Title: PORTABLE ELECTRONIC PRODUCT WITH WATERPROOF STRUCTURE AND WATERPROOFING METHOD THEREOF

Abstract: Provided is a portable electronic product having an exterior casing forming a first accommodation space and an interior part assembly having a waterproof portion accommodated in the first accommodation space of the exterior casing. The portable electronic product includes upper and lower waterproof frames having a second accommodation space in which the interior part assembly is accommodated when the upper and lower waterproof frames are coupled to each other, respectively first injection molded using synthetic resin to have at least one cut portion, and combined to each other to encompass the waterproof portion of the interior part assembly by accommodating the interior part assembly in the second accommodation space. A gripping groove is formed during the first injection molding along an edge portion of a wall portion of one of the upper and lower waterproof frames, the wall portion facing the other one of the upper and lower waterproof frames, and a gripping rib forcibly inserted in the gripping groove is second injection molded using synthetic resin exhibiting elasticity along an edge portion of a wall portion of the other one of the upper and lower waterproof frames, the wall portion facing the one of the upper and lower waterproof frames.
Published:  
— with international search report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.
Description
PORTABLE ELECTRONIC PRODUCTS WITH WATERPROOF STRUCTURE AND WATERPROOFING METHOD THEREOF

Technical Field

[1] The present invention is related to a portable electronic product with a waterproof structure and a waterproofing method thereof, and more particularly, to a portable electronic product with a waterproof structure having a waterproof function that is not lost even if the product is exposed to water, and a waterproofing method thereof.

Background Art

[2] Portable electronic products such as mobile phones, PDAs (personal digital assistants), notebook computers, LCD TVs, walkietalkies, CD players, MP3 players, and digital cameras can be freely used regardless of places. These portable electronic products can be exposed to water, for example, falling into water or being wet by rain. In this case, if the product is not waterproof and thus water intrudes into an exterior casing so that circuit parts inside the exterior casing are wet, the circuit parts may malfunction or do not work properly. Thus, there is a need to prevent such defects so that a user can carry the portable electronic products on the beach or in the sauna or conveniently make a telephone call in such a place. Therefore, there is a need for a portable electronic product with a waterproof structure which can prevent the circuit parts from contacting water by blocking intrusion of water or moisture into the circuit parts when the portable electronic products accidentally fall into water.

[3] However, in the conventional portable electronic product, in particular, in a conventional mobile phone, since a waterproof design is hardly available, the mobile phone when being slightly exposed to water easily malfunctions or does not work properly. Also, although there are a few of products which are waterproof designed considering the above problem, a method of sealing all openings in the exterior casing of the portable electronic product is adopted. However, since it is practically difficult to seal all openings in the exterior casing into which water intrudes, sufficient waterproof processing is not achieved. To seal all openings in the exterior casing, the size of the portable electronic product needs to be increased, which may greatly limit exterior design of the portable electronic product. Also, the costs for development and manufacture are raised so that the market value of the portable electronic product is deteriorated.

[4] To solve the above problems, Korean Patent Publication No. 2004-0022161 was filed by the present applicant, in which a waterproof portion of an interior part assembly included in an exterior casing is provided first by covering the outside of the
interior part assembly coupled to a core frame by injection molding a resin mold using a material such as elastomer, or second by molding a resin mold using a material such as polycarbonate in vacuum molding, covering the core frame with the resin mold to enclose the outside of the interior part assembly accommodated in the core frame, and coupling the same to the exterior casing to prevent contact between water and the circuit part. According to the above-described structure, even when the circuit part of the interior part assembly is exposed to water, the intrusion of water or moisture can be clearly blocked without affecting the design of the exterior casing.

However, in the conventional portable electronic product with a waterproof structure and a waterproofing method thereof, when the interior part assembly malfunctions and the core frame is separated to repair the malfunction, the resin mold is destroyed. Thus, when the interior part assembly is accommodated and coupled to the core frame, since an upper core frame and a lower core frame cannot be sealed like the original state, the original level of the waterproof function cannot be resumed. Also, since the insert injection mold is performed after the core frame and the interior part assembly are coupled to each other or the core frame and the resin mold are welded using an ultrasonic wave and a rubber coated layer is provided on the outer surface of the resin mold, the productivity of a product having the waterproof function is deteriorated.

Disclosure of Invention

Technical Problem

To solve the above and/or other problems, the present invention provides a portable electronic product with a waterproof structure which provides a waterproof function to prevent intrusion of water or moisture into circuit parts of the interior part assembly installed in the exterior casing, hardly affecting the design of an exterior casing of the portable electronic product such as a mobile phone, when the circuit parts are exposed to water, enables efficient production of the portable electronic products, and maintains the waterproof function to be used conveniently even when upper and lower waterproof frames are separated for the repair of the interior part assembly and then combined after the repair, and a waterproofing method thereof.

