



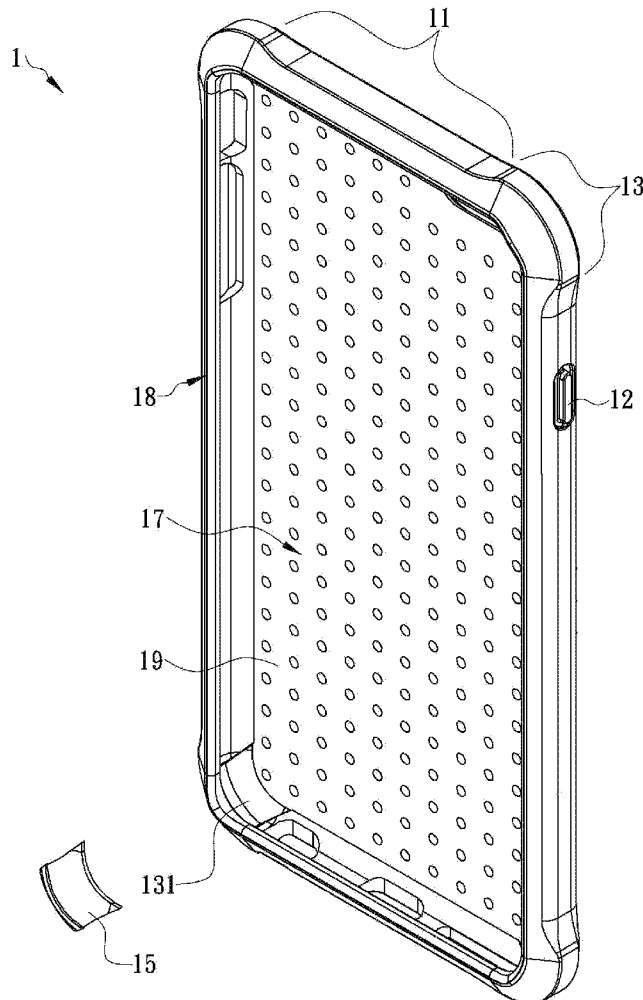
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(19) **United States**(12) **Patent Application Publication**
CHANG(10) **Pub. No.: US 2016/0219999 A1**(43) **Pub. Date: Aug. 4, 2016**(54) **PROTECTIVE CASE WITH EMBEDDED
ELASTIC CUSHION PLATES**(52) **U.S. Cl.**CPC *A45C 11/00* (2013.01); *A45C 2011/002*
(2013.01); *A45C 2011/003* (2013.01)(71) Applicant: **Ke-Chang CHANG**, New Taipei City
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A45C 11/00 (2006.01)(57) **ABSTRACT**

The present invention is to provide a protective case embedded with elastic cushion plates and applicable to a portable electronic device (e.g., a smartphone, tablet PC, or e-book reader), which includes a case body made of a first elastic material (e.g., thermoplastic polyurethane) and having four sidewalls and four curved walls each connecting two adjacent sidewalls to jointly form a receiving space, and four elastic cushion plates made of a second elastic material (e.g., silicone) whose hardness is less than that of the first elastic material. Each curved wall is embedded with the elastic cushion plate. Thus, when the portable electronic device is fitted into the receiving space through an opening of the protective case, four corners of the portable electronic device lie against the elastic cushion plates respectively, so as to ensure that the elastic cushion plate can greatly reduce impact of an external force applied to the corner.



