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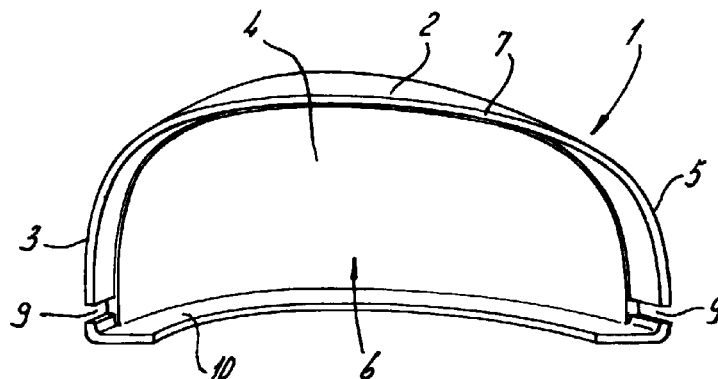
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(54) **Protective cap, in particular for a safety shoe or protective shoe, and shoe provided with protective cap**

(57) The invention relates to a protective cap (1) for a safety shoe or protective shoe. The cap (1) comprises a single-part, hollow body which is formed from plastic and has an insertion opening (6), which is open towards the rear, for toes of a foot to be fitted into the hollow body. The hollow body is delimited by a top wall (2) which, at the sides and front, merges into a side wall (3, 4, 5). On either side of the insertion opening, resilient means (9) are formed in the side wall for allowing

deflection and/or lateral outward springing of the side wall parts located above the resilient means (9) when a force is exerted on the cap from above. The resilient means (9) may, on either side of the insertion opening, comprise a slot which extends forwards from the edge of the side wall, for example over approximately 10 mm. The plastic is in particular a polycarbonate, preferably without fibre-based reinforcing means.

fig - 2



EP 1 095 582 A1

Description

[0001] The present invention relates to a protective cap, in particular for a safety shoe or protective shoe, the cap comprising a single-part, hollow body which is formed from plastic and has an insertion opening, which is open towards the rear, for toes of a foot to be fitted into the hollow body, the hollow body being delimited by a top wall which at the sides and front merges into a side wall.

[0002] A protective cap of this type is known, for example, from US-A-5,809,666. Plastic protective caps of this type have the advantage of being relatively light-weight compared to metal protective caps and, on account of their insulating property, being comfortable when used in cold weather, at least compared to metal protective caps. Various authorities impose demands on (plastic) caps of this type relating to the strength of the said caps. With regard to the United States of America, reference may be made, for example, to ANSI Z 41-1991, with regard to Canada reference may be made to Toe Impact Test Z 195 March 1984, and with regard to Europe reference may be made to EN 12568:1998, which was recently formulated by the EEC. These tests are generally carried out at room temperature. According to test variants, protective caps are also cooled to a subzero temperature before the test, in order to carry out tests into gradual warming in the environment at a temperature of from 0 to 20°C. To be able to satisfy the regulations, the plastic caps are in many cases reinforced with fibre-based reinforcing means, as described in US-A-5,809,666, inter alia. At least if the design is suitable, protective caps of this type made from fibre-reinforced plastics withstand various tests at temperatures of above 0 without particular problems. There are few if any regulations which require testing at subzero temperatures. However, in practice it has been found that shoes with fibre-reinforced plastic caps offer little or no protection at ambient temperatures of below zero °C. If an impact force is exerted on the protective cap under such conditions, the fibre-reinforced plastic tends to tear open and/or shatter easily. When it does so, it is quite conceivable that residues of the reinforcing fibres may penetrate into the feet of the person wearing a shoe of this type and thus also enter the bloodstream. Reinforcing fibres of this type, in particular in the case of glass fibres, entering the bloodstream may lead to medical complications and even life-threatening situations. However, the tendency which emerges from the test results, as stated for example in US-A-5,809,666, is that the fibre reinforcement is indispensable in order to be able to withstand the tests at all at normal temperatures.

[0003] The object of the present invention is to provide a plastic protective cap which is able to withstand various impact tests at temperatures of both above 0°C and below 0°C.