Technical Solution

According to an aspect of the present invention, a portable electronic product with a waterproof structure which includes an exterior casing forming a first accommodation space therein and an interior part assembly having a waterproof portion that needs to avoid contact with water and moisture and accommodated in the first accommodation space of the exterior casing, comprises upper and lower waterproof frames having a second accommodation space in which the interior part assembly is accommodated
when the upper and lower waterproof frames are coupled to each other, respectively first injection molded using synthetic resin to have at least one cut portion that is cut off a predetermined area facing a portion that needs exposure of the interior part assembly to the outside when the interior part assembly is accommodated in the second accommodation space, and combined to each other to encompass the waterproof portion of the interior part assembly by accommodating the interior part assembly in the second accommodation space, wherein a gripping groove is formed during the first injection molding along an edge portion of a wall portion of one of the upper and lower waterproof frames, the wall portion facing the other one of the upper and lower waterproof frames, and a gripping rib forcibly inserted in the gripping groove is second injection molded using synthetic resin exhibiting elasticity along an edge portion of a wall portion of the other one of the upper and lower waterproof frames, the wall portion facing the one of the upper and lower waterproof frames.

[8] The gripping groove is formed on the upper waterproof frame while the gripping rib is provided on the lower waterproof frame.

[9] The lower waterproof frame and the gripping rib are provided in a double shot injection molding method, a material of the lower waterproof frame is a plastic frame, and a material of the gripping rib is elastomer.

[10] A plurality of hook grooves are formed to be separated a predetermined distance from each other in an outer wall of the upper waterproof frame where the gripping groove is formed, and a plurality of hook protrusions caught by the hook protrusions are provided on an outer wall of the gripping rib. Thus, the release between the gripping rib and the gripping groove can be prevented.

[11] A seal vibration isolation rib is second injection molded using synthetic resin exhibiting elasticity along an edge portion of the cut portion. Thus, during the final product assembly, various input/output holes can be sealed and an impact to the exterior casing can be reduced.

[12] The seal vibration isolation rib is also provided during the second injection molding along an edge portion of a wall portion opposite to a wall portion of the upper waterproof frame that faces the lower waterproof frame.

[13] The seal vibration isolation rib comprises a locking member provided as a portion extends to the outside and having a fold line, at least one gripping protrusion is formed at an end portion of the locking member, and at least one gripping groove in which the gripping protrusion is forcibly inserted is formed in a wall portion opposite to a wall portion of the lower waterproof frame that faces the upper waterproof frame when the locking member is folded along the fold line.

[14] The upper waterproof frame and the seal vibration isolation rib is provided by double shot injection molding, the lower waterproof frame and the seal vibration
isolation rib is provided by double shot injection molding, a material of the upper waterproof frame and the lower waterproof frame is a plastic frame, a material of the seal vibration isolation rib is elastomer.

[15] The portable electronic product is a mobile phone and the interior part assembly is one of a printed circuit board installed on a main body casing of the mobile phone and a printed circuit board installed on a flip casing of the mobile phone.

[16] When the interior part assembly is a printed circuit board installed on the main body casing of the mobile phone, a keypad portion is integrally injection molded with the upper waterproof frame during the first injection molding to provide a keypad of the mobile phone.

[17] According to another aspect of the present invention, a method for waterproofing a portable electronic product having an exterior casing forming a first accommodation space therein and an interior part assembly having a waterproof portion that needs to avoid contact with water and moisture and accommodated in the first accommodation space of the exterior casing, comprises first injection molding upper and lower waterproof frames having a second accommodation space in which the interior part assembly is accommodated when the upper and lower waterproof frames are coupled to each other and at least one cut portion that is cut off a predetermined area facing a portion that needs exposure of the interior part assembly to the outside when the interior part assembly is accommodated in the second accommodation space, such that a gripping groove having a slot shape is formed along an edge portion of a wall portion of one of the upper and lower waterproof frames, the wall portion facing the other one of the upper and lower waterproof frames, second injection molding a gripping rib that is forcibly inserted in the gripping groove, using synthetic resin exhibiting elasticity, along an edge portion of a wall portion of the other one of the upper and lower waterproof frames, the wall portion facing the one of the upper and lower waterproof frames, and combining the upper and lower waterproof frames by accommodating the interior part assembly in the second accommodation space and forcibly coupling the gripping groove and the gripping rib of the upper and lower waterproof frames.

[18] The gripping groove is formed on the upper waterproof frame while the gripping rib is provided on the lower waterproof frame.

[19] In the second injection molding of a gripping rib, the lower waterproof frame and the gripping rib are provided in a double shot injection molding method, a material of the lower waterproof frame is a plastic frame, and a material of the gripping rib is elastomer.

[20] In the second injection molding of a gripping rib, a seal vibration isolation rib is injection molded along an edge portion of the cut portion when the gripping rib is injection molded, the seal vibration isolation rib is also provided during the second
injection molding along the edge portion of an opposite wall portion of the upper waterproof frame that faces the lower waterproof frame, and the seal vibration isolation rib is formed of elastomer.

[21] In the first injection molding of the upper and lower waterproof frames, when the upper waterproof frame is injection molded, a plurality of hook grooves separated a predetermined distance from each other are formed in an outer wall of the upper waterproof frame where the gripping groove is formed.

[22] In the second injection molding of a gripping rib, when the gripping rib is injection molded, a plurality of hook protrusions that are caught by the hook grooves of the upper waterproof frame are formed on an outer wall of the gripping rib.

[23] When the interior part assembly is a printed circuit board installed on a main body casing of the mobile phone, a keypad portion is integrally injection molded with the upper waterproof frame during the first injection molding of the upper and lower waterproof frames to provide a keypad of the mobile phone.

