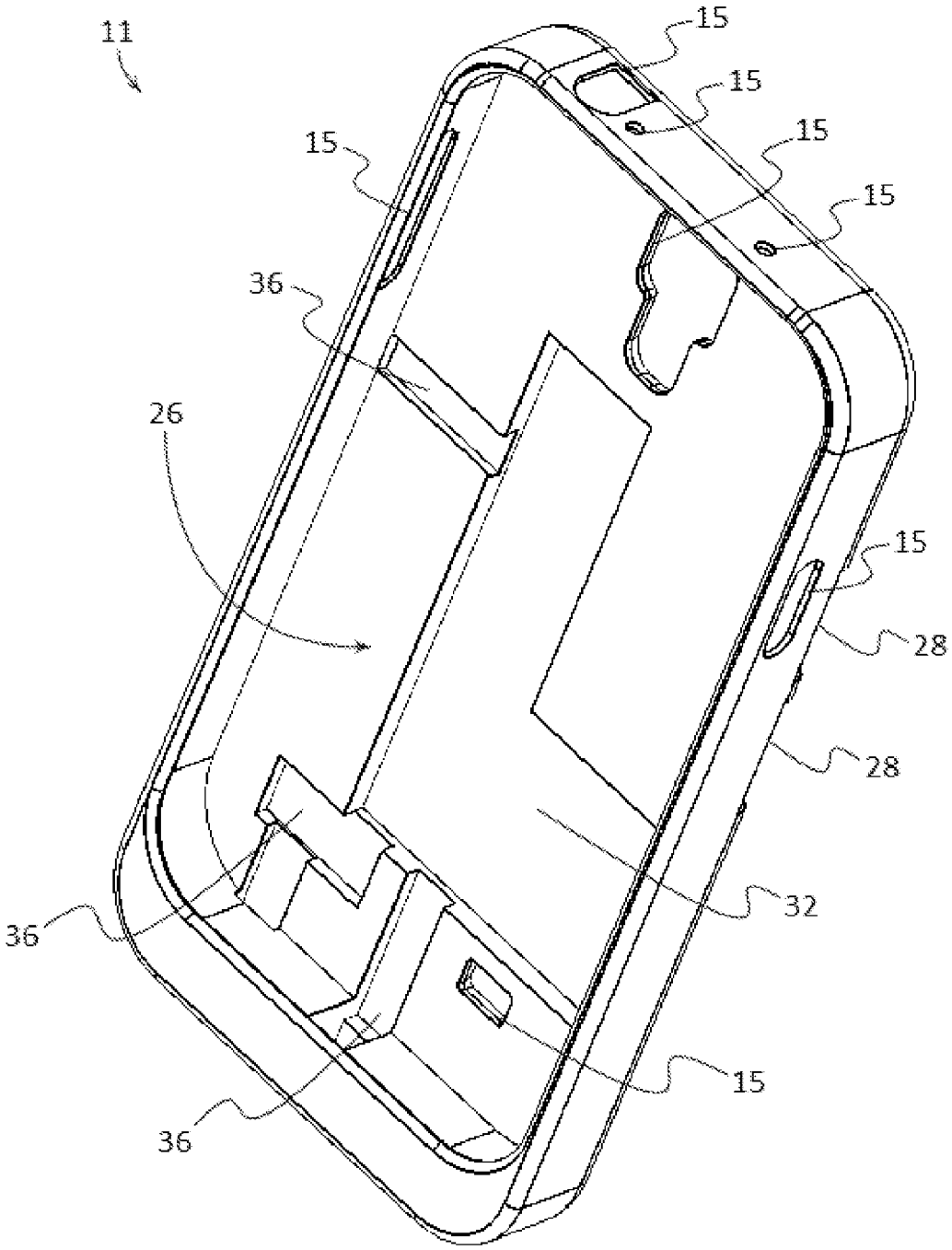


FIG. 10

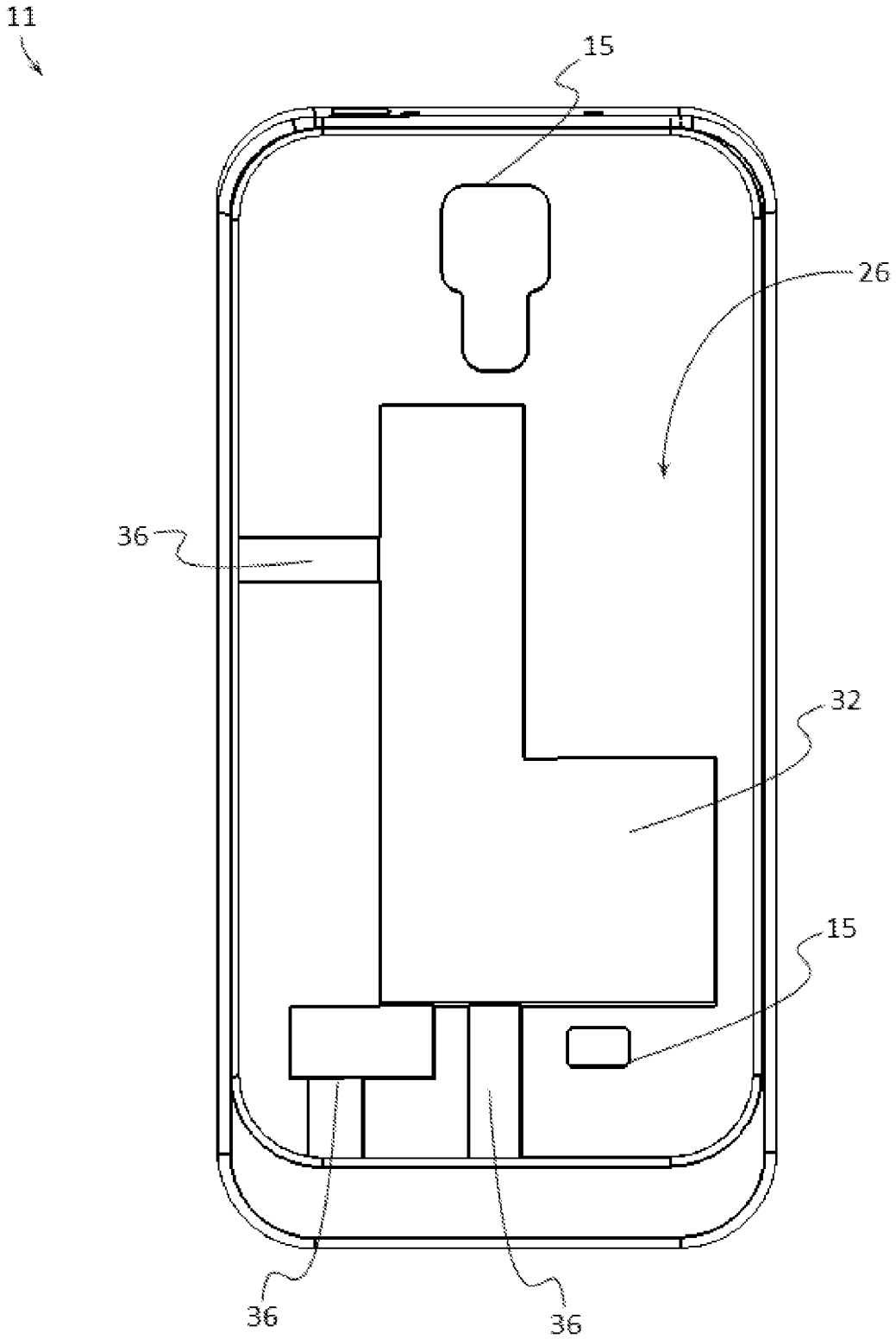


FIG. 11

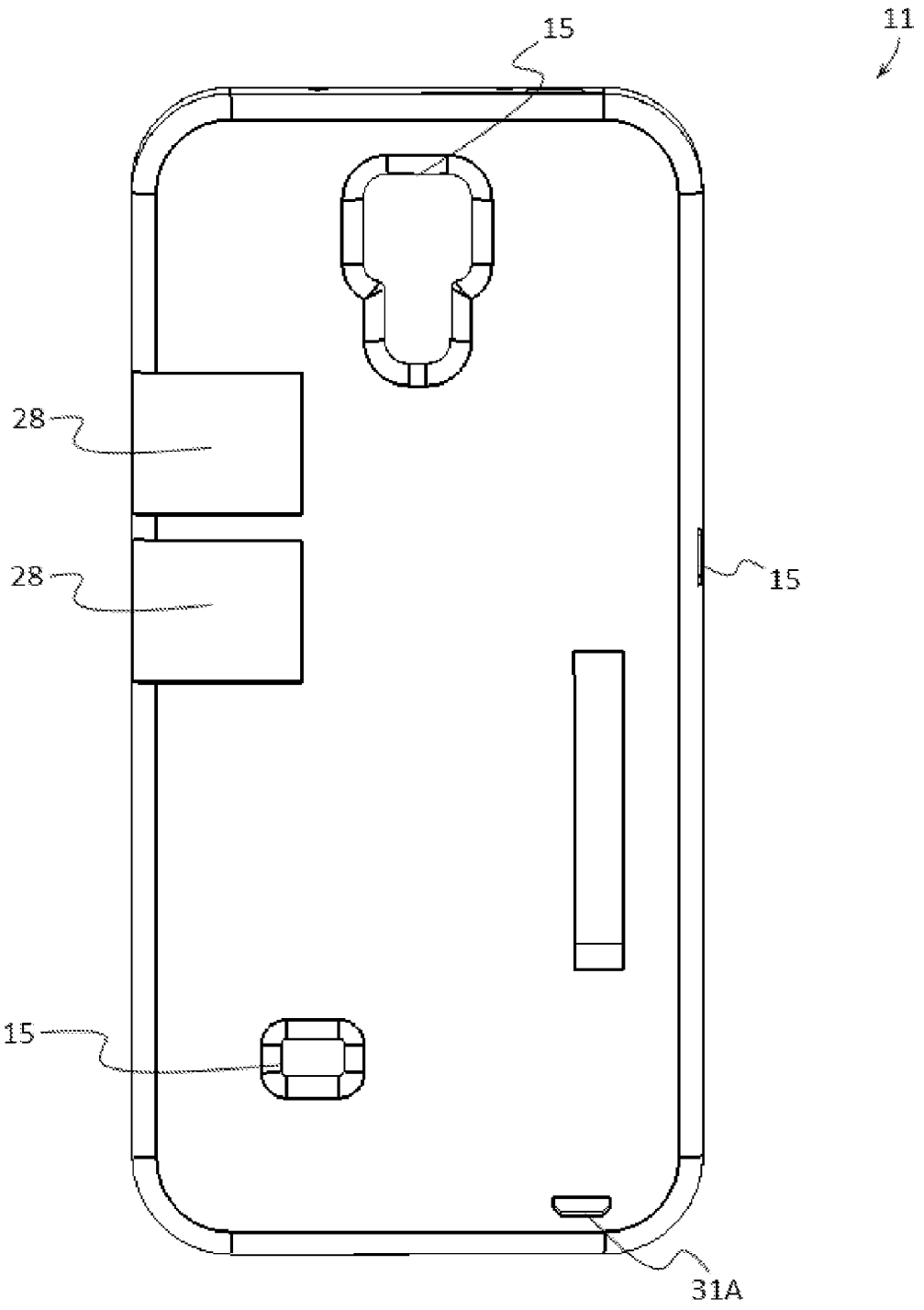


FIG. 12

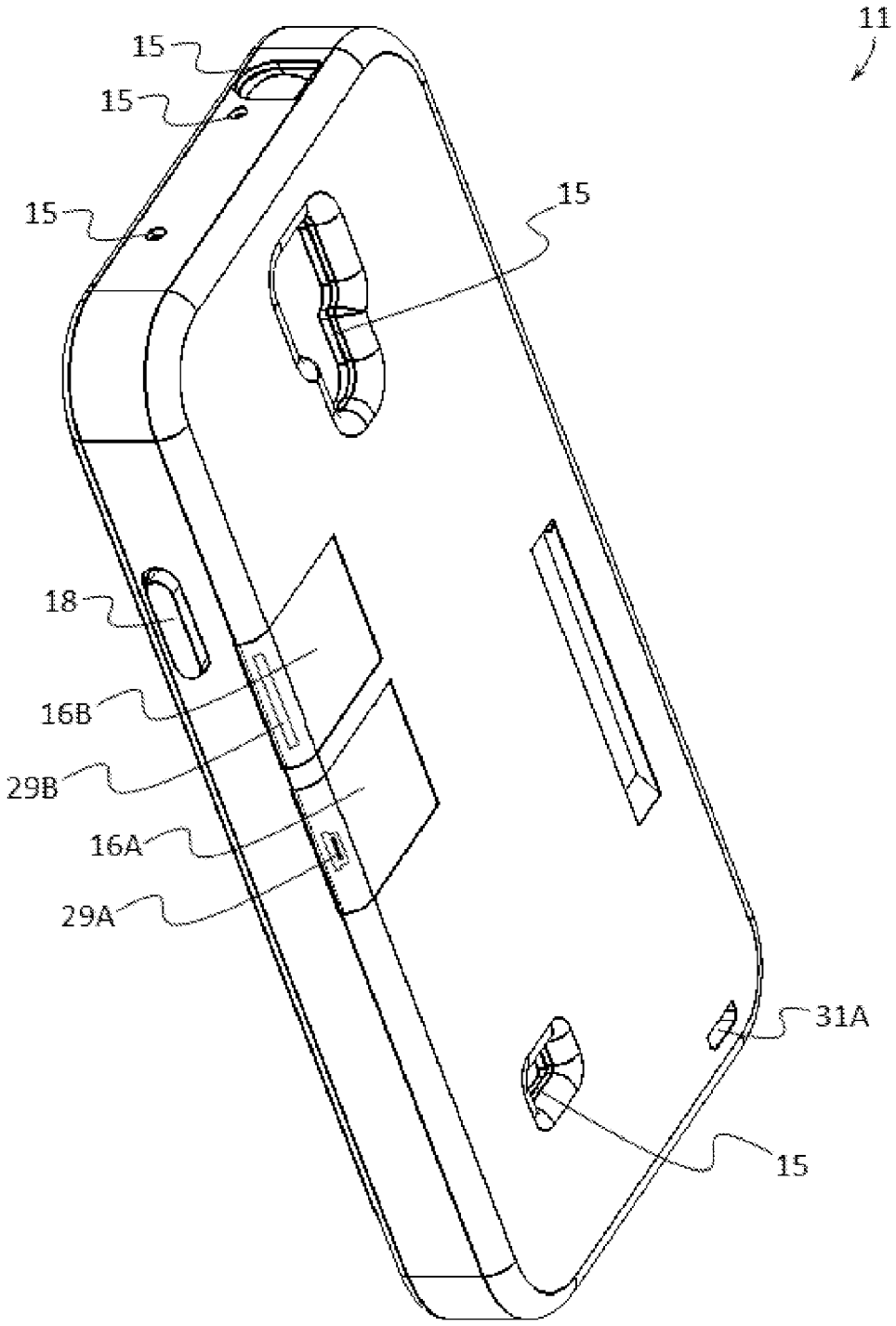