[0004] According to the invention, this object is achieved by the fact that on either side of the insertion

opening resilient means are formed in the side wall for allowing deflection and/or lateral outward springing of the side wall parts located above the resilient means when a force is exerted on the cap from above. The resilient means preferably allow deflection and/or lateral outward springing of the side-wall parts which are located above the resilient means with respect to side-wall parts located below the resilient means when a force is exerted on the cap from above. Resilient means of this type formed in the side wall of the body may essentially be realized in various ways. For example, consideration may be given to a crumple zone which is formed during the moulding of a body, obtained by weakening a section of the side wall in the vicinity of the insertion opening in such a manner that some degree of flexibility for lateral outward springing or deflection is obtained. Weakening of this nature can be achieved, for example, by making a section of the side wall very thin, by providing a section of the side wall with, for example, a row of holes positioned close together which extends in the forwards direction from the edge which adjoins the insertion opening. In the event of an impact load being exerted from above, the small ribs which separate the adjacent holes from one another will break away easily. Surprisingly, the applicant has found that it thus becomes possible to form the caps from plastic with little or no fibre- or carbon-based reinforcing means. This has the further advantage that the plastic is also much more able to withstand impact loads at temperatures below zero compared to protective caps made from fibre-reinforced plastics. The applicant assumes that this can be explained by the fact that features of this nature allow the forces which occur in the event of an impact load to be absorbed since they allow deflection or lateral outward springing of the side-wall parts located above the resilient means.

[0005] According to the invention, sufficient lateral outward springing and/or deflection can be ensured in particular if the resilient means extend forwards from that edge of the side wall which delimits the insertion opening. This ensures that the cap allows sufficient deflection and/or lateral outward springing at the rear side.

[0006] According to the invention, an embodiment which is easy to realize in design terms is obtained if the resilient means, on either side of the insertion openings, comprise a slot or incision which extends forwards from the edge of the side wall. If the mould is shaped suitably, a slot or incision of this type can be produced at the same time as moulding, although it may also be made after moulding, for example by milling or sawing. In the context of the present invention, the term "incision" is understood as meaning a passage which cuts all the way through the wall from the inside outwards (or vice versa), while the term "slot" is understood as meaning in particular a similar passage which, however, is not entirely open from the inside outwards, but rather is just kept closed by a thin web or thin membrane. This thin

web or membrane will then break away in the event of a sufficient impact load.

[0007] Tests have shown to the applicant that the resilient means extend, to some extent depending on the type of plastic, over at most 20 mm, and more particularly over at most approximately 8 to 12 mm. If the resilient means extend over an excessive great distance, there will be a risk of the cap as a whole losing its strength.

[0008] According to a further special embodiment of the invention, it is of considerable advantage if the top wall and side wall of the body, in an edge region around the insertion opening, are narrowed in the manner of a step with respect to outside the edge region, and if the resilient means are preferably formed only in the narrowed edge region. An edge region which is narrowed in the form of a step with respect to the remainder of the wall, around the insertion opening, is not as such unknown from the prior art. Narrowed edge regions of this type are used to make the cap adjoin the interior of the shoe more smoothly, so that there is no perceptible seam for the user and as such there is no seam visible on the outside of the shoe. However, the applicant has found that if the resilient means extend through the edge region the impact strength of the cap increases to an additional degree. Although the additional increase in the impact strength is not immediately lost if the resilient means also extend into the unnarrowed wall region, the applicant has found that it is less preferable for the resilient means to extend further, into the unnarrowed region. The narrowed edge region will generally extend at most 10 to 15 mm in the forwards direction from the insertion opening.

[0009] The applicant has found that a protective cap according to the invention can very advantageously be produced from a polycarbonate. The polycarbonate may be substantially a relatively pure polycarbonate, in the sense that no fibre-based reinforcing means are added to it. However, additions for the purpose of, for example, colouring the cap, for example in grey, or for increasing its chemical resistance, are considered by the applicant to be a real possibility also covered by the scope of protection of the invention as defined in the claims.

[0010] The invention will be explained in more detail below with reference to the drawings, in which:

Fig. 1 shows a plan view of a protective cap according to the invention;

Fig. 2 shows a rear view onto and into the protective cap shown in Figure 1;

Fig. 3 shows a detailed view of the left-hand bottom part of Figure 2;

Fig. 4 shows a detailed view, corresponding to that shown in Figure 3, of a first variant embodiment of the resilient means according to the invention; and

Fig. 5 shows a detailed view corresponding to that shown in Figure 3 of a second variant embodiment

of the resilient means according to the invention.