**Advantageous Effects**

[24] As described above, according to the present invention, the portable electronic product with a waterproof structure provides a waterproof function to prevent intrusion of water or moisture into circuit parts of the interior part assembly installed in the exterior casing, hardly affecting the design of an exterior casing of the portable electronic product such as a mobile phone, when the circuit parts are exposed to water, enables efficient production of the portable electronic products, and maintains the waterproof function to be used conveniently even when upper and lower waterproof frames are separated for the repair of the interior part assembly and then combined after the repair, and a waterproofing method thereof.

**Brief Description of the Drawings**

[25] FIG. 1 is a partially cut-away perspective view of a mobile phone according to an embodiment of the present invention;

[26] FIG. 2 is a plan view of the mobile phone of FIG. 1 in a state in which an interior part assembly of a main body is coupled to a waterproof frame;

[27] FIG. 3 is a cross-sectional view taken along line III-III of FIG. 2;

[28] FIG. 4 is a rear view of the mobile phone of FIG. 2;

[29] FIG. 5 is a right side view of the mobile phone of FIG. 2;

[30] FIG. 6 is an exploded perspective view of the mobile phone of FIG. 2;

[31] FIG. 7 is a perspective view of a main body of an upper waterproof frame of FIG. 2;

[32] FIG. 8 is a perspective view of a seal vibration isolation rib of the upper waterproof frame of FIG. 2;

[33] FIG. 9 is a perspective view of a main body of a lower waterproof frame of FIG. 2;
FIG. 10 is a perspective view of a gripping rib and a seal vibration isolation rib coupled to the lower waterproof frame of FIG. 2;

FIG. 11 is a plan view of the mobile phone of FIG. 1 in a state in which an interior part assembly of a flip is coupled to a waterproof frame;

FIG. 12 is a cross-sectional view taken along line XII-XII of FIG. 11;

FIG. 13 is a rear view of the mobile phone of FIG. 11;

FIG. 14 is a right side view of the mobile phone of FIG. 11;

FIG. 15 is an exploded perspective view of the mobile phone of FIG. 11;

FIG. 16 is a perspective view of a main body of an upper waterproof frame of FIG. 11;

FIG. 17 is a perspective view of a seal vibration isolation rib of the upper waterproof frame of FIG. 11;

FIG. 18 is a perspective view of a main body of a lower waterproof frame of FIG. 11;

FIG. 19 is a perspective view of a gripping rib and a seal vibration isolation rib coupled to the lower waterproof frame of FIG. 11;

FIG. 20 is a plan view of a mobile phone according to another embodiment of the present invention, showing a state in which an interior part assembly of a main body of the mobile phone is coupled to a waterproof frame;

FIG. 21 is a right side view of the mobile phone of FIG. 20;

FIG. 22 is an exploded perspective view of the mobile phone of FIG. 20;

FIG. 23 is a perspective view of the mobile phone of FIG. 20, showing a state in which a seal vibration isolation rib coupled to an upper waterproof frame is injected; and

FIG. 24 is a perspective view of the mobile phone of FIG. 20, showing a state in which a locking member of the seal vibration isolation rib is folded.

**Best Mode for Carrying Out the Invention**

The present invention can be applied to any of portable electronic products such as mobile phones, PDAs (personal digital assistants), notebook computers, LCD TVs, walkietalkies, CD players, MP3 players, and digital cameras, which has an exterior casing forming an inner accommodation space and an interior part assembly having a waterproof portion which needs to be prevented from contacting water and accommodated in and coupled to the exterior casing. In the following description, the present invention is applied to a mobile phone.

FIG. 1 is a partially cut-away perspective view of a mobile phone according to an embodiment of the present invention. FIG. 2 is a plan view of the mobile phone of FIG. 1 in a state in which an interior part assembly of a main body is coupled to a
waterproof frame. FIG. 3 is a cross-sectional view taken along line III-III of FIG. 2. FIG. 4 is a rear view of the mobile phone of FIG. 2. FIG. 5 is a right side view of the mobile phone of FIG. 2. FIG. 6 is an exploded perspective view of the mobile phone of FIG. 2. FIG. 7 is a perspective view of a main body of an upper waterproof frame of FIG. 2. FIG. 8 is a perspective view of a seal vibration isolation rib of the upper waterproof frame of FIG. 2. FIG. 9 is a perspective view of a main body of a lower waterproof frame of FIG. 2. FIG. 10 is a perspective view of a gripping rib and a seal vibration isolation rib coupled to the lower waterproof frame of FIG. 2.