FIG. 13

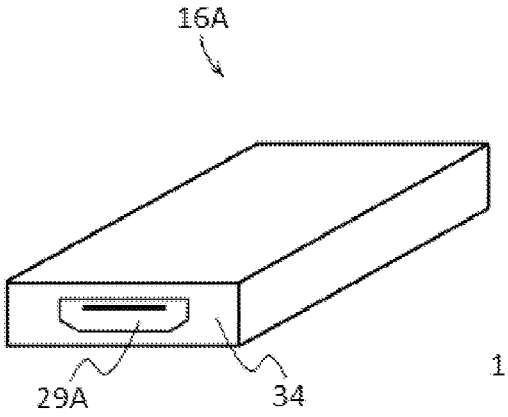


FIG. 14A

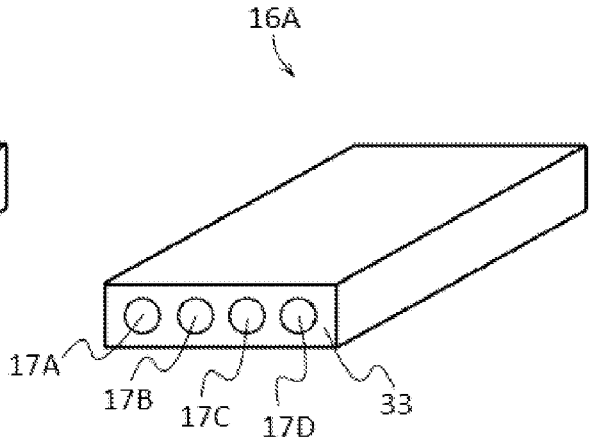


FIG. 14B

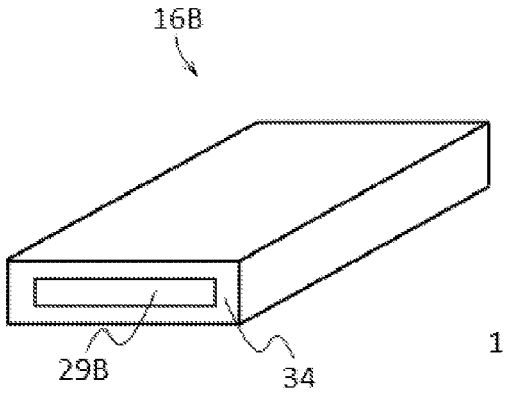


FIG. 14C

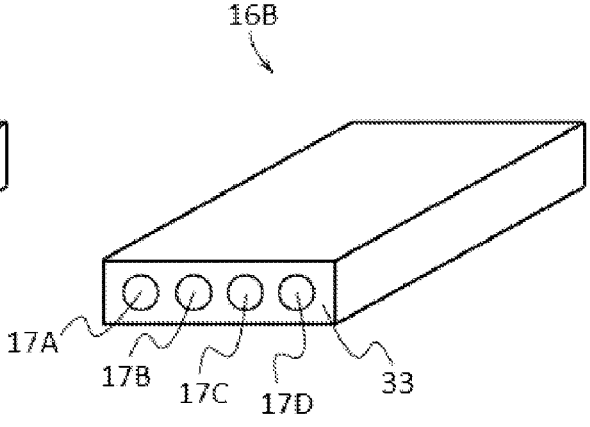