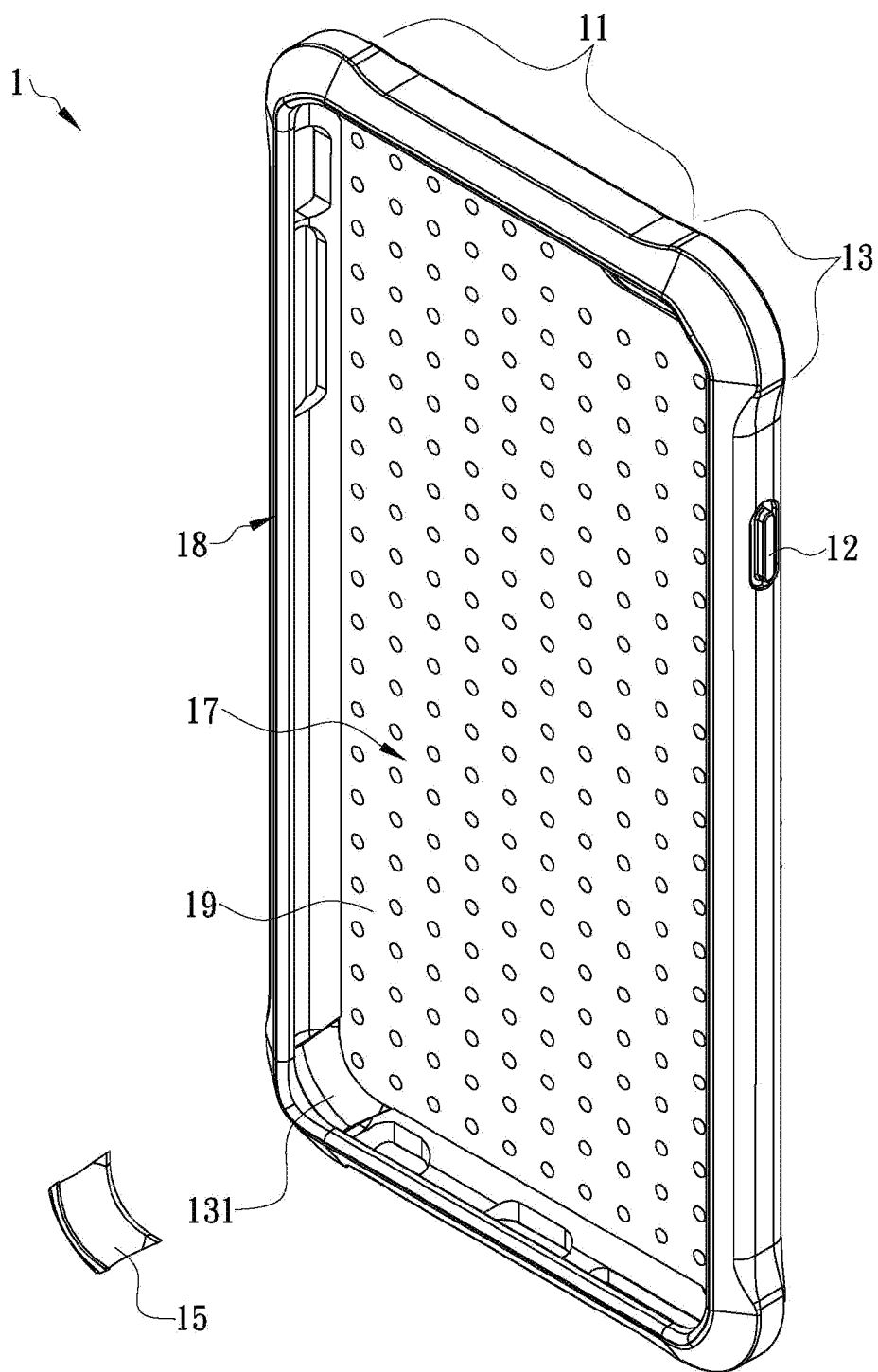


FIG. 1

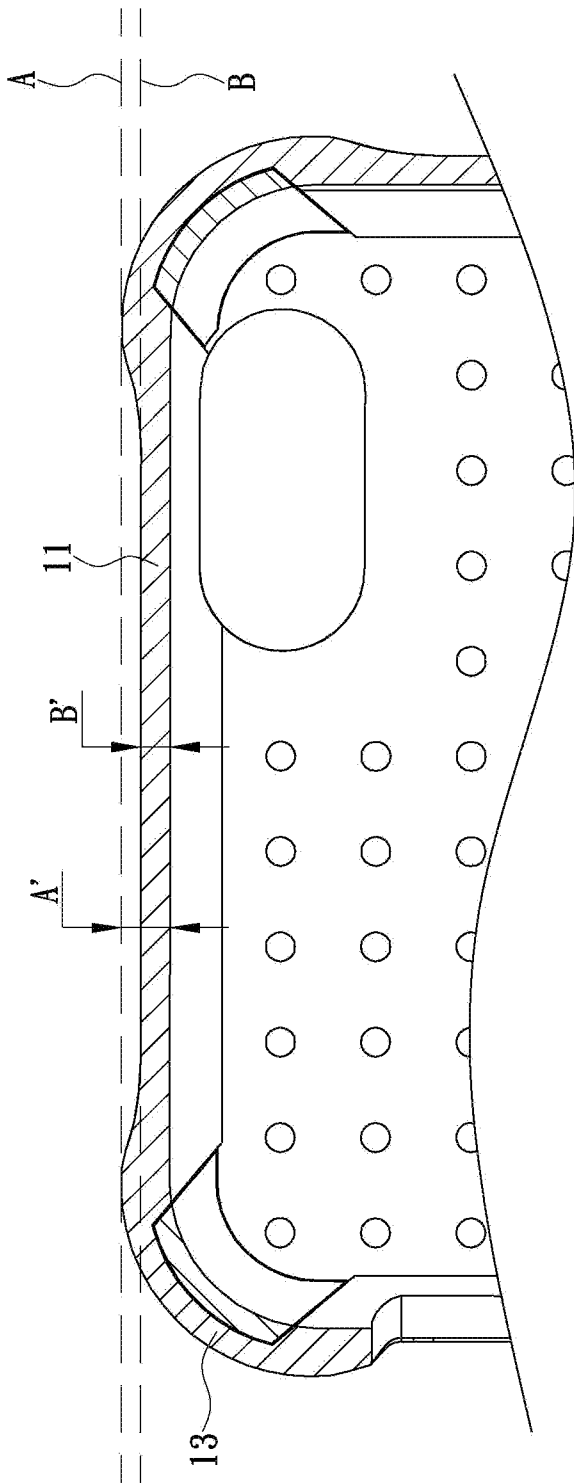


FIG. 2

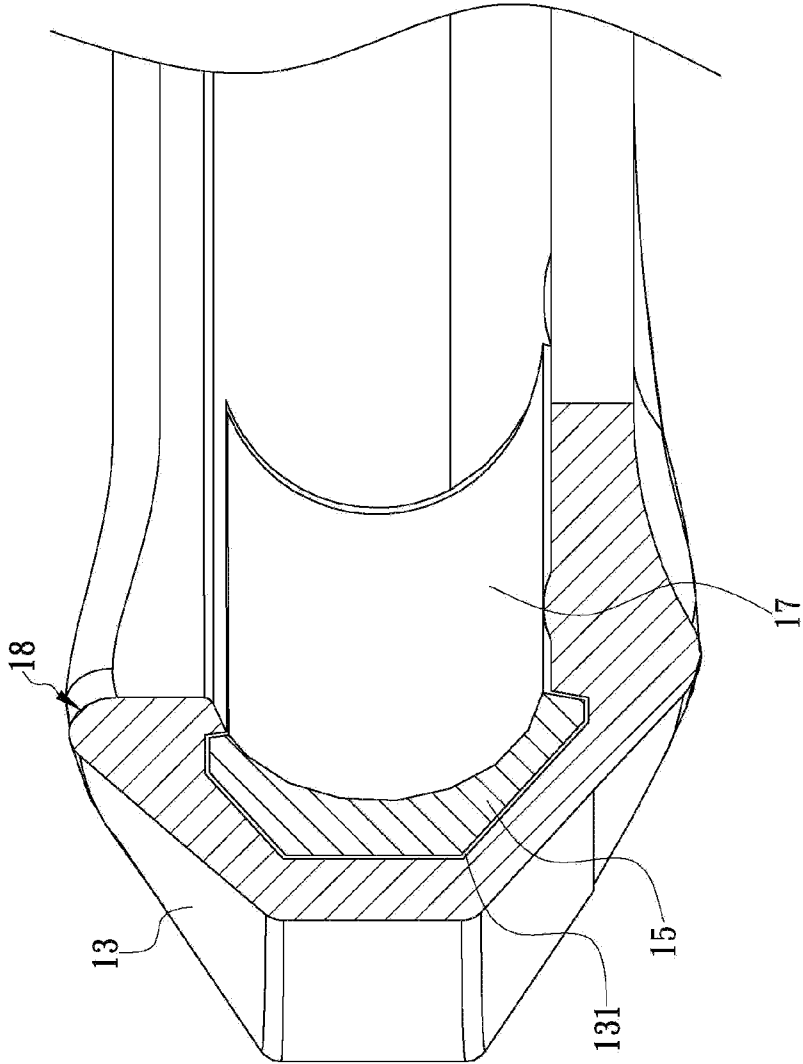


FIG. 3

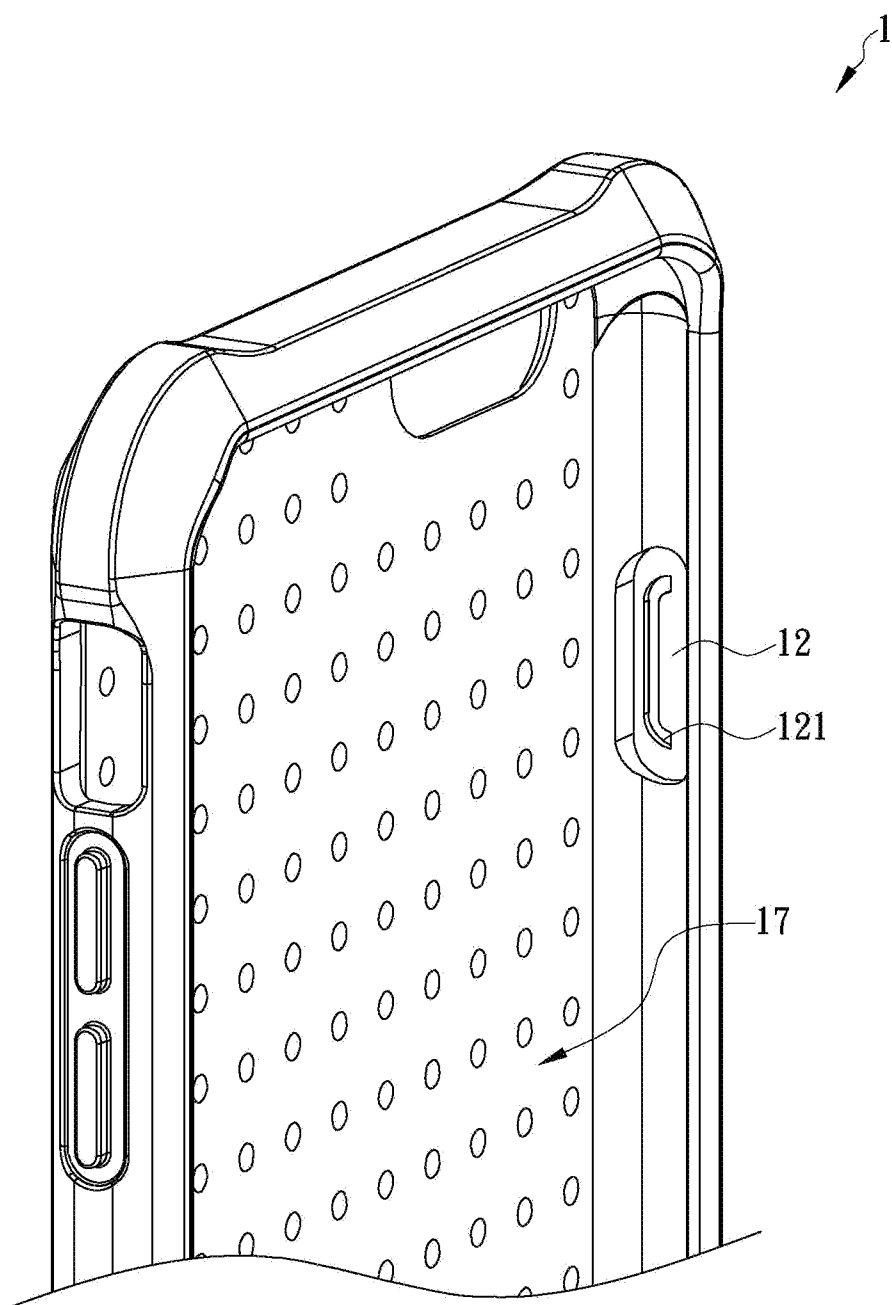


FIG. 4

PROTECTIVE CASE WITH EMBEDDED ELASTIC CUSHION PLATES

FIELD OF THE INVENTION

[0001] The present invention relates to a protective case, more particularly to a protective case embedded with elastic cushion plates and applicable to a portable electronic device (e.g., a smartphone, tablet PC, or e-book reader), which includes a case body made of a first elastic material (e.g., thermoplastic polyurethane) and having four sidewalls and four curved walls each connecting two adjacent sidewalls to jointly form a receiving space, and four elastic cushion plates made of a second elastic material (e.g., silicone) whose hardness is less than that of the first elastic material. Each curved wall is embedded with the elastic cushion plate. Thus, when the portable electronic device is fitted into the receiving space through an opening of the protective case, the inner side of each sidewall lies against each side of the portable electronic