[51] Referring to FIGS. 1 through 10, a mobile phone 1 according to an embodiment of the present invention includes an exterior casing 10 forming a first accommodation space 18 therein, an interior part assembly 20 having a waterproofing portion to avoid contact with water or moisture and accommodated in the first accommodation space 18 of the exterior casing 10, and a lower waterproof frame 30 and an upper waterproof frame 40 formed of synthetic resin and first injection molded, accommodating the interior part assembly 20 in a second accommodation space (not shown) to encompass the waterproof portion of the interior part assembly 20, and accommodated in the first accommodation space 18 in the mobile phone 1 after being coupled to each other. A gripping groove 41, which will be described in detail later, is formed during a first injection molding along the edge portion of a wall portion of the upper waterproof frames 40 facing the lower waterproof frame 30. A gripping rib 31 to be forcibly inserted into the gripping groove 41 of the lower waterproof frame 30 is provided along the edge portion of a wall portion of the lower waterproof frame 30 facing the upper waterproof frame 40, in a second injection molding, that is, a double shot injection molding in which, for example, the second injection molding is continuously performed after the first injection molding of the lower waterproof frame 30. When the upper and lower waterproof frames 40 and 30 are coupled to each other while accommodating the interior part assembly 20 in the second accommodation space, a gripping combination occurs between the gripping groove 41 and the gripping rib 31. The gripping combination reinforces a combining strength between the upper and lower waterproof frames 40 and 30. Furthermore, since the gripping rib 31 is elastic, water is not able to intrude into a coupling portion between the upper and lower waterproof frames 40 and 30, thus providing a waterproof function.

[52] The exterior casing 10 has a main body casing 11 in which a plurality of signal input buttons 23a for a user to input data are installed, and a flip casing 15 in which a liquid crystal display (LCD) is installed. A main body interior part assembly 21 accommodated in and coupled to the upper and lower waterproof frames 40 and 30, which will be described later, is accommodated in and coupled to the main body casing 11. A flip interior part assembly 25 accommodated in and coupled to the upper and
lower waterproof frames 40 and 30, which will be described later, is accommodated in and coupled to the flip casing 15.

The main body casing 11 includes a plurality of button holes 12 formed according to the positions of the signal input buttons 23a so that the signal input buttons 23a can be exposed to the outside, and a connection portion 13 hinge-coupled to the flip casing 15. The flip casing 15 includes a screen hole 16 formed such that the LCD can be exposed to the outside, and a hinge connection portion 17 hinge-coupled to the main body casing 11. The flip casing 15 is open or closed with respect to the main body casing 11 by relatively pivoting around a pivot axis of a center line along the lengthwise direction of the hinge connection portion 17.

The interior part assemblies 20, 21, and 25 which are shown in detail in FIGS. 6 and 15 typically include printed circuit boards (PCB) 22 and 28 and functional parts such as antenna jack (not shown), an earphone jack 22a (please refer to FIG. 2), an external antenna jack (not shown), a contact point 22b (please refer to FIG. 2), and a dual speaker 27, and signify part assemblies after all operation tests are completed. The concept of waterproof design of the mobile phone 1 according to the present invention goes beyond that of the conventional waterproof design in which all openings in the exterior casing 10 of the mobile phone are sealed because the portion of the interior part assemblies 20, 21, and 25 exclusive of a portion such as a portion connected to an external device which needs exposure are encompassed using the upper and lower waterproof frames 40 and 30 that are injection molded with synthetic resin, the gripping groove 41 is provided in the upper waterproof frame 40 during the injection molding and the gripping rib 31 is provided in the lower waterproof frame 30 along the edge thereof, which is formed of synthetic resin exhibiting elasticity and a sealing feature in the double shot injection molding and capable of being forcibly inserted in the gripping groove 41, the gaps in a combining portion between the gripping groove 41 and the gripping rib 31 are sealed when the upper and lower waterproof frames 40 and 30 are coupled to each other so that water is prevented from intruding into the combining portion, thus providing a waterproof function.

In the folder type mobile phone 1 according to the present embodiment, the interior part assembly 20 includes the interior part assembly 21 accommodated in the main body casing 11 and the interior part assembly 25 installed in the flip casing 15. Thus, although the interior part assemblies 21 and 25 are respectively referred to as the main body interior part assembly 21 and the flip interior part assembly 25 for the convenience of explanation, these interior part assemblies 21 and 25 are part assemblies in a state in which all operation tests are completed and these interior part assemblies 21 and 25 include in the interior part assembly 20 which was defined above. Considering this point, in the portable electronic product such as a flip type
mobile phone, each of the main body interior part assembly 21 and the flip interior part assembly 25 has an interior part assembly that is integrally formed. The waterproof processing is performed by accommodating the interior part assembly between the upper and lower waterproof frames 40 and 30 having the gripping groove 41 and the gripping rib 31 that are provided during the injection molding or the double shot injection molding. Then, the combined frame is coupled to the exterior casing 10 of the mobile phone 1.

As shown in FIG. 6, the main body interior part assembly 20 or 21 includes the main body PCB 22 and a keypad portion 23 electrically connected to the main body PCB 22 in the front side of the main body PCB 22. The keypad portion 23 is a portion having the signal input buttons 23a for a user to input data, and the keypad portion 23 is integrally formed by being inserted during the first injection molding of the upper waterproof frame 40 coupled to the main body interior part assembly 21. However, the keypad portion 23 can be simultaneously formed with the upper waterproof frame 40 by performing the first injection molding to form the keypad shape during the first injection molding of the upper waterproof frame 40. In this case, the keypad portion 23 is generally formed thin. The contact point 22b to which the external device is connected may use a waterproof contact point that is disclosed in Korean Utility Model Registration No. 198490 entitled "Terminal Structure Having Waterproof Structure" and filed by the present applicant. For the interior of the external antenna or the earphone jack 22a, any known techniques in this regard can be used. For the flip interior part assembly 20 or 25 shown in FIG. 15, the dual speaker 27 and a liquid crystal display (LCD) 26 are electrically installed on the PCB 28 of the LCD 26.