FIG. 14D

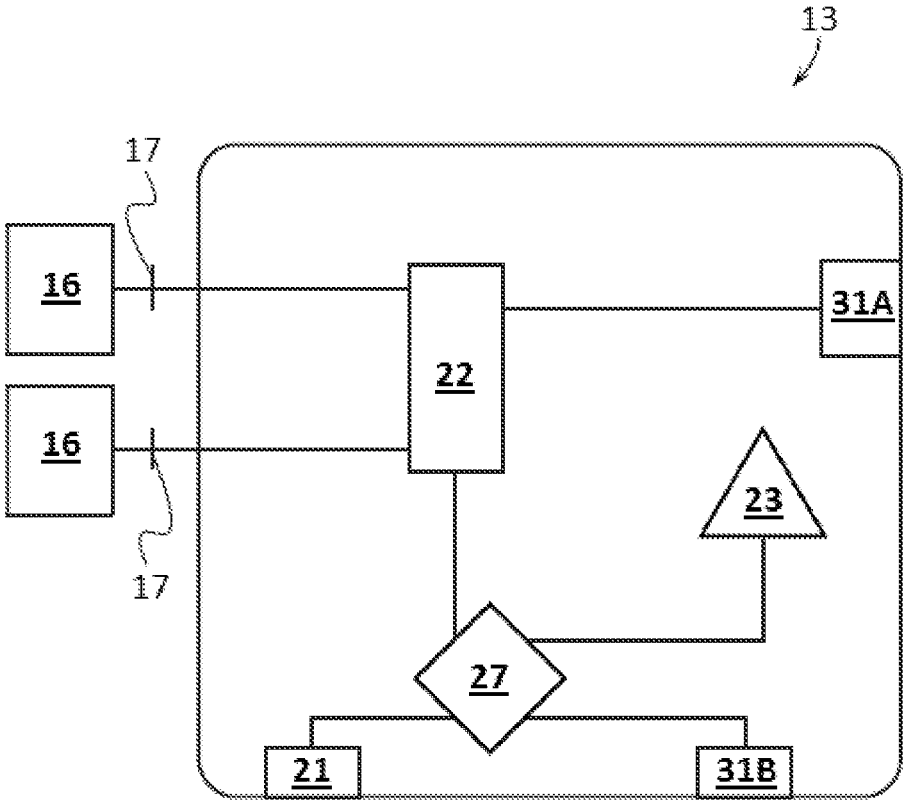


FIG. 15

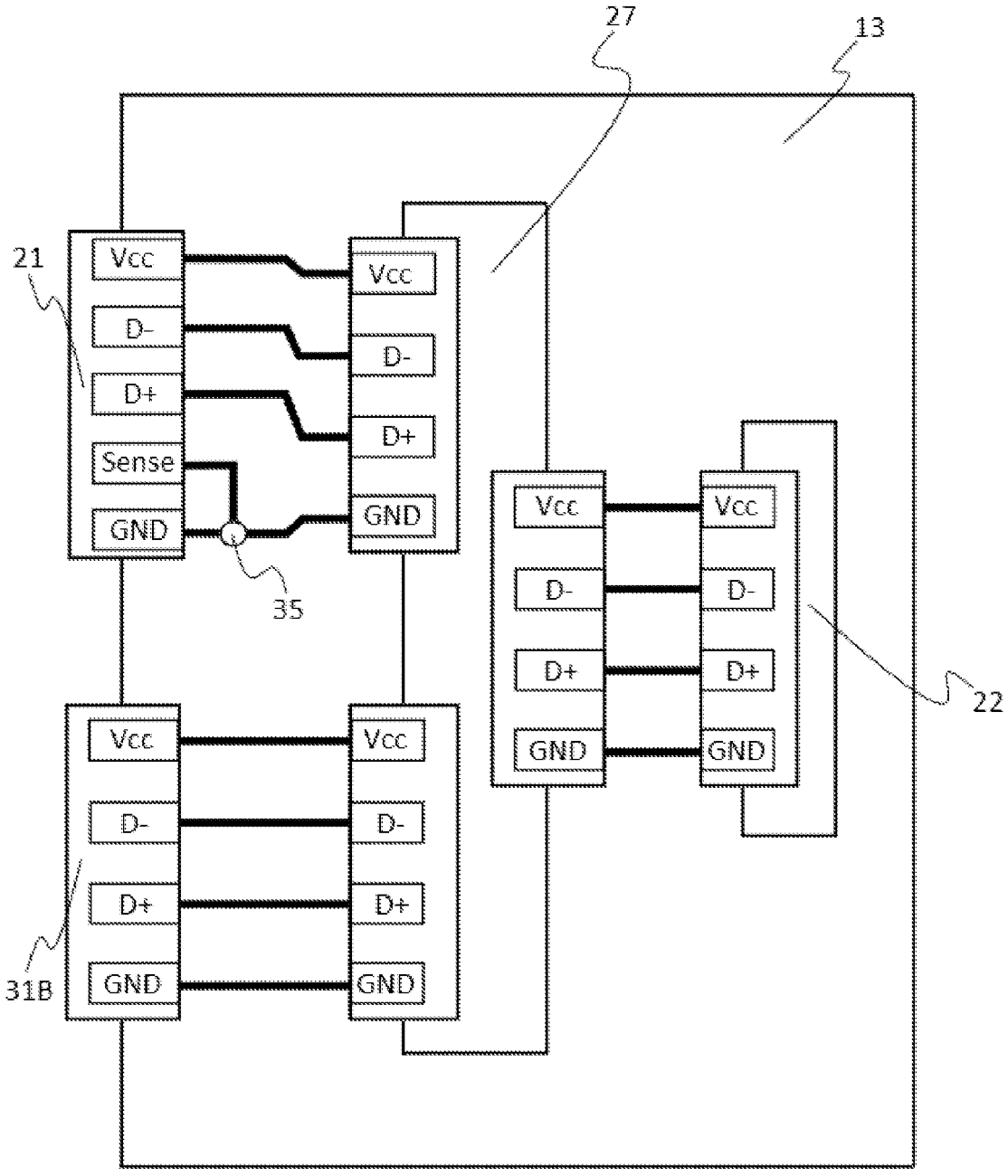

27
13
21
Vcc
D-
D+
Sense
GND
35
Vcc
D-
D+
GND
Vcc
D-
D+
GND
22
Vcc
D-
D+
GND
31B
Vcc
D-
D+
GND