device, and each curved wall corresponds to each corner of the portable electronic device, such that the four corners of the portable electronic device lie against the elastic cushion plates respectively, so as to ensure that the curved wall and the elastic cushion plate corresponding to the corner will be elastically deformed by an external force applied to the portable electronic device and hence greatly reduces the impact of the external force.

BACKGROUND OF THE INVENTION

[0002] Microcomputers and mobile broadband Internet connection techniques have advanced significantly with the rapid development of technology around the globe. In consequence, portable electronic devices have shown a decline in production costs and been made increasingly thinner and lighter. Today, the market is supplied with a good variety of portable electronic devices featuring Internet connectivity and multimedia functions, some notable examples of which devices are smartphones, personal digital assistants (PDAs), tablet PCs, digital frames, and e-book readers. As portable electronic devices continue to be the subject of research and development efforts of many a manufacturer, more and more people are adapting their reading habits to the use of e-book readers, digital frames, or the like as the principal information reading media in lieu of the conventional paper books or picture frames.

[0003] Compared with personal computers, the aforesaid portable electronic devices can be carried with greater ease and have more diversified functions, which, aside from picture taking, video calls, and music playback, may also include word processing, receiving and sending e-mails, or downloading and playing streaming media. The ultimate goal is to satisfy all sorts of user needs. Portable or mobile electronic devices, therefore, are in extensive use and almost ubiquitous in our daily lives.

[0004] Due to their powerful functions and wide application, the aforesaid portable electronic devices are used more and more frequently by their users and hence stand a progressively greater chance of being worn or scratched by pointed objects or damaged by the impact of an inadvertent drop or collision. Should any of the foregoing incidents happen to a portable electronic device, a minor damage (e.g., scratches on the screen or on the main body of the portable electronic device) may impair the appearance only, but a major one (e.g., that caused to the circuit board and circuits in the portable

electronic device or a cracked or shattered screen) may lead to malfunction. In light of this, protective elements have been developed to lower the chances of damage to the aforesaid portable electronic devices.

[0005] Currently, the most common protective elements are in the forms of shrink wraps, protective cases or pouches, and adhesive films. These protective elements serve mainly to keep a portable electronic device from wear and scratches attributable to contact with a pointed object but are hardly protective against the impact of collision. In other words, the conventional protective elements for use with a portable electronic device can only prevent superficial damages but fail to provide sufficient protection against collision which may cause severe damage to functionality. Obviously, there is plenty of room for improvement on the protection that a conventional protective element can offer a portable electronic device.