As shown in FIGS. 6 through 10, and 15 through 19, the waterproof frame includes the upper waterproof frame 40 and the lower waterproof frame 30. When the upper and lower waterproof frames 40 and 30 are coupled to each other, the second accommodation space (not shown) is provided in which the interior part assembly 20 is accommodated. When the interior part assembly 20 is accommodated in the second accommodation space, a portion corresponding to the portion where the outside exposure of the interior part assembly 20 is needed is formed of synthetic resin in the first injection molding to have a plurality of cut portions 33 and 43 formed by cutting off predetermined areas, for example, a portion for inserting the earphone jack, a portion for inserting input/output terminals, or a portion for installing a speaker unit. The upper and lower waterproof frames 40 and 30 are typically formed of a plastic frame (polycarbonate (PC) + glass fiber 20%) to have a thin thickness. In the strict sense, upper and lower waterproof frames 40 and 30 can be divided into the upper and lower waterproof frames 40 and 30 for accommodating the main body interior part assembly 21 in the second accommodation space, and the upper and lower waterproof frames 40
and 30 for accommodating the flip interior part assembly 25 in the second accommodation space. Although these two sets of the upper and lower waterproof frames 40 and 30 can be different in the shape and the number and position of the cut portions 33 and 43, since both are based on the same concept, the same names and reference numerals are used herein.

[58] The gripping rib 31 can be provided in the double shot injection molding method in which the second injection molding is continuously performed after the first injection molding of the lower waterproof frame 30. When a seal vibration isolation rib 34 is molded, as necessary, on the edge portion of various input/output holes corresponding to the cut portion 33, with the molding of the gripping rib 31 during the second injection, sealing with respect to the input/output holes is achieved. Also, when the seal vibration isolation rib 34 is molded at a corner portion of the lower waterproof frame 30 to protrude from the anti-shock structure of the lower waterproof frame 30, for example, the outer surface of the lower waterproof frame 30, in particular, mainly at the eight corners and any necessary portions, the interior circuit parts are prevented from being damaged by an external impact. Like the lower waterproof frame 30, for the upper waterproof frame 40, a seal vibration isolation rib 44 can be molded along the edge portion of an upper wall portion of the upper waterproof frame facing the wall portion of the lower waterproof frame 30 through the double shot injection molding method in which the second injection molding is continuously performed after the first injection molding of the upper waterproof frame 40. The seal vibration isolation ribs 34 and 44 can be formed of elastomer that is the same material used for the gripping rib 31.

[59] In the double shot injection molding method, the double shot injection molding is a mold designed capable of double shot injection using two injection apparatuses and an injector having a rotary mechanism installed on a mobile plate or a core or a slider structure and using two sorts of different resins or reins of two different colors. A space between a first molding product that is initially molded and a second cavity is filled with a second resin. Since the cavities in the first and second sides are accurately replaced, the shape is less limited and the scope of product application is wide so that a variety of designs are available. Also, since injection is made at one time, compared to the convention technology in which injection was made twice to mold two parts which are made into a product by welding them or through a second process such as a coating process, the cost can be reduced and manufacture of a variety of product designs becomes available. In the present embodiment, the lower waterproof frame and the upper waterproof frame 40 correspond to the first molding product and the gripping rib 31 and the seal vibration isolation ribs 34 and 44 are formed by the second molding.

[60] To further reinforce the combining force between the upper and lower waterproof
frames 40 and 30, during the injection molding of the upper waterproof frame 40, a plurality of hook grooves 42 are formed separated by a predetermined interval on the outer wall of the upper waterproof frame 40 that forms the gripping groove 41. A plurality of hook protrusions 32 to be caught by the hook grooves 42 of the upper waterproof frame 40 are formed on the outer wall of the gripping rib 31 of the lower waterproof frame 30 during the second injection molding of the gripping rib 31. Accordingly, when the upper and lower waterproof frames 40 and 30 are assembled, the hook combination between the hook grooves 42 and the hook protrusions 32 is achieved in addition to the gripping combination between the gripping rib 31 and the gripping groove 41, so that the upper and lower waterproof frames 40 and 30 are more firmly coupled to each other and sealing therebetween becomes more tight.

To prevent electromagnetic wave interference, EMI shield coating can be performed on the entire surfaces of the upper and lower waterproof frames 40 and 30 without special jig. The inclusion of a conductive additive in elastomer facilitates connection to the ground of the main body PCB 22 and shields an electromagnetic wave which can come out through an opening between the combining portion between the upper and lower waterproof frames 40 and 30.

FIG. 11 is a plan view of the mobile phone of FIG. 1 in a state in which an interior part assembly of a flip is coupled to a waterproof frame. FIG. 12 is a cross-sectional view taken along line XII-XII of FIG. 11. FIG. 13 is a rear view of the mobile phone of FIG. 11. FIG. 14 is a right side view of the mobile phone of FIG. 11. FIG. 15 is an exploded perspective view of the mobile phone of FIG. 11. FIG. 16 is a perspective view of a main body of an upper waterproof frame of FIG. 11. FIG. 17 is a perspective view of a seal vibration isolation rib of the upper waterproof frame of FIG. 11. FIG. 18 is a perspective view of a main body of a lower waterproof frame of FIG. 11. FIG. 19 is a perspective view of a gripping rib and a seal vibration isolation rib coupled to the lower waterproof frame of FIG. 11. As shown in these drawings, the structures of the upper and lower waterproof frames 40 and 30 in the flip interior part assembly 20 or 25 are similar to those of the main body interior part assembly 21. Thus, descriptions about the repeated portions will be omitted herein and only different portions will be described below.