[0011] Figures 1-3 show a protective cap 1 according to the invention in various views. The protective cap 1 substantially comprises a hollow body with an insertion opening 6 which is delimited by a substantially U-shaped front edge 7. The body is delimited by a top wall 2, which merges into a side wall 3, 4, 5 which can be imaginarily divided into a left-hand side wall 3, a right-hand side wall 4 and a front side wall 4 located between them. However, the transition from the right-hand side wall and left-hand side wall into the front side wall 4 will be able to have a considerable curvature (although the possibility of a more or less angular transition is not ruled out). On their underside, the side walls are provided with a flange 10 which faces inward in, as it were, a U shape or horseshoe shape and on the underside also delimits an opening. However, it should be noted that the underside could also be entirely closed.

[0012] To be able to obtain a more or less flat, seamless joint between the cap and the remainder of the shoe on the inside, the edge region 8 of the side wall 3, 5 and top wall 2, which delimits the insertion opening 6, is, as it were, narrowed in the form of a step with respect to that part of the body forming the cap 1 which is located outside the edge region. Measured from the edge 7 which delimits the insertion opening 6, this narrowed edge region has a depth A which in practice will be at most 10 to 15 mm. A smaller depth, for example 2 or 5 mm, is also conceivable. In practice, the applicant has found that a depth of approximately 10 mm (i.e. including, for example, 9 or 11 mm) is generally sufficient.

[0013] The invention lies in particular in the so-called resilient means, which are formed as a single unit with the body forming the protective cap. These resilient means 9 are formed on either side of the insertion opening in the left-hand side wall 3 and right-hand side wall 5. The resilient means extend a length in the forwards direction from the edge 7. This direction in which they extend does not per se have to be horizontal, as shown, but could also be inclined upwards or downwards. The length of this extension, as seen in the horizontal direction, will in practice preferably be of the order of magnitude of at most 8 to 12 mm, and will more preferably be approximately the same as the depth A of the narrowed edge region 8.

[0014] The resilient means 9 can preferably be designed as an incision which extends substantially horizontally in the forwards direction from the edge 7.

[0015] The resilient means enable the protective cap 9 to absorb in particular an impact load. The applicant is of the opinion that this impact absorption is attributable to the possibility of lateral outwards deflection (indicated by arrow Z in Figure 3) and/or deflection in the downwards direction (indicated by arrow D in Figure 3) of that section of the side wall 3, 5 which is located above the resilient means.

[0016] Figures 4 and 5 show a detailed view of two variants of the resilient means. Figure 5 shows a row of holes 20 running from the inside to the outside of the protective cap. These holes 20 are positioned close together and are just still separated by thin intermediate webs 23. If an impact load of sufficient magnitude acts on the top wall 2, these intermediate ribs 23 will break, and the effect will then be similar to where there is an incision 9. Fig. 4 shows another alternative embodiment. In this case, there is actually an incision 9 which is still closed off by a thin web, as it were a skin 21. In this case, a groove 22, as it were, is formed on the inside. It should be noted that in the alternative shown in Fig. 4, the thin web 21 may also be arranged in the centre, on the inside or at any other location in the side wall. In the event of a vertical impact load of sufficient magnitude on the top wall 2, the web 22 will break away and what will be left is, as it were, an incision 9.

[0017] According to an advantageous embodiment of the invention, the height H, measured from the underside of the side wall to the top of the resilient means, will be at most approximately 15 mm, preferably at most approximately 10 mm. This height H may, for example, be 8, 9, 10 or 11 mm. According to the invention, the vertical height of the resilient means, in particular of the incision, will advantageously be at most approximately 6 mm, for example approximately 2 or 3 mm.

[0018] The applicant has found that a protective cap as outlined above and made from polycarbonate which has been coloured grey without the addition of fibre-like reinforcing means, on the outside of a shoe, meets the requirements of the impact test described in EN 12568:1998 E both at a temperature of approximately 40°C and a temperature of — 20°C. At these temperatures, this protective cap also satisfies the inside-shoe impact test in accordance with EN 345:1999. Incidentally, it is pointed out that the protective cap according to the invention also satisfies the other requirements imposed by these European standards.