[0006] According to the above, the conventional protective elements designed for portable electronic devices are incapable of furnishing complete protection, and this has given rise to the issue to be addressed by the present invention: to design a protective case capable of mitigating the impact of an external force so that a portable electronic device enclosed in the protective case is protected from damage upon collision.

BRIEF SUMMARY OF THE INVENTION

[0007] In view of and in order to overcome the aforementioned drawbacks of the conventional protective elements in design, the inventor of the present invention incorporated years of practical experience in the industry into careful observation and extensive research and development and, after repeated adjustments and performance evaluations, finally succeeded in developing a protective case with embedded elastic cushion plates as disclosed herein.

[0008] The present invention provides a protective case embedded with elastic cushion plates and applicable to a portable electronic device (e.g., a smartphone, tablet PC, or e-book reader). The protective case includes a case body and four elastic cushion plates. The case body is made of a first elastic material (e.g., thermoplastic polyurethane), at least includes four sidewalls and four curved walls, and is embedded with the four elastic cushion plates. Each curved wall connects two adjacent sidewalls such that a receiving space is jointly formed and surrounded by the curved walls and the sidewalls. The rear ends of the curved walls and of the sidewalls are joined together to form a rear wall at the rear end of the case body. The front end of the case body forms an opening. The opening is in communication with the receiving space and has a diameter smaller than the inner diameter of the receiving space. The inner side of each curved wall is concavely provided with an embedment groove. Each two adjacent curved walls jointly define a tangent line tangent to the outer peripheries of both curved walls. The sidewall between each two adjacent curved walls has an outer side defining an extension line. The elastic cushion plates are made of a second elastic material (e.g., silicone) whose hardness is less than that of the first elastic material. Each elastic cushion plate matches a corresponding one of the embedment grooves in configuration. Each elastic cushion plate is securely fitted in the corresponding embedment groove and is thus firmly connected to the corresponding curved wall. Once the portable electronic device is fitted into the receiving space through the opening, the inner side of each sidewall lies against one of the four peripheral sides of the portable elec-

tronic device, each curved wall corresponds to one of the four corners of the portable electronic device, and the four corners of the portable electronic device lie against the elastic cushion plates respectively. In addition, a first distance defined between each tangent line and the portable electronic device is greater than a second distance defined between each extension line and the portable electronic device. Therefore, if any of the four corners of the case body is hit by an external force while the portable electronic device is enclosed in the case body, the curved wall corresponding to the corner will be elastically deformed by the external force and hence greatly reduce the impact of the external force. In the meantime, the corresponding elastic cushion plate will undergo an even greater elastic deformation and further reduce the impact already alleviated by the curved wall. A better protective effect than achievable in the prior art is thus produced to keep the portable electronic device from damage by the impact of the external force. Besides, a manufacturer can make the case body transparent and provide the elastic cushion plates with various colors so that the colorful embedded elastic cushion plates enhance the protective case esthetically.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0009] The objectives as well as the assembly method, structural features, and effects of the present invention will be best understood by referring to the following detailed description of some illustrative embodiments in conjunction with the accompanying drawings, in which:

[0010] FIG. 1 is a perspective view of the protective case in the present invention;

[0011] FIG. 2 is a partial sectional view of the protective case in the present invention;

[0012] FIG. 3 is another partial sectional view of the protective case in the present invention, showing in particular the curved walls; and

[0013] FIG. 4 is a perspective view, taken from a different viewing angle, of the protective case in the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0014] The present invention provides a protective case having embedded elastic cushion plates. In the first preferred embodiment of the present invention as shown in FIG. 1, the protective case is applied to a smartphone (not shown). A manufacturer, however, may adjust the dimensions of the protective case so that the dimensionally modified protective case is applicable to other portable electronic devices such as a tablet PC or e-book reader.