The seal vibration isolation rib 34 which can encompass the dual speaker 27 is molded on the upper and lower waterproof frames 40 and 30 for waterproof of the dual speaker 27 that is typically applied to the flip interior part assembly 20 or 25, the main body interior part assembly 21 and the flip interior part assembly 25 are connected via a flexible PCB 29. A hole for passing the flexible PCB 29 is waterproofed by assembling an additional up/down separation type sealing member 50 shown in FIG. 16. Both elastomer and rubber can be used as a material for the sealing member 50.
A method for proofreading a portable electronic product with a waterproof structure according to an embodiment of the present invention will be described below.

The interior part assembly 20 is provided by assembling the part assembly and completing the operation tests. The upper and lower waterproof frames 40 and 30 are injection molded to have a shape corresponding to the shape of the interior part assembly 20. The upper and lower waterproof frames 40 and 30 are injection molded to provide the second accommodation space for accommodating the interior part assembly 20 when the upper and lower waterproof frames 40 and 30 are coupled to each other, and make a portion opposite to a portion needing the outside exposure of the interior part assembly 20 have the cut portions 33 and 43 formed by cutting off a predetermined area. The gripping groove 41 having a groove shape is formed along the edge portion of the upper waterproof frame 40 by injection molding. The hook grooves 42 are formed at a predetermined interval on the outer wall of the upper waterproof frame 40 which forms the gripping groove 41. The upper waterproof frame 40 is integrally molded with the keypad portion 123 by inserting the keypad portion 123.

Next, the gripping rib 31 is forcibly inserted in the gripping groove 41 is formed of elastomer by the second injection molding along the edge portion of the lower waterproof frame 30. In the present embodiment, the first and second injection molding of the lower waterproof frame 30 and the gripping rib 31 are continuously performed in the double shot injection molding method. To reinforce the combining force between the upper and lower waterproof frames 40 and 30, the hook protrusions 32 to be caught by the hook grooves 42 of the upper waterproof frame 40 are formed on the outer wall of the gripping rib 31 of the lower waterproof frame 30. The seal vibration isolation ribs 34 and 44 are molded of elastomer with the gripping rib 31 on the edge portion of the cut portion 33 of the lower waterproof frame 30 or at the corner portion of the lower waterproof frame 30. Likewise, for the upper waterproof frame 40, the seal vibration isolation ribs 34 and 44 are formed of elastomer on the edge portion of the cut portion 43 of the upper waterproof frame 40 or on the edge portion or corner portion thereof by the second injection molding that is continuously performed after the first injection molding of the upper waterproof frame 40, that is, in the double shot injection molding method.

Next, the upper and lower waterproof frames 40 and 30 are coupled to each other by accommodating the interior part assembly 20 in the second accommodation space between the upper and lower waterproof frames 40 and 30 and forcibly combining the gripping groove 41 and the gripping rib 31 of the upper and lower waterproof frames 40 and 30. The coupling of the upper and lower waterproof frames 40 and 30 is firmly maintained by the forcible combination of the gripping groove 41 and the gripping rib 31 and the hook combination of the hook grooves 42 and the hook protrusions 32.
Further, the combined portion is sealed so that the intrusion of water into the interior part assembly 20 is prevented, thus completing the waterproof structure.

[68] The interior part assembly 20 accommodated between the upper and lower waterproof frames 40 and 30 has all functions by itself. Accordingly, the assembly of the mobile phone 1 is completed by coupling the interior part assembly accommodated between the upper and lower waterproof frames 40 and 30 to the exterior casing 10. The mobile phone 1 is sealed by the upper and lower waterproof frames 40 and 30 except for the cut portions 33 and 43 of the upper and lower waterproof frames 40 and 30. The respective holes that are the cut portions 33 and 43 when being connected to the input/output terminals are waterproofed because the seal vibration isolation ribs 34 and 44 or the additional sealing member 50 seal the openings between the holes and the input/output terminals to blocks the intrusion of water into the interior part assembly 20 and prevent water from contacting the circuit parts of the PCBs 22 and 28.

[69] FIG. 20 is a plan view of a mobile phone according to another embodiment of the present invention, showing a state in which an interior part assembly of a main body of the mobile phone is coupled to a waterproof frame. FIG. 21 is a right side view of the mobile phone of FIG. 20. FIG. 22 is an exploded perspective view of the mobile phone of FIG. 20. FIG. 23 is a perspective view of the mobile phone of FIG. 20, showing a state in which a seal vibration isolation rib coupled to an upper waterproof frame is injected. FIG. 24 is a perspective view of the mobile phone of FIG. 20, showing a state in which a locking member of the seal vibration isolation rib is folded.