FIG. 16

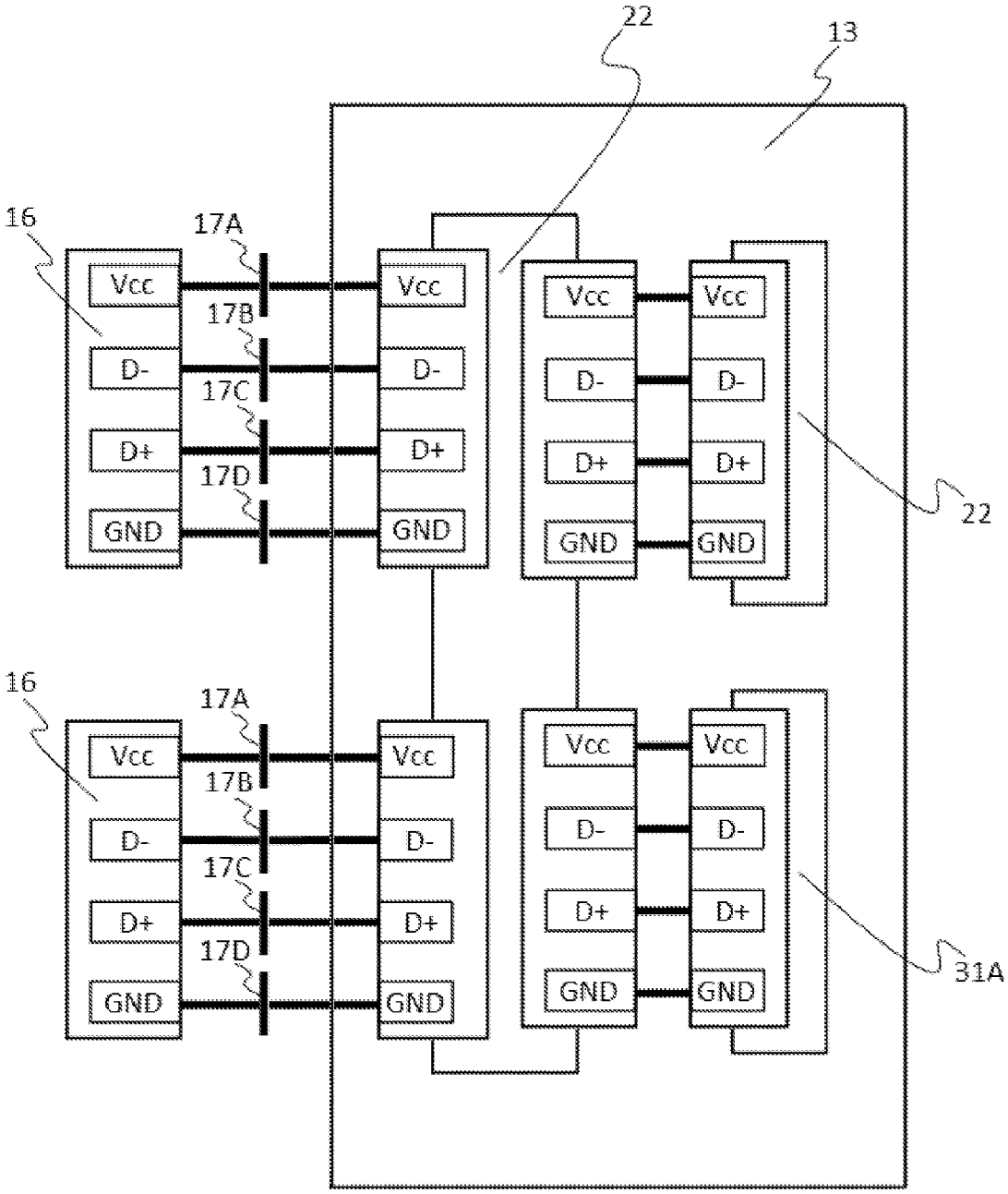

22
13
16
17A
17B
17C
17D
Vcc
D-
D+
GND
22
16
17A
17B
17C
17D
Vcc
D-
D+
GND
31A

FIG. 17

MODULAR MOBILE DEVICE CASE

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims priority to and the benefit of the filing date of U.S. Provisional Application No. 61/911,043, filed on Dec. 3, 2013, entitled "EXPANDABLE AND MODULAR PROTECTIVE MOBILE DEVICE CASE COMPRISING A USB HUB AND MEMORY CARD READER(S)", which is hereby incorporated by reference in its entirety.

FIELD OF THE INVENTION

This patent specification relates to a case for portable electronic devices. More specifically, this patent specification relates to a case for portable electronic devices that is configured to connect electronic devices to a portable electronic device in the case.

BACKGROUND

There are many types of portable electronic devices including personal digital assistants (PDAs), computers, smartphones, mobile phones, satellite phones, cellular phones, pagers, music player, MP3 players, media players, digital cameras, video cameras, bar code scanner, global positioning system (GPS), and portable game consoles.

A major restriction of these portable electronic devices is limited storage capacity. Typically, the storage capacity is built into the portable electronic device at the time of manufacture. Often, purchasing the model of mobile device with the most base storage capacity can cost much more than the model with the least amount of capacity. A significant amount of portable electronic devices are only configured with the built in storage capacity and are unable to accept storage capacity upgrades. Also, the current state of portable electronic device manufacturing is such that upgrading the built in storage capacity is beyond the capabilities of most end users if not impossible, leaving the consumer with few options.

There currently exist external electronic modules to expand storage memory; however, they often require cables and adapters, the majority of which are bulky to carry and the sleek form factors of mobile devices are lost once these modules are connected. A further drawback to these modules is that one connected to a portable electronic device, these modules would also be unprotected from shock and vibration.

Some portable electronic devices are able to accept aftermarket electronic devices such as memory cards which may be used to increase or augment the storage capacity of a portable electronic device. Unfortunately, in order to attach these electronic devices, the portable electronic device to which they are to be attached must be partially disassembled. For example, the back case or even the back case and battery must be removed from a majority of portable electronic devices in order to attach a memory card. Since these portable devices are only able to accept one memory card, they must be disassembled every time a memory card is swapped out which has the drawback of increasing the possibility of damaging the portable device. Since most portable electronic devices are also only able to attach one aftermarket electronic device at a time, the user is further limited by what electronic devices they may add to their portable device and the amount of time required to switch an electronic device for another.

Therefore, a need exists for novel apparatuses that are able to attach aftermarket electronic devices to portable electronic devices. There is a further need for novel apparatuses that are able to protect a portable electronic device and any aftermarket electronic devices attached to it from impacts, abrasions, and the like. Finally, there exists a need for a novel apparatus which is able to simultaneously attach different aftermarket electronic devices to a portable electronic device.

BRIEF SUMMARY OF THE INVENTION

In preferred embodiments, an expandable and modular protective mobile device case apparatus comprises a protective shell configured to receive a mobile device; a circuit board located within the protective shell said circuit board comprising a USB hub and a mode selection switch, wherein the USB hub is in electrical communication with the mode selection switch; and a male plug member in electrical communication with the mode selection switch and configured to transfer electrical signals from the mode selection switch to the mobile device.

BRIEF DESCRIPTION OF THE DRAWINGS

Some embodiments of the present invention are illustrated as an example and are not limited by the figures of the accompanying drawings, in which like references may indicate similar elements or components and in which:

FIG. **1** depicts a front perspective view of an example of an expandable and modular protective mobile device case apparatus according to various embodiments described herein.

FIG. **2** illustrates a front elevation view of an example of an expandable and modular protective mobile device case apparatus according to various embodiments described herein.

FIG. **3** shows a back perspective view of an example of an expandable and modular protective mobile device case apparatus according to various embodiments described herein.

FIG. **4** depicts a perspective exploded view of an example of an expandable and modular protective mobile device case apparatus according to various embodiments described herein.

FIG. **5** illustrates a front perspective view of an example of aback plate according to various embodiments described herein.

FIG. **6** shows a front perspective view of an example of a back plate according to various embodiments described herein.

FIG. **7** depicts a back perspective view of an example of a back plate according to various embodiments described herein.

FIG. **8** illustrates a back perspective view of an example of a back plate according to various embodiments described herein.

FIG. **9** shows a front perspective view of an example of protective shell according to various embodiments described herein.

FIG. **10** depicts a front perspective view of an example of protective shell according to various embodiments described herein.

FIG. **11** illustrates a front elevation view of an example of a protective shell according to various embodiments described herein.

FIG. **12** shows a back elevation view of an example of a protective shell according to various embodiments described herein.

FIG. **13** depicts a back perspective view of an example of protective shell according to various embodiments described herein.

FIG. **14**A illustrates a front perspective view of an example of an expansion module according to various embodiments described herein.

FIG. **14**B shows a back perspective view of the example of an expansion module illustrated in FIG. **14**A according to various embodiments described herein.

FIG. **14**C depicts a front perspective view of an example of an expansion module according to various embodiments described herein.

FIG. **14**D illustrates a back perspective view of the example of an expansion module depicted in FIG. **14**C according to various embodiments described herein.

FIG. **15** shows a circuit block diagram for a circuit board of an example of an expandable and modular protective mobile device case apparatus according to various embodiments described herein.

FIG. **16** depicts a circuit block diagram of a mode selection switch of an example of an expandable and modular protective mobile device case apparatus according to various embodiments described herein.

FIG. **17** illustrates a circuit block diagram of a USB hub of an example of an expandable and modular protective mobile device case apparatus according to various embodiments described herein.

DETAILED DESCRIPTION OF THE INVENTION

Definitions

The term "electronic device" or "module" as used herein is preferably a type of electronic device comprising circuitry and configured to generally perform functions such as recording audio, photos, and videos; displaying or reproducing audio, photos, and videos; storing, retrieving, or manipulation of electronic data; providing electrical communications and network connectivity; or any other similar function. Non-limiting examples of electronic devices include; personal computers (PCs), workstations, laptops, tablet PCs including the iPad, cell phones including iOS phones made by Apple Inc., Android OS phones, Microsoft OS phones, Blackberry phones, digital music players, or any electronic device capable of running computer software and displaying information to a user, memory cards, other memory storage devices, digital cameras with optical zoom and/or lens attachments, external battery packs, external charging devices, HDMI in/out adapters, projectors, and the like. Certain types of electronic devices which are portable and easily carried by a person from one location to another may sometimes be referred to as a "portable electronic device" or "portable device". Some non-limiting examples of portable devices include; cell phones, smart phones, tablet computers, laptop computers, wearable computers such as watches, Google Glasses, etc. and the like.

The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items. As used herein, the singular forms "a," "an," and "the" are intended to include the plural forms as well as the singular forms, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises" and/or "comprising," when used in this specification, specify the presence of stated features, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, steps, operations, elements, components, and/or groups thereof.

Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one having ordinary skill in the art to which this invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and the present disclosure and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

In describing the invention, it will be understood that a number of techniques and steps are disclosed. Each of these has individual benefit and each can also be used in conjunction with one or more, or in some cases all, of the other disclosed techniques. Accordingly, for the sake of clarity, this description will refrain from repeating every possible combination of the individual steps in an unnecessary fashion. Nevertheless, the specification and claims should be read with the understanding that such combinations are entirely within the scope of the invention and the claims.

New electronic device cases and apparatuses are discussed herein that are configured to receive a portable electronic device. It should be understood that for the purposes of understanding the orientation of individual elements or components of the invention, the terms "front" and "front side" shall generally be used to indicate a surface or surface of an element or component that when assembled in an expandable and modular protective mobile device case apparatus, is orientated toward the primary display screen of the portable electronic device. Conversely, for the purposes of understanding the orientation of individual elements or components of the invention, the terms "back" and "back side" shall generally be used to indicate a surface or a surface of an element or component that when assembled in an expandable and modular protective mobile device case apparatus is orientated away from (i.e. faces away from) the primary display screen of the electronic device.