Claims

1. Protective cap (1), in particular for a safety shoe or protective shoe, the cap comprising a single-part body which is formed from plastic and has an insertion opening (6), which is open towards the rear, for toes of a foot to be fitted into the hollow body, the hollow body being delimited by a top wall (2) which at the sides and front merges into a side wall (3, 4, 5), characterized in that on either side of the insertion opening (6) resilient means (9; 21, 22; 20, 23) are formed in the side wall (3, 4, 5) for allowing deflection and/or lateral outward springing (Z) of the side wall parts (3, 5) located above the resilient means (9; 21, 22; 20, 23) when a force, in particular an impact load, is exerted on the cap (1) from above.
2. Cap according to Claim 1, characterized in that the resilient means (9; 21, 22; 20, 23) extend forwards from that edge (7) of the side wall (3, 7) which delimits the insertion opening (6).
3. Cap according to one of the preceding claims, characterized in that the resilient means (9; 21, 22; 20, 23) on either side of the insertion opening (6) comprise a slot (22) or incision (9) which extends forwards from the edge (7) of the side wall (3, 5).
4. Cap according to one of the preceding claims, characterized in that the resilient means (9; 21, 22; 20, 23) extend over at most 20 mm, preferably at most 8 to 12 mm.
5. Cap according to one of the preceding claims, characterized in that the top wall (2) and side wall (3, 4, 5) of the body, in an edge region (8) around the insertion opening (6), are narrowed in the manner of a step with respect to outside the edge region (8), and in that the resilient means (9; 21, 22; 20, 23) are preferably formed in the narrowed edge region (8).
6. Cap according to Claim 5, characterized in that the narrowed edge region (8) extends at most 10 to 15 mm in the forwards direction from the insertion opening (6).
7. Cap according to one of the preceding claims, characterized in that the plastic is a polycarbonate.
8. Cap according to Claim 7, characterized in that the plastic does not contain any fibre-based reinforcing means.
9. Cap according to one of the preceding claims, characterized in that the resilient means (9; 21, 22; 20, 23) are provided at the bottom edge of the side wall (3, 5) at a height (H) of at most 15 mm, preferably at most approximately 10 mm.
10. Shoe provided with a protective cap according to one of Claims 1-9.