[70] Referring to FIGS. 20 through 24, in upper and lower waterproof frames 140 and 130 according to another embodiment of the present invention, a locking member 145 is formed on a gripping vibration isolation rib 144 of the upper waterproof frame 140 and a gripping protrusion 146 and a fold line 147 are formed on the locking member 145, instead of forming the hook grooves 42 and the hook protrusions 32 provided on the waterproof frames 30 and 40 and the gripping rib 31 in the previous embodiment. Accordingly, when the upper and lower waterproof frames 140 and 130 are coupled to each other, the locking member 145 is folded along the fold line 147 so that the gripping protrusion 146 at an end portion of the locking member 145 is forcibly inserted in a gripping groove 136 formed at a rear side wall portion of the lower waterproof frame 130. In the present embodiment, since the slide core which is required in a mold in the previous embodiment is not needed, inaccuracy of injection molding generated by using the slider core can be reduced.

[71] In the above-described embodiments, although the folder type mobile phone 1 is described, the present invention can be applied to a flip type mobile phone or various portable electronic products such as PDAs, notebook computers, LCD TVs, walkietalkies, CD players, and MP3 players, if it is a portable electronic product
having the exterior casing 10 and the interior part assembly 20 having a waterproof portion and accommodated in and coupled to the exterior casing 10. A secure waterproof function can be provided by accommodating the interior part assembly 20 in the second accommodation space between the upper and lower waterproof frames 40 and 30 and blocking openings in the combined portion between the gripping rib 31 and the gripping groove 41 by the upper and lower waterproof frames 40 and 30.

Also, in the above-described embodiments, elastomer is used as a material for the gripping rib 31. However, any material which can maintain elasticity and a sealing characteristic, for example, synthetic resin such as polyurethane or soft PVC, can be therefor.

In the above-described embodiments, although the gripping groove 41 is formed on the upper waterproof frame 40 while the gripping rib 31 is provided on the lower waterproof frame 30, the gripping rib 31 can be provided on the upper waterproof frame 40 while the gripping groove 41 can be formed on the lower waterproof frame 30, as necessary. In the above-described embodiments, although the gripping protrusion 146 is formed on the end portion of the locking member 145 while the gripping groove 136 is formed on the rear wall portion of the lower waterproof frame 130, the gripping groove 136 or gripping hole can be formed on the end portion of the locking member 145 while the gripping protrusion 146 can be formed on the rear wall portion of the lower waterproof frame 130.

In the above-described embodiments, the mobile phone 1 is described as an example of the portable electronic products, the portable electronic product can be a battery of a mobile communication devices. In this case, the gripping groove 41 and the gripping rib 31 are injection molded and double shot injection molded on the battery exterior casing so that a battery exterior casing can work as the upper and lower waterproof frames 40 and 30. Then, the battery exterior casing is coupled and welded using an ultrasonic wave.

**Industrial Applicability**

As described above, according to the present invention, the intrusion of water or moisture into the circuit parts in the interior part assembly can be prevented even when portable electronic products such as a mobile phone is exposed to water, without affecting the design of the exterior casing of the portable electronic product, thus providing a secure waterproof function. Also, the portable electronic product can be efficiently manufactured. Furthermore, even when the upper and lower waterproof frames are separated to repair the interior part assembly, the upper and lower waterproof frames can be easily combined again and used while the waterproof function is maintained.
Claims

[1] A portable electronic product with a waterproof structure which includes an exterior casing forming a first accommodation space therein and an interior part assembly having a waterproof portion that needs to avoid contact with water and moisture and accommodated in the first accommodation space of the exterior casing, the portable electronic product comprising:
upper and lower waterproof frames having a second accommodation space in which the interior part assembly is accommodated when the upper and lower waterproof frames are coupled to each other, respectively first injection molded using synthetic resin to have at least one cut portion that is cut off a predetermined area facing a portion that needs exposure of the interior part assembly to the outside when the interior part assembly is accommodated in the second accommodation space, and combined to each other to encompass the waterproof portion of the interior part assembly by accommodating the interior part assembly in the second accommodation space, wherein a gripping groove is formed during the first injection molding along an edge portion of a wall portion of one of the upper and lower waterproof frames, the wall portion facing the other one of the upper and lower waterproof frames, and a gripping rib forcibly inserted in the gripping groove is second injection molded using synthetic resin exhibiting elasticity along an edge portion of a wall portion of the other one of the upper and lower waterproof frames, the wall portion facing the one of the upper and lower waterproof frames.

[2] The portable electronic product of claim 1, wherein the gripping groove is formed on the upper waterproof frame while the gripping rib is provided on the lower waterproof frame.

[3] The portable electronic product of claim 2, wherein the lower waterproof frame and the gripping rib are provided in a double shot injection molding method, a material of the lower waterproof frame is a plastic frame, and a material of the gripping rib is elastomer.

[4] The portable electronic product of claim 3, wherein a plurality of hook grooves are formed to be separated a predetermined distance from each other in an outer wall of the upper waterproof frame where the gripping groove is formed, and a plurality of hook protrusions caught by the hook grooves are provided on an outer wall of the gripping rib.

[5] The portable electronic product of claim 1, wherein a seal vibration isolation rib is second injection molded using synthetic resin exhibiting elasticity along an edge portion of the cut portion.
[6] The portable electronic product of claim 5, wherein the seal vibration isolation rib is also provided during the second injection molding along an edge portion of a wall portion opposite to a wall portion of the upper waterproof frame that faces the lower waterproof frame.

