Description

Enclosure, particularly a housing for a mobile telephone and a method for producing a housing part

The invention relates to an enclosure having a first enclosure base body and a second enclosure base body. In particular, the invention relates to an enclosure which constitutes a housing for a mobile telephone. The invention also relates to a method for producing a housing part for a mobile telephone.

The British patent application GB 2 345 818 describes a portable telecommunication component, a hand-held mobile radio device. This consists of a plurality of components, in particular a keypad, a display field, an upper housing and a lower housing, and a battery part. The individual components are assembled by inserting the keypad into the upper housing, then inserting the component containing the display into the upper housing and subsequently screwing together the lower housing and the upper housing. The lower housing contains a recess into which the battery part is introduced. Patent application GB 2 345 818 A specifies different possible ways of screwing together the upper housing and the lower housing or inserting one into other.

The international patent application WO 01/083381 A1 relates to a mobile telephone having an upper housing shell comprising an integrated keypad and display. To this end, a transparent plastic housing is produced in an injection molding process by injecting a plastic into a mold and makes a connection with a film in such a way that an upper housing shell is produced. In this situation, the plastic housing has a first area which serves as a display window, and also a second area having at least one cutout with means for transmitting a key depression. The film covers at least the second area and implements a key, located above the cutout, which in particular is identified by a character printed on the film and whereby a key depression is transmitted by way of the means.

The international patent application WO 00/08722 A1 relates to a mobile radio telephone having a moisture-resistant electrical contact. The mobile radio telephone has a housing with an upper housing part and a lower housing part which together form a shell that surrounds the components contained therein. The moisture-resistant electrical contact is located outside the housing and penetrates the lower housing part, whereby it is connected by means of a spring arm to the electrical circuits of the mobile radio telephone. By melting the electrical contact into the lower housing parts a moisture-resistant connection is produced between the material comprising the lower housing part and the electrical contact.

More rigorous demands can be made of the housings or enclosures for electrical devices or enclosures and also of storage containers, for example for the storage of perishable foodstuffs or weather-sensitive objects, in respect of their capability to seal against moisture, dust or other detrimental influences.

The object of the present invention is to specify an enclosure comprising at least two enclosure base bodies, whereby a sealing function is implemented between the two enclosure base bodies.

This object is achieved according to the invention by an enclosure, particularly a housing for a mobile telephone, having a first enclosure base body made of a first base material comprising a first edge and having a second enclosure base body made of a second base material comprising a second edge. The two enclosure base bodies butt against one another along the first edge and the second edge and have a seal there made of a sealing material which is permanently fixed to the first enclosure base body and which forms a seal resting against the second edge, whereby the sealing material consists of an elastically deformable material.

The enclosure can preferably be a housing for accommodating electrical devices or mechanical elements, components or equipment. In particular, in this situation this can be a mobile radio

telephone, in other words a mobile radio terminal device, a cordless telephone also for use in an industrial environment, such as for example in repair and production workshops, paint shops right through to a potentially explosive environment such as for example in the petrochemical industry. Other possible enclosures can be provided for pocket calculators, electronic appointment planners, sensor housings, clocks and other items. In this situation, a corresponding housing can have a length of just a few up to several tens of centimeters, a width of likewise just a few up to several tens of centimeters and accordingly a height of just a few up to likewise several tens of centimeters. Typical dimensions for mobile radio terminal devices and cordless telephones lie in the order of a length of 5 to 20 centimeters, a width of 2 to 5 centimeters and a height of 1 to 3 centimeters. In this situation the actual seal can run along the edge or circumference of a corresponding housing and have a width of less than one millimeter up to several millimeters and a height of below one millimeter up to several millimeters.

A seal which is permanently fixed to the first edge, and in particular is linked conclusively and in integrated fashion to first base body itself actually implements a sealing effect in respect of the first enclosure base body. The seal is an integral part of the first edge. A sealing effect in respect of the second enclosure base body is achieved by means of the elastic deformability of the material comprising the seal in that when the first edge and the second edge are pushed together the sealing material deforms elastically against the second edge and thus largely implements a sealing effect against the penetration of moisture, dust or similar.