fig - 1

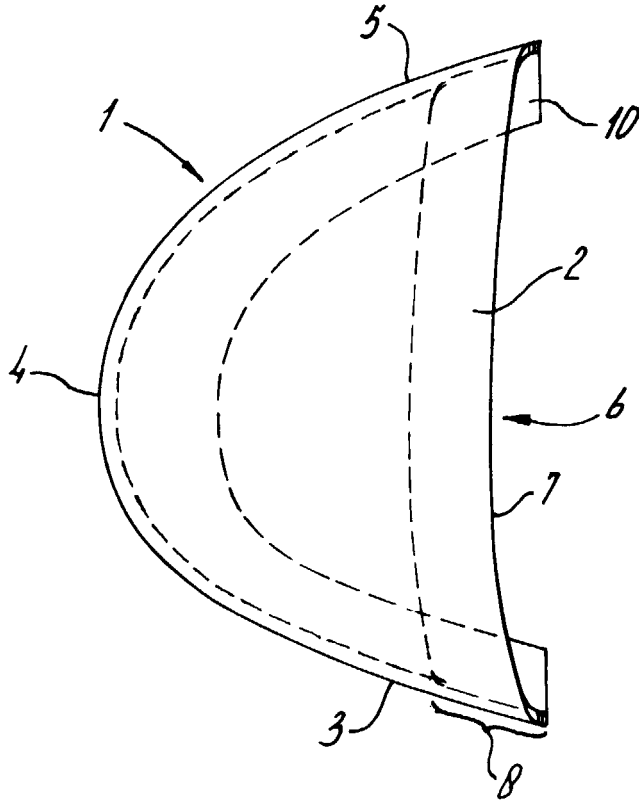


fig - 2

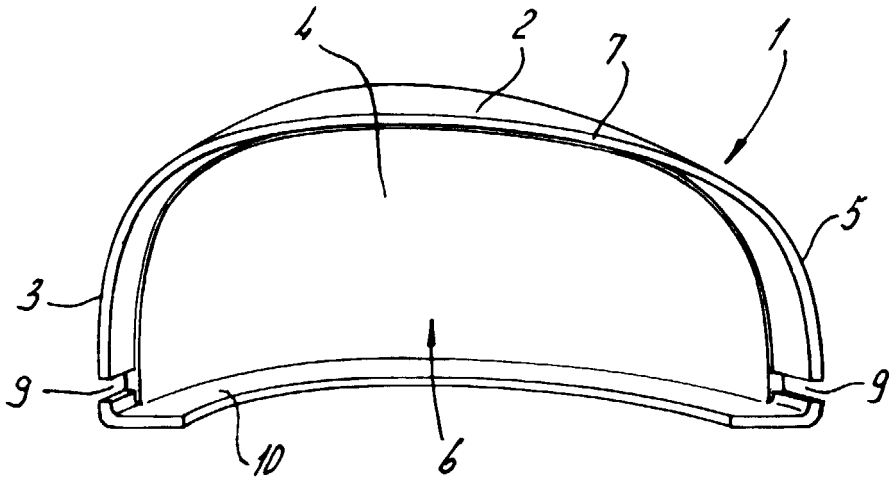


fig-3

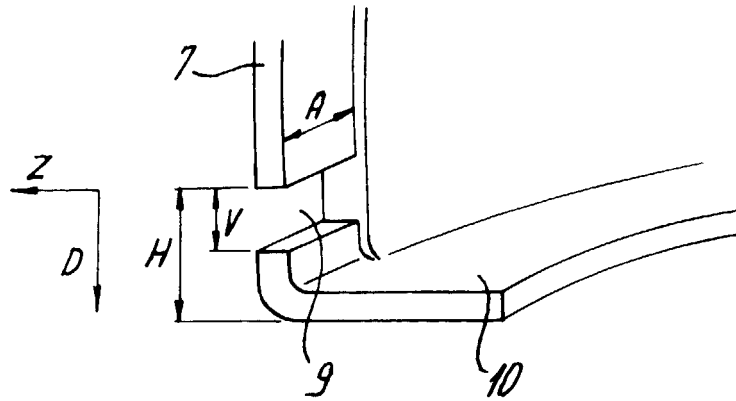


fig-4

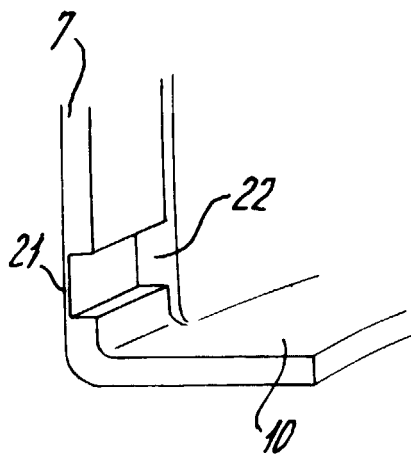
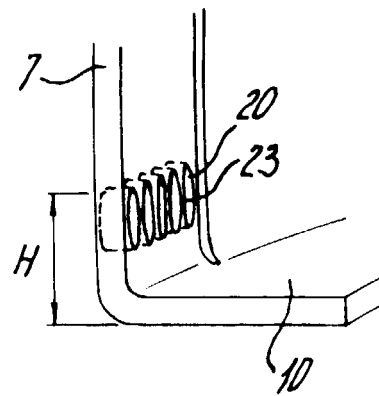


fig-5





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EUROPEAN SEARCH REPORT

Application Number
EP 00 20 3768

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 5 342 070 A (MILLER DOUGLAS R ET AL) 30 August 1994 (1994-08-30)	1-7,10	A43B23/17
Y	* column 3, line 1 - line 17; figures 11-14,14A * * column 1, line 44 - line 50 *	8,9	
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A	US 2 381 280 A (HANDELSMAN) 7 August 1945 (1945-08-07) * the whole document *	1,10	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			A43B
Place of search		Date of completion of the search	Examiner
THE HAGUE		30 January 2001	Scholvinck, T
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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 00 20 3768

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30-01-2001

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