[7] The portable electronic product of claim 6, wherein the seal vibration isolation rib comprises a locking member provided as a portion extends to the outside and having a fold line, at least one gripping protrusion is formed at an end portion of the locking member, and at least one gripping groove in which the gripping protrusion is forcibly inserted is formed in a wall portion opposite to a wall portion of the lower waterproof frame that faces the upper waterproof frame when the locking member is folded along the fold line.

[8] The portable electronic product of claim 5, wherein the upper waterproof frame and the seal vibration isolation rib is provided by double shot injection molding, the lower waterproof frame and the seal vibration isolation rib is provided by double shot injection molding, a material of the upper waterproof frame and the lower waterproof frame is a plastic frame, a material of the seal vibration isolation rib is elastomer.

[9] The portable electronic product of claim 1, wherein the portable electronic product is a mobile phone and the interior part assembly is one of a printed circuit board installed on a main body casing of the mobile phone and a printed circuit board installed on a flip casing of the mobile phone.

[10] The portable electronic product of claim 9, wherein, when the interior part assembly is a printed circuit board installed on the main body casing of the mobile phone, a keypad portion is integrally injection molded with the upper waterproof frame during the first injection molding to provide a keypad of the mobile phone.

[11] A method for waterproofing a portable electronic product having an exterior casing forming a first accommodation space therein and an interior part assembly having a waterproof portion that needs to avoid contact with water and moisture and accommodated in the first accommodation space of the exterior casing, the method comprising: first injection molding upper and lower waterproof frames having a second accommodation space in which the interior part assembly is accommodated when the upper and lower waterproof frames are coupled to each other and at least one cut portion that is cut off a predetermined area facing a portion that needs exposure of the interior part assembly to the outside when the interior part assembly is accommodated in the second accommodation space, such that a gripping groove having a slot shape is formed along an edge portion of a wall
portion of one of the upper and lower waterproof frames, the wall portion facing
the other one of the upper and lower waterproof frames;
second injection molding a gripping rib that is forcibly inserted in the gripping
groove, using synthetic resin exhibiting elasticity, along an edge portion of a wall
portion of the other one of the upper and lower waterproof frames, the wall
portion facing the one of the upper and lower waterproof frames; and
combining the upper and lower waterproof frames by accommodating the
interior part assembly in the second accommodation space and forcibly coupling
the gripping groove and the gripping rib of the upper and lower waterproof
frames.

[12] The method of claim 11, wherein the gripping groove is formed on the upper
waterproof frame while the gripping rib is provided on the lower waterproof
frame.

[13] The method of claim 12, wherein, in the second injection molding of a gripping
rib, the lower waterproof frame and the gripping rib are provided in a double shot
injection molding method, a material of the lower waterproof frame is a plastic
frame, and a material of the gripping rib is elastomer.

[14] The method of claim 13, wherein, in the second injection molding of a gripping
rib, a seal vibration isolation rib is injection molded along an edge portion of the
cut portion when the gripping rib is injection molded, the seal vibration isolation
rib is also provided during the second injection molding along the edge portion
of an opposite wall portion of the upper waterproof frame that faces the lower
waterproof frame, and the seal vibration isolation rib is formed of elastomer.

[15] The method of claim 11, wherein, in the first injection molding of the upper and
lower waterproof frames, when the upper waterproof frame is injection molded, a
plurality of hook grooves separated a predetermined distance from each other are
formed in an outer wall of the upper waterproof frame where the gripping groove
is formed.

[16] The method of claim 15, wherein, in the second injection molding of a gripping
rib, when the gripping rib is injection molded, a plurality of hook protrusions that
are caught by the hook grooves of the upper waterproof frame are formed on an
outer wall of the gripping rib.

[17] The method of claim 11, wherein, when the interior part assembly is a printed
circuit board installed on a main body casing of the mobile phone, a keypad
portion is integrally injection molded with the upper waterproof frame during the
first injection molding of the upper and lower waterproof frames to provide a
keypad of the mobile phone.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

H04B 1/38(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04B 1/38

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Patents and applications for inventions since 1975
Korean Utility models and applications for Utility models since 1975
Japanese Utility models and application for Utility models since 1975
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
waterproof, mobile, phone, frame, rib,

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>KR 1020050085054 A (WATERCOM) 22.08.2005 abstract, claims 1,5,6 fig. 1-9</td>
<td>1, 11</td>
</tr>
<tr>
<td>A</td>
<td>KR 20029627 Y1 (WATERCOM) 12.11.2002 abstract, claim 1, 4, fig 1,2</td>
<td>1,3,8,11,13,14</td>
</tr>
<tr>
<td>A</td>
<td>US 6950156 B2 (NOKIA Co) 27.09.2005 the whole documents</td>
<td>1, 11</td>
</tr>
</tbody>
</table>

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

"A" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" document member of the same patent family

Date of the actual completion of the international search
28 FEBRUARY 2006 (28.02.2006)

Date of mailing of the international search report
28 FEBRUARY 2006 (28.02.2006)

Name and mailing address of the ISA/KR
Korean Intellectual Property Office
920 Dunsan-dong, Seo-gu, Daejeon 302-701, Republic of Korea
Facsimile No. 82-42-472-7140

Authorized officer
HA, Yoo Jung
Telephone No. 82-42-481-8128

Form PCT/ISA/210 (second sheet) (April 2005)