It should also be understood that the terms "right" and "left" are used solely to denote opposite sides of an element, component, or surface in the same manner that "top" and "bottom" are used solely to denote opposite sides of an element, component, or surface and should not unnecessarily be construed as limiting the position or orientation of said element, component, or surface.

In the following description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the present invention. It will be evident, however, to one skilled in the art that the present invention may be practiced without these specific details.

The present disclosure is to be considered as an exemplification of the invention, and is not intended to limit the invention to the specific embodiments illustrated by the figures or description below.

The present invention will now be described by example and through referencing the appended figures representing preferred and alternative embodiments. FIGS. **1-3** illustrate three views of an example of an expandable and modular protective mobile device case apparatus ("the case") **100** according to various embodiments, while FIG. **4** shows an exploded view of some of the components of an example of the case **100** according to various embodiments. In this example, the case **100** comprises a protective shell **11**, a back plate **12**, and a circuit board **13**. The circuit board **13** may comprise electrical components of the case **100** and be configured to provide electrical communication between them. In preferred embodiments, the case may comprise a protective shell **11** configured to receive a mobile or portable device; a

circuit board **13** coupled to the protective shell said circuit board comprising a USB hub **22** and a mode selection switch **27**, wherein the USB hub is in electrical communication with the mode selection switch **27**; a male plug member **21** in electrical communication with the mode selection switch **27** and configured to transfer electrical signals from the mode selection switch **27** to the portable device received in the case.

The protective shell **11** may be configured to receive and be coupled to the circuit board **13** and may comprise one or more apertures **15** which are configured to provide access to one or more electrical components and to provide access to various components of a portable electronic device received in the case **100**. Preferably, the case **100** may comprise a back plate **12** to facilitate manufacturing by allowing the circuit board **13** to be assembled and then coupled to the case **100** by being encased between the protective shell **11** and the back plate **12**. The optional back plate **12** may be configured to be coupled to the circuit board **13** and/or the protective shell **11**, thereby encasing the circuit board **13** between the protective shell **11** and the back plate **12**. In alternative embodiments, a circuit board **13** may be encased solely in a protective shell **11** with the protective shell **11** formed or coupled around the circuit board **13**. In further alternative embodiments, a circuit board **13** may be encased solely in a back plate **12** with the back plate **12** formed or coupled around the circuit board **13**. In further alternative embodiments, the circuit board **13** may not be encased by a protective shell **11** and/or a back plate **12** so that portions of the circuit board **13** are visible or accessible without removing portions of a protective shell **11** and/or a back plate **12**.

In preferred embodiments, a back plate **12** and/or the protective shell **11** may comprise or be constructed from a softer polymer, elastomer, rubber, or other resilient material to increase protection of the case **100** against drops and shocks. The protective shell **11** and back plate **12** may be integrally formed as a single unit (i.e. through a molding manufacturing process). In some embodiments, for portable device models which use a removable back cover to access the internal circuitry of the portable device, the back plate **12** and/or the protective shell **11** may function as a replacement for the removable back cover of the device. In some embodiments, a back plate **12** may comprise ARTiLAGE foams, Poron foams, silicone foams, rubber foams, plastic foams, neoprene foam, latex foam rubber, polyurenthane foam rubber, or elastomer materials such as elastic plastics, elastic silicone, elastic rubbers, silicone rubbers, or any other suitable elastomer or resilient material.

In further preferred embodiments, the protective shell **11** and/or portions of a back plate **12** may comprise a substantially rigid material such as nylon, polytetrafluoroethylene (PTFE), polyethylene terephthalate (PET), high-density polyethylene (HDPE), polyvinyl chloride (PVC), polypropylene (PP), low density polyethylene (LDPE), other substantially rigid plastics, hard rubbers, resins, ceramics, wood, carbon fiber, glass, metals and metal alloys, or any other suitable substantially rigid material including combinations of materials.

In further preferred embodiments, the circuit board **13** may preferably be flexible and water resistant, with the circuit board **13** preferably placed in between a back plate **12** comprising a resilient material and a protective shell **11** comprising a substantially rigid material, which protects both a portable device received in the case **100** and the circuit board **13** from damage. The protective shell **11** and a back plate **12** may be coupled together and/or to a circuit board **13** with silicone or other suitable material, which may have physical properties to act as an adhesive, to be thermally conductive for the purpose of drawing heat away from temperature-sensitive electronic devices, and to also provide a level of shock and dent protection. In further embodiments, a circuit board **13** may be coupled to a material such as a metal or metal alloy that is capable of acting as a heat sink by absorbing heat from the circuit board **13**.

In preferred embodiments, a circuit board **13** and/or an optional back plate **12** are coupled to the protective shell **11**. The protective shell **11**, circuit board **13**, and/or an optional back plate **12** may be coupled be being connected, removably connected, or integrally formed or molded with the case **100**. In some embodiments, the protective shell **11**, circuit board **13**, and/or an optional back plate **12** may be coupled or connected together with heat bonding, chemical bonding, thermally conductive epoxy, silicone adhesives, metal-oxide ceramic adhesives, other adhesives, clasp type fasteners, clip type fasteners, rivet type fasteners, threaded type fasteners, other types of fasteners, or any other suitable joining method.

In other embodiments, the protective shell **11**, circuit board **13**, and/or an optional back plate **12** may be coupled or removably connected by being press fit or snap fit together, by one or more fasteners such as magnetic type fasteners, threaded type fasteners, sealable tongue and groove fasteners, snap fasteners, clip type fasteners, clasp type fasteners, ratchet type fasteners, a push-to-lock type connection method, a turn-to-lock type connection method, slide-to-lock type connection method or any other suitable temporary connection method as one reasonably skilled in the art could envision to serve the same function. In further embodiments, the protective shell **11**, circuit board **13**, an optional back plate **12**, and/or any other component described herein may be coupled by being one of connected to and integrally formed with another component of a case **100**.

In some embodiments, FIGS. a protective shell **11** may comprise a circuit board depression **32** (FIGS. **4**, **9-11**) configured to receive a circuit board **13** to provide space for the circuit board **13** to be coupled between the protective shell **11** and a back plate **12**. In further embodiments, a protective case **11** may comprise one or more conduits **36** or depressions configured to receive electrical connections providing electrical communication between the circuit board **13** and a electrical component disposed on the protective case **11** such as a female plug connector **29**A (FIGS. **1** and **3**). A protective shell **11** may also comprise a kickstand **37** as shown in FIGS. **3**, **12**, and **13** which may be connected with a hinge or other movable coupling. A kickstand **37** may be moving into position so that a portion of the kickstand **37** extends away from the case **100** and contacts a surface allowing the case **100** to lean on the kickstand **37**.

As shown in FIGS. **1** and **2**, when assembled together, a back plate **12** and optionally the protective shell **11** and/or circuit board **13** may define a back plate opening **25** in the front of the case **100** configured to receive a portable device. In other alternative embodiments, the protective shell **11** may define a protective shell opening **26** (FIGS. **9-11**) in the front of the case **100** configured to receive a portable device through which the user can view and access the touch screen, home button, and other like components of the portable device. As shown in these figures, a protective shell opening **26** may have a generally rectangular prism shape which is open on the front side, with the shape of the back protective shell opening **26** configured to be generally complementary in shape to a portable device also configured with a generally rectangular prism shape. In other embodiments, a protective shell opening **26** may comprise any other shape, allowing the protective shell opening **26** to receive any other shaped por-

table device so that the display screen and optionally one or more user inputs on the front of the portable device may be accessed.

In some alternative embodiments, the shape of a protective shell opening **26** opening may be configured to be slightly smaller than the shape of a portable device that is to be received into the case **100** with portions of the protective shell **11** that surround or form the protective shell opening **26** comprising a resilient material. The resilient material may be conformed around portions of a portable device received in the protective shell opening **26** of the case **100** with the resilient nature of the material frictionally securing the portable device within the protective shell opening **26**.

In further alternative embodiments, the shape of the protective shell opening **26** may be configured to be generally the same size and shape of a portable device that is to be received into the case **100** with portions of the protective shell **11** configured to temporarily conform around portions of a portable device received in the protective shell opening **26** of the case **100**. For example, the protective shell **11** may comprise two or more temporarily coupled subunits which when uncoupled may be place around portions of a portable device and then coupled to secure the portable device within the protective shell opening **26**.

In the preferred embodiment shown in FIGS. **1**, **2**, **4-6**, the back plate **12** may comprise a back plate opening **25** configured to receive a portable device through which the user can view and access the touch screen, home button, and other like components of the portable device. As shown in these figures, back plate opening **25** has a generally rectangular prism shape which is open on the front side, with the shape of the back plate opening **25** configured to be complementary in shape to a portable device also configured with a generally rectangular prism shape. In other embodiments, aback plate opening **25** may comprise any other shape, allowing the back plate opening **25** to receive any other shaped portable device so that the display screen and optionally one or more user inputs on the front of the portable device may be accessed.