Such an enclosure is therefore suitable for accommodating sensitive objects such as electronic devices or mechanical equipment and also foodstuffs which require protection against ambient influences such as moisture, water, chemicals, dust or also mechanical influences for example. Having a fixed joint between the seal and the first enclosure base body reduces the number of loose elements or elements which can be displaced with respect to one another in order to produce a sealing connection between the first enclosure base body and the second enclosure base body on these two enclosure base

bodies. It is therefore not necessary to provide a separate seal, for example in the form of a sealing ring and to provide corresponding holding devices, grooves or other mounting facilities for this purpose with their associated production resource requirement. The number of enclosure parts to be provided is thus also reduced, which simplifies both the storage and also the handling of the enclosure parts.

By preference, the second edge against which the seal rests is produced from a harder material than the seal itself. In this situation, the second enclosure base body can preferably be produced from a single material which is simultaneously also used as the material for the second edge. It is likewise also possible to produce the second edge from a different material than is used for the remainder of the second enclosure body. The first enclosure body can likewise preferably be produced from a harder material than is used for the seal.

In this situation, the first enclosure base body is preferably produced from a hard plastic and the seal from a soft plastic.

By preference, the first enclosure base body is produced together with the seal using the so-called two-color injection molding method. In two-color injection molding, also known as two-component injection molding, plastic materials for individual components and functional elements also employing different materials and hardness (hard/soft combinations) are produced in a single processing cycle, which can result in considerable savings in assembly costs. Depending on the choice of materials, components or elements produced in this way are resistant to external influences and are characterized by a high adhesive strength. An adhesion achieved in the boundary surface area can in this situation brought about by means of a chemical bond or mechanical anchoring. With regard to chemically compatible plastics, a permanent molecular bond is generally achieved by means of melting or welding. The two-component injection molding method is based on the friction-locked and/or form-locked connection of two plastic components having generally different properties to form an integrated shaped part. The two-

component injection molding method is particularly suitable for components which are intended to have both rigid and elastic area, as a result of which different functions can be implemented simultaneously.

The material for the seal is preferably a thermoplastic elastomer. Elastomers are understood to include synthetic or natural polymers with rubber-elastic properties, as described for example in Römpps Chemielexikon 8th Edition, p. 1082, Franksche Verlagshandlung Stuttgart, 1981. Thermoplastic elastomers can be obtained for example from Kraiburg TBE GmbH, Teplitzer Strasse 20, D-84478 Waldkraiburg, Germany. With regard to thermoplastic elastomers, these can be such as are based on SEBS and SEPS (filtered styrol block copolymers).

A thermoplastic material is preferably used for the first base material of the first enclosure base body. The second base material for the second enclosure base body likewise preferably consists of a thermoplastic material. According to the above Römpps Chemielexikon, thermoplastic materials are at normal temperature, particularly room temperature, hard or even brittle plastics which soften reversibly on the application of heat and become mechanically easily deformable. Furthermore, thermoplastic materials are defined in Deutsche Industrienorm 7724 (DIN, German Industrial Standard).

The sealing material comprising the seal preferably exhibits a Shore hardness of between 50 and 60. In accordance with the above Römpps Chemielexikon, the Shore hardness is defined according to Deutsche Industrienorm (DIN) 53505 by way of the resistance of elastomers, rubber and natural rubber to the penetration of a truncated cone.

By preference, a housing for a mobile telephone, which can be a handset for a cordless telephone or for a mobile radio telephone, has a third enclosure base body which serves to accommodate an exchangeable electrical power source, in particular a battery or a rechargeable accumulator. In this situation, the third enclosure base body butts either against the first enclosure base body or against the second enclosure base body and is sealed with respect to

the corresponding enclosure base body by means of a further elastic seal. The further seal is preferably located either on the third enclosure base body itself or on the enclosure base body butting against the latter, in other words the first or the second enclosure base body. In this situation the seal can be of the same type as the seal between the second and the first enclosure base body, in particular it can in a two-color injection molding method form an integral part with the third enclosure base body or the first or second enclosure base body associated with the latter.

By applying the seal to one of the enclosure base bodies it is possible, as already described above, to establish a sealing effect between the enclosure base bodies butting against one another, in particular against moisture and dust, in a simple manner with a small number of individual components.