[0015] Referring to FIG. 1 and FIG. 2, the protective case includes a case body 1 and four elastic cushion plates 15. The case body 1 is made of a first elastic material such as silicone, rubber, or thermoplastic polyurethane (TPU). The case body 1 at least includes four sidewalls 11 and four curved walls 13 and, as explained in more detail below, is embedded with the four elastic cushion plates 15. Each curved wall 13 connects two adjacent sidewalls 11 such that the curved walls 13 and the sidewalls 11 jointly form and surround a receiving space 17. The inner side of each curved wall 13 is concavely provided with an embedment groove 131. Each two adjacent curved walls 13 jointly define a tangent line A which is tangent to the outer peripheries of both curved walls 13. The outer side of the sidewall 11 between each two adjacent curved walls 13 defines an extension line B. In the first preferred

embodiment, the rear ends of the curved walls 13 and of the sidewalls 11 are joined together to form a rear wall 19 at the rear end of the case body 1. Meanwhile, an opening 18 is formed at the front end of the case body 1 and is in communication with the receiving space 17. The diameter of the opening 18 is smaller than the inner diameter of the receiving space 17 so that a user can put the smartphone into the receiving space 17 through the opening 18, with the screen of the smartphone corresponding to the opening 18, in order to read the data displayed on the screen or perform touch control operations on the screen through the opening 18. The rear wall 19 serves to protect the back of the smartphone from scratches and wear but can be dispensed with if so desired, in which case the case body 1 covers only the peripheral sides of the smartphone.

[0016] Referring to FIG. 1 and FIG. 3, the elastic cushion plates 15 are made of a second elastic material (e.g., silicone, rubber, or TPU) whose hardness is less than or equal to that of the first elastic material. In addition, the configuration of each elastic cushion plate 15 matches the configuration of a corresponding one of the embedment grooves 131. Each elastic cushion plate 15 is securely fitted in the corresponding embedment groove 131 and is thus firmly connected to the corresponding curved wall 13.

[0017] Reference is now made to FIG. 1, FIG. 2, and FIG. 3. Once the smartphone is fitted into the receiving space 17 via the opening 18, the inner side of each sidewall 11 lies against one of the four peripheral sides of the smartphone, and each curved wall 13 corresponds to one of the four corners of the smartphone such that the four corners of the smartphone lie against the elastic cushion plates 15 respectively. Moreover, referring to FIG. 2, a first distance A', which is defined as the distance between the tangent line A and the smartphone, is greater than a second distance B', which is defined as the distance between the extension line B and the smartphone. Thus, should the smartphone enclosed in the case body 1 be inadvertently dropped to the ground, it will be one or two of the curved walls 13 that touch the ground first, thereby keeping the sidewalls 11 from direct contact with the ground. The impact of the collision, therefore, is applied directly to the one or two curved walls 13 rather than the sidewalls 11 or the smartphone itself and is prevented from damaging the smartphone.

[0018] More specifically, when the smartphone is enclosed in the case body 1, and one of the four corners of the case body 1 is hit by an external force, the corresponding curved wall 13 is elastically deformed by the external force and thus substantially reduces the impact of the external force. In addition, the corresponding elastic cushion plate 15 undergoes an even greater elastic deformation to further relieve the impact already reduced by the curved wall 13. Thus, better protection than achievable by the conventional protective elements is provided against the impact of the external force to keep the smartphone from damage.

[0019] Referring back to FIG. 1, the major features of the present invention are as follows. When any of the curved walls 13 is subjected to an external force, both the curved wall 13 and the corresponding elastic cushion plate 15 are deformed to produce a double cushioning effect that well protects the portable electronic device enclosed in the case body 1. Furthermore, the case body 1 not only is lightweight and easy to carry, but also allows a high degree of freedom in the selection of material. More specifically, the case body 1 need not be made of a highly elastic material such as silicone

but can be made of a slightly less elastic material such as TPU instead without compromising the intended protective effect. Now that the material of the case body **1** can be selected from a wide variety, the case body **1** features high flexibility in external design. For example, a transparent case body can be made of TPU while colorful elastic cushion plates are made of silicone. Such flexibility is expected to boost market competitiveness considerably.