The shape of the back plate opening **25** may be configured to be slightly smaller than the shape of a portable device that is to be received into the case **100** with portions of the back plate **12** that surround or form the back plate opening **25** comprising a resilient material. The resilient material may be conformed around portions of a portable device received in the back plate opening **25** of the back plate **12** with the resilient nature of the material frictionally securing the portable device within the back plate opening **25**. Also in preferred embodiments, the protective shell **11** may comprise a protective shell opening **26** configured to receive and secure the back plate **12** with a portable device received and secured in the back plate opening **25** of the back plate **12**.

In some embodiments, the shape of the protective shell opening **26** may be configured to be slightly smaller than the shape of the back plate **12** that is to be received into the protective shell opening **26** of the protective shell **11** with portions of the protective shell **11** that surround or form the protective shell opening **26** comprising a resilient material. The resilient material may be conformed around portions of a back plate **12** received in the protective shell opening **26** of the protective shell **11** with the resilient nature of the material frictionally securing the back plate **12** within the protective shell opening **26**. In other embodiments, the shape of the protective shell opening **26** may be configured to be generally the same size and shape of a back plate **12** that is securing a portable device that is received into the back plate opening **25** with portions of the protective shell **11** configured to temporarily conform around portions of a back plate **12** received in the protective shell opening **26** of the protective shell **11**. For example, the protective shell **11** may comprise two or more temporarily coupled subunits which when uncoupled may be placed around portions of a back plate **12** and then coupled to secure the back plate **12** within the protective shell opening **26** of the protective shell **11**.

As shown in FIGS. **1-13**, in preferred embodiments, a protective shell **11** and a back plate **12** may comprise one or more apertures **15** which may be positioned and configured to allow elements of a portable device such as a camera, flash, microphone, head set or head phone connection, power buttons, volume buttons, other buttons, and the like to be unobstructed by the protective shell **11** and/or a back plate **12** when the portable device is received or secured within the protective shell opening **26** and/or back plate opening **25** of the case **100**. One or more apertures **15** may be located anywhere on a protective shell **11** and/or anywhere on a back plate **12**. In further embodiments, an aperture **15** may be configured to receive or secure a portion of an expansion module **16** or other accessory.

A protective shell **11** and/or a back plate **12** may also comprise one or more input toggles which may be configured to physically communicate manual inputs such as a depressing motion to a user input such as a power button or volume button on a portable device received and secured within an opening **14** of an case **100** as illustrated in FIGS. **1-13**. An input toggle may be positioned on the protective shell **11** and/or back plate **12** so that when a portable device is received in the case **100**, a portion of the input toggle is configured to contact a user input on the portable device.

In some embodiments, an input toggle may comprise a power button toggle **18** which when pressed, may communicate the force of the press to the power button user input on a portable device received in the case **100**, thereby toggling the power button of the portable device. In other embodiments, an input toggle may comprise a volume button toggle **19** which when pressed, may communicate the force of the press to a volume button user input on a portable device received in the case **100**, thereby toggling the volume button of the portable device. In further embodiments, an input toggle may comprise a home button toggle which when pressed, may communicate the force of the press to the home button user input on a portable device received in the case **100**, thereby toggling the home button of the portable device. In still further embodiments, an input toggle may comprise a camera button toggle which when pressed, may communicate the force of the press to the camera button user input on a portable device received in the case **100**, thereby toggling the camera button of the portable device. In even further embodiments, an input toggle may comprise a button toggle which when pressed, may communicate the force of the press to any other type of button, slider, rocker, or like type of user input on a portable device received in the case **100**, thereby toggling any other type of user input on a portable device.

In the embodiments shown in FIGS. **3**, **4**, **10**, and **12**, a protective shell **11** may comprise one or more expansion ports **28** configured to be coupled to, contain or grant access to an expansion module **16** (FIGS. **13** and **14**). An expansion port **28** is configured to comprise one or more electrical contacts points **17** (FIGS. **3** and **9**) which may be coupled in electrical communication with the circuit board **13**. As shown in FIG. **3**, the electrical contact points **17** may be configured to pass from an expansion port **28** through a protective shell **11**, into the circuit board depression **32** (FIGS. **4**, **9-11**) and into electrical communication with an electrical component of the circuit board **13** such as a USB hub **22** (FIGS. **15** and **16**). In preferred embodiments as shown in FIG. **17**, an expansion

port **28** may comprise a V+ or VCC +5 V (red wire) electrical connection point **17**A, a D+ or Data+ (green wire) electrical connection point **17**B, a D− or Data− (white wire) electrical connection point **17**C, and a GND or Ground (black wire) electrical connection point **17**D similar to those commonly used in USB standard connections. In other embodiments, an expansion port **28** may comprise one or more other electrical connection points **17** which may provide electrical communication with a circuit board **13**.

In preferred embodiments, an expansion module **16** may be temporarily coupled into or to an expansion port **28** of the protective shell **11** allowing different types of expansion modules **16** to be electrical communication with the circuit board **13** with any suitable coupling or connection method. For example in the embodiment depicted in FIG. **13**, the expansion module **16** may be temporarily secured or coupled in an expansion port **28** by a push-to-lock connection method allowing different types of expansion ports **16** to be temporarily coupled in an aperture **15** to a circuit board **13**. In some embodiments, an expansion module **16** may be permanently coupled to a circuit board **13**, back plate **12**, and/or a protective shell **11**. In other embodiments, an expansion module **16** may be temporarily coupled anywhere on the protective shell **11**, preferably to one or more apertures **15** optionally providing electrical communication with the circuit board **13** allowing different types of expansion ports **16** to be temporarily coupled or attached to a circuit board **13** and/or a protective shell **11**.

The an expansion module **16** may be coupled to the case **100** by being connected, removably connected, or integrally formed or molded with an expansion port **28** and/or the protective case **11**. In some embodiments, an expansion module **16** may be coupled to an expansion port **28** and/or the protective case **11** with heat bonding, chemical bonding, adhesives, clasp type fasteners, clip type fasteners, rivet type fasteners, threaded type fasteners, other types of fasteners, or any other suitable joining method. In other embodiments, an expansion module **16** may be coupled to an expansion port **28** and/or the protective case **11** may be coupled or removably connected by being press fit or snap fit together, by one or more fasteners such as magnetic type fasteners, threaded type fasteners, sealable tongue and groove fasteners, snap fasteners, clip type fasteners, clasp type fasteners, ratchet type fasteners, a push-to-lock type connection method, a turn-to-lock type connection method, slide-to-lock type connection method or any other suitable temporary connection method as one reasonably skilled in the art could envision to serve the same function. In further embodiments, an expansion module **16** may be coupled to an expansion port **28**, the protective case **11**, and/or any other component described herein may be coupled by being one of connected to and integrally formed with another component of the case **100**.

As shown in FIG. **14**, an expansion module **16** may comprise a first end **33** and a second end **34**, and having electrical contact points **17** on the first end **33** and having a female connector **29** on said second end **34**, the electrical contact points **17** on the first end **33** are adapted to operably engage or electrically communicate with the electrical contact points **17** of an expansion port **28**. An expansion module **16** may comprise one or more temporary electrical connection points which may be configured to temporarily be in electrical communication with a circuit board **13**. In preferred embodiments as shown in FIGS. **14** and **17**, an expansion module **16** may comprise a V+ or VCC +5 V (red wire) electrical connection point **17**A, a D+ or Data+ (green wire) electrical connection point **17**B, a D− or Data− (white wire) electrical connection point **17**C, and a GND or Ground (black wire) electrical connection point **17**D similar to those commonly used in USB standard connections. In other embodiments, an expansion module **16** may comprise one or more other electrical connection points which may provide electrical communication with a circuit board **13**.

In some embodiments, an expansion module **16** may be configured as a female plug member expansion module **16**A (FIGS. **13** and **14**A) which comprises a female connector such as a female micro-USB connector or female mini-USB connector. A female plug member expansion module **16**A may be configured to provide electrical communication between a male connector such as a male micro-USB connector, male mini-USB connector, or any other type of male connector that is inserted into the female plug member expansion module **16**A and the circuit board **13** allowing data and electricity to transfer between the male connector and the circuit board **13**. In other embodiments, a female plug member expansion module **16**A may comprise a female connector such as a Type A USB plug, a Type B USB plug, a Mini-A USB plug, a Mini-B USB plug, a Micro-A USB plug, a Micro-B USB plug, a Micro-B USB 3.0 plug, a ExtMicro USB plug, a HDMI port, a Lightning plug, a30-pin dock connector, a Pop-Port connector, a Thunderbolt plug, a Firewire plug, a Portable Digital Media Interface (PDMI) plug, a coaxial power connector plug, a barrel connector plug, a concentric barrel connector plug, a tip connector plug, or any other plug, connector, or receptacle capable of electrical communication with an electronic device.