According to the invention, the object directed towards a method for producing a housing part, in particular for a mobile telephone, is achieved by a method in which an elastic seal is applied using the two-color injection molding method. In a first production step, a hard component is injected onto a fixed tool and the hard component is shaped by means of a first countertool which moves in a mold release direction. In a second production step, a soft component forming the seal is injected onto the hard component and is shaped by means of a second countertool which is moved in the same mold release direction as the first countertool in order to release the mold. Releasing the mold both for the hard component and also for the soft component in the same direction provides a simple and fast but also cost-effective production method for a housing part having a sealing function, as a result of which the danger of backspraying is excluded or at least considerably reduced. If slight backspraying should occur, then this would occur firstly at non-visible locations and secondly at non-load locations in the circular slot and would therefore be unproblematic. By using only two countertools, also referred to pressing dies, only a minimum effort with low costs is required in order to produce the tools. Compared with a production method using four pressing dies, the production method can be accelerated and implemented more cost-effectively.

By preference, the method employs a rotary platen mold on which at least two housing parts of the same type are processed. By rotating the rotary platen mold, a housing part currently undergoing processing is passed from a first processing operation, the application of the hard component, to a second processing operation, the application of the soft component. By using a rotary platen mold, the production time for a large number of housing parts of the same type can therefore be reduced. At one point in time during processing, the hard component is produced at one position on the rotary platen mold while at the same time at another position on the rotary platen mold the soft component is being applied to an already produced hard component of the housing part. After the rotary platen mold has rotated, the housing part with a hard component and a soft component is removed and the housing part with the hard component is rotated into the position in which the soft component is applied at the next point in time during processing.

By preference, the soft component is applied to the hard component while the hard component is still warm. In this context, warm means that the hard component still has a temperature at which a bonding of the soft component to the hard component takes place, in particular a chemical molecular bonding, which is stronger than would be the case at normal room temperature.

The enclosure, particularly a housing for a mobile telephone, and also the method for producing a housing part will be described in detail by way of example with reference to the drawing. Other embodiments are naturally also possible, which are also covered by the invention. In this situation the figures show a representation, not necessarily to scale and partly schematized, of a mobile telephone. In the drawings:

Figure 1 shows a perspective view of a housing of a mobile telephone,

Figure 2 shows an enclosure base body, an upper shell, of a mobile telephone,

Figure 3 shows a top view of a lower enclosure base body, a lower shell,

Figure 4 shows a top view of the interior of an upper shell according to Figure 2,

Figure 5 shows a schematic top view of a rotary platen mold with two mounting positions for a housing part,

Figure 6 shows a section of a longitudinal section through the rotary platen mold with a hard component of a housing part and one pressing die,

Figure 7 shows a section by analogy with Figure 6 with a soft component applied to the hard component and a pressing die corresponding to this,

Figure 8 shows a section through a longitudinal section of an enclosure with a first enclosure base body, having a seal, and a second enclosure base body, and

Figure 9 shows a section through a further enclosure with a first enclosure base body and seal and also a second enclosure base body.

The reference characters have the same meaning in all the figures.

Figure 1 shows a perspective view of an enclosure 1, here a housing 1 for a mobile telephone. The housing 1 has a first enclosure base body 2 which is produced from a hard component 8, onto which is applied an elastically deformable soft component 4 on a first edge 3, essentially corresponding to the outer circumference of the first enclosure base body 2. In the first enclosure base body 2, which represents an upper shell 2, openings are provided for keys 5, a display 6 and a loudspeaker 7. The hard component 8 is produced from a first base material, in particular a thermoplastic material. The housing 1 has a second enclosure base body 9, a lower shell. This

lower shell 9 has a second edge 10 which butts against the first edge 3 of the upper shell 2. In this situation, the second edge 10 comes into direct contact with the soft component 4, the seal 4, such that the housing 1 is sealed to prevent the penetration of dust and moisture. On the side facing the upper shell 2, a further soft component 11 is applied onto the lower shell 9 at least in an area for accommodating a third enclosure base body 12, a battery or accumulator part. A send and receive antenna 13 additionally projects from the housing 1.

Figure 2 shows an alternative embodiment of a first enclosure base body 2, an upper shell of a cordless telephone in a top view of the outside. The upper shell 2 likewise has openings for keys 5, a display 6, a loudspeaker 7 and also a microphone 14. Around the outer circumference, a first edge 3 of the first enclosure base body 2, a soft material is applied on the outside which, as represented schematically in Figure 4, is directed in the form of a flange by way of first base material forming a hard component 8 away from the outside through to a second enclosure base body 9 (see Figure 3). The soft component 4 is also applied to the outside of the upper shell 2 in the form of a broad band where it has no sealing function. In this situation it can serve as an additional visual element.