[0020] In another embodiment of the present invention, referring to FIG. 4 in conjunction with FIG. 1, the case body **1** is further provided with at least one pressing portion **12**. The pressing portion **12** is provided at a position corresponding to a button of a portable electronic device and matches the button in configuration. Thus, even if the portable electronic device is enclosed in the case body **1**, the user can still press the button easily through the pressing portion **12** in order to operate the portable electronic device. Moreover, one lateral side of the pressing portion **12** is formed with a press-facilitating groove **121** which extends through the pressing portion **12** and is in communication with the receiving space **17** so as to reduce the resistance felt by the user when pressing the pressing portion **12**. Thanks to the press-facilitating groove **121**, the pressing portion **12** can be elastically deformed to a greater extent than without the groove, thus reducing the force required, and making it more facile, to trigger the button via the pressing portion **12**.

[0021] The above-mentioned descriptions represent merely the exemplary embodiment of the present disclosure, without any intention to limit the scope of the present disclosure thereto. Various equivalent changes, alternations or modifications based on the claims of present disclosure are all consequently viewed as being embraced by the scope of the present disclosure.

What is claimed is:

1. A protective case with embedded elastic cushion plates, applicable to a portable electronic device, the protective case comprising:

a case body made of a first elastic material and comprising four sidewalls and four curved walls, each said curved wall connecting two adjacent said sidewalls such that the curved walls and the sidewalls jointly form a receiving space surrounded by the curved walls and the sidewalls, the case body having a front end forming an opening, the opening being in communication with the receiving space and having a diameter smaller than an inner diameter of the receiving space, each said curved wall having an inner side concavely provided with an embedment groove; and

four elastic cushion plates made of a second elastic material having a hardness less than a hardness of the first elastic material, each said elastic cushion plate matching a corresponding one of the embedment grooves in con-

figuration and being securely fitted in the corresponding embedment groove and thus firmly connected to the curved wall concavely provided with the corresponding embedment groove;

wherein after the portable electronic device is fitted into the receiving space through the opening, each said sidewall has an inner side lying against one of four peripheral sides of the portable electronic device, each said curved wall corresponds to one of four corners of the portable electronic device, and the four corners of the portable electronic device lie against the elastic cushion plates respectively.

2. The protective case of claim **1**, wherein each two adjacent said curved walls define a tangent line tangent to outer peripheries of the two adjacent curved walls, the sidewall between each two adjacent said curved walls has an outer side defining an extension line, each said tangent line and the portable electronic device jointly define a first distance therebetween, each said extension line and the portable electronic device jointly define a second distance therebetween, and each said first distance is greater than a corresponding said second distance.

3. The protective case of claim **1**, wherein the curved walls and the sidewalls have rear ends joined together to form a rear wall at a rear end of the case body.

4. The protective case of claim **2**, wherein the curved walls and the sidewalls have rear ends joined together to form a rear wall at a rear end of the case body.

5. The protective case of claim **3**, wherein the case body is further provided with at least one pressing portion corresponding in position to a button of the portable electronic device and matching the button in configuration.

6. The protective case of claim **4**, wherein the case body is further provided with at least one pressing portion corresponding in position to a button of the portable electronic device and matching the button in configuration.

7. The protective case of claim **5**, wherein the pressing portion is provided with a press-facilitating groove extending through the pressing portion and being in communication with the receiving space of the case body.

8. The protective case of claim **6**, wherein the pressing portion is provided with a press-facilitating groove extending through the pressing portion and being in communication with the receiving space of the case body.

9. The protective case of claim **7**, wherein the first elastic material or the second elastic material is silicone, rubber, or thermoplastic polyurethane.

10. The protective case of claim **8**, wherein the first elastic material or the second elastic material is silicone, rubber, or thermoplastic polyurethane.

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