In some embodiments, an expansion module **16** be configured as a memory card reader expansion module **16**B (FIGS. **13** and **14**C) which comprises a memory card connector such as a Micro SD card connector. A memory card reader expansion module **16**B may be configured to provide electrical communication for the transfer of data between a memory card such as a Micro SD card that is inserted or received into the memory card reader expansion module **16**B and the circuit board **13** allowing data to be read from and written to the memory card. In other embodiments, a memory card reader expansion module **16**B may comprise a memory card reader configured to receive a PC Card memory card, CompactFlash I memory card, CompactFlash II memory card, SmartMedia memory card, Memory Stick memory card, Memory Stick Duo memory card, Memory Stick PRO Duo memory card, Memory Stick PRO-HG Duo memory card, Memory Stick Micro M2 memory card, Miniature Card memory card, Multimedia Card memory card, Reduced Size Multimedia Card memory card, MMCmicro Card memory card, P2 card memory card, Secure Digital card memory card, SxS memory card, Universal Flash Storage memory card, miniSD card memory card, xD-Picture Card memory card, Intelligent Stick memory card, Serial Flash Module memory card, µ card memory card, NT Card memory card, XQD card memory card, or any other removable memory storage device including USB flash drives.

In some embodiments, an expansion module **16** may be configured as a universal male or female connector type expansion module which comprises any other male or female connector which may be configured to provide electrical and optionally physical connection between a device comprising a male or female connector and the case **100** allowing data and electricity to transfer between the male or female connector of the device and the circuit board **13**. A universal male or female connector type expansion module may comprise a V+ or VCC +5 V (red wire) electrical connection point, a D+ or Data+ (green wire) electrical connection point, a D− or Data− (white wire) electrical connection point, and a GND or Ground (black wire) electrical connection point similar to those com-

monly used in USB standard connections or any other type of electrical connection points and may be configured to provide electrical communication between a male or female connector that is inserted into the universal male or female connector type expansion module and the circuit board **13**.

Turning now to FIG. **2**, a protective shell **11** may also comprise a male plug member **21** which may be positioned in aback plate opening **25** and/or a protective shell opening **26** so that when a portable device is received in the case **100**, the male plug member **21** may mate with a complementary female plug member such as a charging port or data port on the portable device. A male plug member **21** may provide electrical communication between a female plug member on a portable device and an electrical component of the circuit board **13** such as a mode selection switch **27** (FIGS. **15** and **16**). A male plug member **21** may comprise any type of male plug connector commonly received or mated with any type of female plug member commonly found on portable devices.

In preferred embodiments, a male plug member **21** may comprise a male USB connector such as a male micro-USB or male mini-USB. In other embodiments, a male plug member **21** may comprise a male Type A USB plug, a male Type B USB plug, a male Mini-A USB plug, a male Mini-B USB plug, a male Micro-A USB plug, a male Micro-B USB plug, a male Micro-B USB 3.0 plug, a male ExtMicro USB plug, a male Lightning plug, amale30-pin dock connector, a male Pop-Port connector, a male Thunderbolt plug, a male Firewire plug, a male Portable Digital Media Interface (PDMI) plug, a male coaxial power connector plug, a male barrel connector plug, a male concentric barrel connector plug, a male tip connector plug, or any other male plug, connector, or receptacle capable of electrical communication with an electronic device.

Turning now to FIGS. **1**, **3**, **9**, **12** and **13**, a protective shell **11** may also comprise one or more female plug members **31** which may be positioned anywhere on a protective shell **11** and/or back plate **12**. A female plug member **31** may provide electrical communication between a male plug member of an electrical device and an electrical component of the circuit board **13** such as a mode selection switch **27** (FIGS. **15** and **16**) or a USB hub **22** (FIGS. **15-17**). A female plug member **31** may comprise any type of male plug connector commonly received or mated with any type of male plug member commonly found on electrical devices. In some embodiments, a female plug member **31** may comprise a female connector such as a Type A USB plug, a Type B USB plug, a Mini-A USB plug, a Mini-B USB plug, a Micro-A USB plug, a Micro-B USB plug, a Micro-B USB 3.0 plug, a ExtMicro USB plug, a Lightning plug, a 30-pin dock connector, a Pop-Port connector, a Thunderbolt plug, a Firewire plug, a Portable Digital Media Interface (PDMI) plug, a coaxial power connector plug, a barrel connector plug, a concentric barrel connector plug, a tip connector plug, or any other plug, connector, or receptacle capable of electrical communication with an electronic device.

FIG. **15** depicts a circuit block diagram for a circuit board **13** of an example of an expandable and modular protective mobile device case **100** according to various embodiments described herein. In this embodiment, the circuit board **13** comprises a USB hub **22** in electrical communication with a mode selection switch **27**, a first female plug member **31**A, and two expansion modules **16**, The circuit board **13** also comprises a mode selection switch **27** in electrical communication with a male plug member **21**, the USB hub **22**, a second female plug member **31**B, and a wireless charging receiver **23**. In other embodiments, the case **100** may comprise one or more male plug members **21**, female plug members **31**, expansion modules **16**, and/or wireless charging receivers **23** which may be in electrical communication with a circuit board **13** by being temporarily or permanently coupled to a circuit board **13** and in electrical communication with one or more USB hubs **22**. In further embodiments, the case **100** may comprise one or more male plug members **21**, female plug members **31**, expansion modules **16**, and/or wireless charging receivers **23** which may be in electrical communication with a circuit board **13** by being temporarily or permanently coupled to a circuit board **13** and in electrical communication with one or more mode selection switches **27**.

In preferred embodiments, a circuit board **13** may comprise a printed circuit board (PCB) which mechanically supports and electrically connects electronic components using conductive tracks, pads and other features etched from copper sheets laminated onto a non-conductive substrate. PCBs can be single sided (one copper layer), double sided (two copper layers) or multi-layer. Conductors on different layers may be connected with plated-through holes called vias. In some embodiments, a circuit board **13** may only comprise copper connections and no embedded components and may be called a printed wiring board (PWB) or etched wiring board. In other embodiments, a circuit board **13** may comprise a printed circuit assembly (PCA), printed circuit board assembly or PCB assembly (PCBA), a circuit card assembly (CCA), or a backplane assembly, or any other suitable electrical connection and communication method including standard wiring and the like.

As shown in FIG. **17**, a USB hub **22** may comprise any type of device which is configured to connect the electrical connection points such as a V+ or VCC +5 V (red wire) electrical connection point **17**A, a D+ or Data+ (green wire) electrical connection point **17**B, a D− or Data− (white wire) electrical connection point **17**C, and a GND or Ground (black wire) electrical connection point **17**D from one USB port to the electrical connectors of another USB port. In this and preferred embodiments, a USB hub **22** may provide electrical communication between one or more expansion modules **16**, optionally one or more first female plug members **31**A, and a mode selection switch **27**. In some embodiments, electrical contact points **17**A-**17**D may be configured to be temporary in nature such electrical contact connectors. A USB hub **22** may be configured to connect two, three, four, five, six, seven, eight, or more USB ports including a female plug member **16** comprising USB type electrical connectors, expansion modules **16** comprising USB type electrical connectors, a mode selection switch **27** comprising USB type electrical connectors, or any other device comprising USB type electrical connectors together in electrical communication. In this embodiment, two expansion modules **16** may be connected to the USB hub **22** by connecting or inserting each expansion module **16** into one of the expansion ports **28** (FIGS. **3**, **4**, **10**, and **12**) as shown in FIG. **13**.

In a similar fashion and in the example shown in FIG. **13**, a memory card and a device comprising a male connector may be connected to a USB hub **22** by connecting or inserting a memory card into a memory card reader expansion module **16**B and the male connector into the female connector of a female plug member expansion module **16**A. In preferred embodiments, a memory card to USB data conversion integrated circuit common in the art may allow data and electrical connection between a memory card reader type expansion module **16**B (FIGS. **13** and **14**C) and the USB hub **22**. By connecting a memory card to USB data conversion integrated circuit between the memory card reader type expansion module **16**B and the USB hub **22**, the memory card reader type expansion module **16**B may be treated as a USB port by the

USB hub **22**. Likewise, an electronic device such as an external battery pack, a solar charger, an external camera attachment, or any other similar device comprising a male connector may be connected to a USB hub **22** by connecting or inserting the male connector of the device into a female connector of a female plug member expansion module **16**A.

As shown in FIGS. **15-17**, a USB hub **22** may preferably be in electrical communication with a mode selection switch **27** which may be configured to selectively provide electrical communication between one or more female plug members **31**, a USB hub **22**, a wireless charging receiver **23**, and/or a male plug member **21**. In preferred embodiments, a mode selection switch **27** may comprise an electronic mode switching using multi-input integrated circuit switch adapted to provided electronic mode switching between a plurality of data sources (i.e. data from a micro USB port and data from a microSD port). In some embodiments, the mode selection switch **27** may comprise a mechanical switch which may be manually operated by a user. In other embodiments, the mode selection switch **27** may comprise an integrated circuit mode selection switch which may be operated by software running on the portable device, the mode selection switch itself, and/or on the USB hub **22**.