Figure 4 shows a top view of the interior of an upper shell 2 according to Figure 2. On the inside of the upper shell 2 the hard component 8 has running around its outer circumference an outer flange 14 which is directed inwards. Further out still, the soft component 4 runs around this outer flange 14, thereby forming a sealing flange 27. The outer flange 14 and also the seal 4 projecting inwards are spaced apart from one another, for example by less than 1 mm or up to several mm. Within the area of the hard component 8 enclosed by the outer flange 14 the former has locking flanges 15 and also guide cylinders 16. These serve to engage in corresponding counterflanges and cylinders situated on the lower shell 9 for fixing purposes and for holding together the upper shell 2 and the lower shell 9 to form a housing 1.

Figure 3 shows a top view, onto the outside, of a lower shell 9, matching the upper shell 2, according to Figure 2. The lower shell 9 has receiving area 17 for an accumulator part which is not shown. The receiving area 17 is edged by a further soft component 11 which is applied to the hard component 18 (second base material) of the lower shell 9. In this situation, the further soft component 11 forms the seal between the lower shell 9 and the accumulator part which is not shown. The hard components 8 and 18 are preferably produced from the same base material, in particular a thermoplastic material. Soft components 4, 11 are likewise preferably produced from an identical sealing material, in particular a thermoplastic elastomer.

Figure 5 shows a schematic top view of a rotary platen mold 19 which can rotate around an axis of rotation 20. The rotary platen mold 19 has two tool structures of the same type for the production of identical housing parts (see Figure 6, Figure 7). The rotary platen mold 19 shown schematically in Figure 5 is used for producing a first enclosure base body 2, an upper shell of a housing for a mobile telephone. By analogy with the upper shells 2 shown in Figures 1 and 2, such a first enclosure base body 2 has openings for keys 5, display 6 and loudspeaker 7. A moving countertool (not shown) which can move in the direction of the axis of rotation is assigned to the rotary platen mold 19 for producing the upper shell 2. The rotary platen mold 19 is the fixed half of the tool, the countertool which is not shown is the moving half of the tool. Production of the upper shell 2 takes place in two steps, whereby in a first method step after bringing together the rotary platen mold 19 and the moveable countertool 22 (see Figure 6) a hard component is injected using the injection molding method between the rotary platen mold 19 and the first moveable countertool 22. The tool structure 21 of the rotary platen mold 19 has a hard component recess 24 and also the housing contour structure 26 joining up with it. The hard component 8 injected into the space between the rotary platen mold 19 and the first moveable countertool 22 assumes the shape of the upper shell 2 in accordance with the housing contour structure 26, whereby the hard component 8 which has penetrated into the hard component recess 24 forms a corresponding flange, for

example an outer flange 14 by analogy with Figure 4. After injection of the hard component 8, the first moveable countertool 22 is driven in the direction of the axis of rotation 20, as a result of which a deformation of the hard component 8 takes place in the vertical direction. After this first production step the rotary platen mold 19 is rotated through 180° such that the hard component 8 can now be surrounded by a second moveable countertool 23 (see Figure 7). The cavity resulting between the hard component 8 and the second moveable tool 23 has a soft component 4 injected into it. This soft component 4 flows right into a soft component recess 25 in the rotary platen mold 19 and receives its contour through the hard component 8. The soft component 4, which can be a thermoplastic elastomer, is preferably then actually injected onto the hard component 8, which can be a thermoplastic material, when the hard component 8 still has a temperature which is elevated such that a good chemical bond occurs between the hard component 8 and the soft component 4. The second moveable countertool 23 is likewise raised in the direction of the axis of rotation 20 such that a deformation of the soft component 4 likewise takes place in the vertical direction (see Figure 7). Through the soft component recess 25, the soft component 4 likewise forms a type of flange which is suited by virtue of the elastic deformability of the soft component 4 for making a seal with respect to a lower shell of the housing for a mobile telephone. (Sealing flange 27 by analogy with Figures 8 and 9).

Figures 8 und 9 show two different embodiments of a first enclosure base body 2 and a second enclosure base body 9 butting against it in a section of a longitudinal section. The first enclosure base body 2 has in each case a hard component 8 with an outer flange 14. A soft component 4 serving as a seal is applied in each case to the first enclosure base body 2 on the outside, which forms a sealing flange 27 that is adjacent to the outer flange 14 and as a result of the material property of the soft component 4 is elastically deformable. The soft component 4 makes a seal with the sealing flange 27 against the edge 10 of the second enclosure base body 9. In Figure 9 the second enclosure base body 9 has an additional sealing flange 28 which extends into the space between the sealing flange 27 and the

outer flange 14. By this means the sealing function of the housing 1 formed from first enclosure base body 2 and second enclosure base body 9 protecting against dust and moisture is further improved. By using the two-color injection molding method, as described above, different embodiments can be implemented between sealing flange 27 of the soft component 4 and of the hard component 8, in particular the outer flange 14, in respect of their mutual position, length etc.

Claims

1. Enclosure (1), particularly a housing for a mobile telephone, having a first enclosure base body (2) made of a first base material (8) comprising a first edge (3) and a second enclosure base body (9) made of a second base material (18) comprising a second edge (10), which butt against one another along the first edge (3) and the second edge (10), and having a seal (4) made of a sealing material
   - which is permanently fixed to the first enclosure base body (2),
   - whose sealing material consists of an elastically deformable material,
   - and which makes a seal resting against the second edge (10).

2. Enclosure (1) according to Claim 1, whereby the second edge (10) against which the seal (4) butts consists of a harder material than the seal (4).

3. Enclosure (1) according to one of the preceding claims, whereby the first enclosure base body (2) is produced from a hard plastic and the seal (4) from a softer plastic.

4. Enclosure (1) according to Claim 3, whereby the first enclosure base body (2) together with the seal (4) is produced using the two-color injection molding method.

5. Enclosure (1) according to one of the preceding claims, whereby the seal (4) consists of a thermoplastic elastomer.

6. Enclosure (1) according to one of the preceding claims, whereby the first base material (8) of the first enclosure base body (2) consists of a thermoplastic material.

7. Enclosure (1) according to one of the preceding claims, whereby the sealing material exhibits a Shore hardness of between 50 and 60.

8. Enclosure (1) according to one of the preceding claims,

for accommodating electrical, electronic or mechanical components or foodstuffs.

9. Enclosure (1) according to one of the preceding claims, which is a housing for a mobile telephone and has a third enclosure base body (12) which serves to accommodate an exchangeable electrical power source, whereby the third enclosure base body (12) butts either against the first enclosure base body or against the second enclosure base body (2) and is sealed with respect to the latter by means of a further elastic seal (11), whereby the further seal (11) is located on the third enclosure base body (12) or on the second (9) or the first (2) enclosure base body.

10. Method for producing a housing part (2,9) for a mobile telephone, having an elastic seal applied (4) using the two-color injection molding process, whereby in a first production step a hard component is injected onto a fixed tool, the hard component (8) is shaped by means of a first countertool (22) which moves in a mold release direction, and in a second production step a soft component forming the seal (4) is injected onto the hard component (8) and is shaped by means of a second countertool (23) which is moved in the same mold release direction as the first countertool (22) in order to release the mold.

11. Method according to Claim 10, whereby a rotary platen mold (19) is used, the rotation allowing simultaneous processing of two housing parts, one having the hard component (8) applied and one having the soft component (4) applied.

12. Method according to one of Claims 10 and 11, whereby the soft component (4) is applied to the hard component (8) while the latter is still warm.

Reference list

1 enclosure, housing for a mobile telephone
2 first enclosure base body (upper shell)
3 first edge, circumference
4 seal, soft component
5 key
6 display
7 opening for loudspeaker
8 hard component, first base material
9 second enclosure base body (lower shell)
10 second edge
11 additional soft component, seal
12 third enclosure base body, a battery or accumulator part
13 send and receive antenna
14 outer flange
15 locking flange
16 guide cylinder
17 receiving area
18 second base material, hard component
19 rotary platen mold
20 axis of rotation
21 tool structure
22 first moveable countertool
23 second moveable countertool
24 hard component recess
25 soft component recess
26 housing contour structure
27 sealing flange
28 additional sealing flange