Turning now to FIG. **16**, a mode selection switch **27** may comprise any type of device which is configured to connect the electrical connection points such as a V+ or VCC +5 V (red wire) electrical connection point **17**A, a D+ or Data+ (green wire) electrical connection point **17**B, a D− or Data− (white wire) electrical connection point **17**C, and a GND or Ground (black wire) electrical connection point **17**D from one electrical component to another electrical component. In this and preferred embodiments, a mode selection switch **27** may provide electrical communication between one or more male plug members **21**, one or more second female plug members **31**B, and a USB hub **22**. In preferred embodiments, the male plug member **21** may comprise a Sense electrical connection point **17**E which may be joined to the GND or Ground (black wire) electrical connection point **17**D through a Sense to GND resistor **35** which may have a resistance of between 0 and 200 k ohm. The electrical communication between the male plug member **21** and the mode selection switch may then comprise a USB OTG connection with the male plug member **21** comprising a Sense electrical connection point **17**E connected to the ground electrical connection point **17**D. In preferred embodiments, a Sense to GND resistor **35** may have a resistance of between 20 and 40 k ohm such as 36.5 k ohm

In this embodiment, a wireless charging receiver **23** may be connected to the mode selection switch **27**. A wireless charging receiver **23** may be configured to receive energy such as an electric charge from an external power supply through an inductive coupling and to communicate the energy to the mode selection switch and the male plug member **21** allowing the energy to inductively charge a portable device connected to the male plug member **21** or any other electrical device connected to the mode selection switch **27**. In further embodiments, a wireless charging receiver **23** may be configured to receive energy or an electric charge from an external power supply through an inductive coupling and to communicate the energy to the USB hub **22** and therefore to any other female plug member **31** or expansion module **16** in electrical communication with the USB hub **22**.

A mode selection switch **27** may be configured to change the mode of the case **100** by changing the electrical communication between the electrical components of the case **100** such as one or more expansion modules **16** in electrical communication with a USB hub **22**, USB hubs **22**, wireless charging receivers **23**, female plug members **31**, and/or male plug members **21**. A mode selection switch **27** may further be configured to selectively interconnect or disconnect the electrical communication between of any of the electrical components of the case **100** such as one or more expansion modules **16**, USB hubs **22**, wireless charging receivers **23**, female plug members **31**, and/or male plug members **21** with any of the other electrical components.

In some exemplary embodiments, the mode of the case **100** may be set to provide or connect the electrical communication between a memory card inserted into a memory card reader expansion module **16**B, a male plug connector inserted into a female connector of a female plug member expansion module **16**A, a male plug connector inserted a first female plug member **31**A (FIG. **15**) and/or any other device in electrical communication with a USB hub **22** with the male plug member **21** which may be inserted into the female connector of a portable device received in the case **100**. The mode selection switch **27** may be configured to set the case into a first mode, wherein the mode selection switch **27** is configured to provide electrical communication between the male plug member **21** and the USB hub **22**, while disconnecting the electrical communication of the female plug member **31** from both the male plug member **21** and the USB hub **27**. This mode, illustratively called Mobile Device to Memory Cards and Expansion Port Mode, would allow the portable device to electrically communicate a device connected to the USB hub **22** such as accessing files on a memory card that is placed into the memory card reader expansion module **16**B, while also allowing the portable device to be connected to one or more external devices or modules which are in electrical communication with the USB hub **22**. In this mode, the mode selection switch **27** may be configured to interconnect the electrical communication from the USB hub **22** to the male plug member **21**. By directing the mode selection switch into this mode, the user can connect an external device or module (for example, battery module, memory card, solar charging module, pico-projector module, and the like) to the case **100** and the portable device could then electrically communicate with the device in electrical communication with the USB hub **22**.

In some exemplary embodiments, the mode of the case **100** may be set to provide electrical communication between a portable device received in the case **100** in which the male plug member **21** is inserted into the female connector of the portable device and a male connector of an external device such as a computer that is inserted into a female plug member **31** which is in electrical communication with the mode selection switch **27**. The mode selection switch **27** may be configured to set the case into a second mode, wherein the mode selection switch **27** is configured to provide electrical communication between the male plug member **21** and the second female plug member **31**B, while disconnecting the electrical communication of the USB hub **22** from both the male plug member **21** and the second female plug member **31**B. This mode, illustratively called Mobile Device to Computer Mode, would allow the external device to access files on the portable device. In this mode, the mode selection switch **27** may be configured to interconnect the electrical communication through the USB hub **22** of the male plug member **21** and the female connector expansion port **16**A. By directing the mode selection switch into this mode, the user can connect the portable device to a computer for the purpose of syncing data between them while the portable device remains secured in the case **100**.

In some exemplary embodiments, the mode of the case **100** may be set to provide electrical communication between a memory card inserted into a memory card reader expansion

module **16**B, and a male connector of an external device such as a computer that is in electrical communication with a second female plug member **31**B in electrical communication with the mode selection switch **27**. The mode selection switch **27** may be configured to set the case into a third mode, wherein the mode selection switch **27** is configured to provide electrical communication between the second female plug member **31**B and an expansion module **16** in electrical communication with the USB hub **22**, while disconnecting the electrical communication of the male plug member **21** from both the female plug member **31** and the USB hub **22**. This mode, illustratively called Memory Card to Computer Mode, would allow the external device to access files on the memory card that is placed into the memory card reader expansion port **16**B, without requiring the memory card to be disconnected from the female connector expansion port **16**A or the portable device to be removed from the case **100**. In this mode, the mode selection switch **27** may be configured to interconnect the electrical communication through the USB hub **22** of a memory card reader expansion port **16**B and a female connector expansion port **16**A. By directing the mode selection switch into this mode, the files on the memory card can be accessed directly from a computer while the portable device remains securely received in the case **100**.

Although the present invention has been illustrated and described herein with reference to preferred embodiments and specific examples thereof, it will be readily apparent to those of ordinary skill in the art that other embodiments and examples may perform similar functions and/or achieve like results. All such equivalent embodiments and examples are within the spirit and scope of the present invention, are contemplated thereby, and are intended to be covered by the following claims.

What is claimed is:

1. A case for mobile devices, the case comprising;

a. a protective shell configured to receive a mobile device;

b. a circuit board coupled to the protective shell said circuit board comprising a USB hub and a mode selection switch, wherein the USB hub is in electrical communication with the mode selection switch;

c. a male plug member in electrical communication with the mode selection switch and configured to transfer electrical signals from the mode selection switch to the mobile device.

2. The case of claim **1**, wherein the mode selection switch provides electronic mode switching between a plurality of data sources.

3. The case of claim **1**, wherein the case comprises a first expansion port positioned within the protective shell and having electrical contact points in electrical communication with the USB hub.

4. The case of claim **2**, wherein the case comprises a second expansion port positioned within the protective shell and having electrical contact points in electrical communication with the USB hub.

5. The case of claim **3**, wherein the case is configured to temporarily couple a first expansion module within the first expansion port, said first expansion module having a first end and a second end, and having electrical contact points on said first end and having a female connector on said second end, the electrical contact points on said first end adapted to operably engage with the electrical contact points of the first expansion port.

6. The case of claim **5**, wherein the female connector is a female plug connector configured to act as a micro USB port.

7. The case of claim **5**, wherein the female connector is a female plug connector configured to act as a microSD port.

8. The case according to claim **5**, wherein the case is configured to temporarily couple a second expansion module, said second expansion module having a first end and a second end, and having electrical contact points on said first end and having a female connector on said second end, the electrical contact points on said first end adapted to operably engage with the electrical contact points of a second expansion port.

9. The case according to claim **1**, further comprising a wireless charging receiver **23** in electrical communication with the mode selection switch and adapted to receive an electrical charge from an external power supply and transfer the electrical charge to the portable device.

10. The case according to claim **9**, wherein the mode selection switch provides electrical communication between the male plug member and the USB hub, said electrical communication comprising:

a. a VCC +5 V electrical communication between the mode selection switch and the USB hub;

b. a Data + electrical communication between the mode selection switch and the USB hub;

c. a Data − electrical communication between the mode selection switch and the USB hub; and

d. a Ground electrical communication between the mode selection switch and the USB hub.

11. The case according to claim **10**, wherein the electrical communication between the male plug member and the mode selection switch is a USB OTG connection and the male plug member comprises a Sense electrical connection point connected to a Ground electrical connection point.

12. The case according to claim **11**, further comprising a resistor between the Ground electrical connection point connection and the Sense electrical connection point.

13. The case according to claim **12**, wherein the resistor has a resistance between 0 and 200 k ohms.

14. The case according to claim **13**, wherein the resistor has a resistance of between 25-50 ohms.

15. The case according to claim **1**, wherein the mode selection switch is configured to selectively provide electrical communication between the USB hub, a female plug member, and the male plug member.

16. The case according to claim **5**, wherein the mode selection switch is configured to selectively provide electrical communication between the first expansion module in electrical communication with the USB hub, a female plug member, and the male plug member.

17. A case for mobile devices, the case comprising a protective shell layer, a circuit board secured within the shell layer configured to receive a plurality of data signals from a plurality of sources, a first expansion port configured to receive a first data signal and a second expansion port configured to receive a second data signal, said first and second expansion ports in electronic communication with the circuit board, and a male plug member in electronic communication with the circuit board and configured to transfer a data signal between a mobile device and the circuit board.

18. The case of claim **17**, further comprising a first expansion module temporarily mounted within the protective shell layer and in electrical communication with the first expansion port and providing the first data signal.

19. The case of claim **18**, further comprising a second expansion module temporarily mounted within the protective shell layer and in electrical communication with the second expansion port and providing the second data signal.

20. The case of claim **19**, wherein the circuit board is configured to accept the first data signal from the first expansion module and the second data signal from the second

expansion module and transfer the first and second data signals between a mobile device through the male plug member.

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