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(54) **Protective shoe**

(57) A protective shoe comprising:

- a sole (10) and an upper (30);
- a toe protective cap (40);
- a metatarsal protective member (50) inserted in the up-

per and having at least one point of support on the toe cap.

The inventive shoe provides continuity of the foot protection without reducing comfort and aesthetics of the shoe.

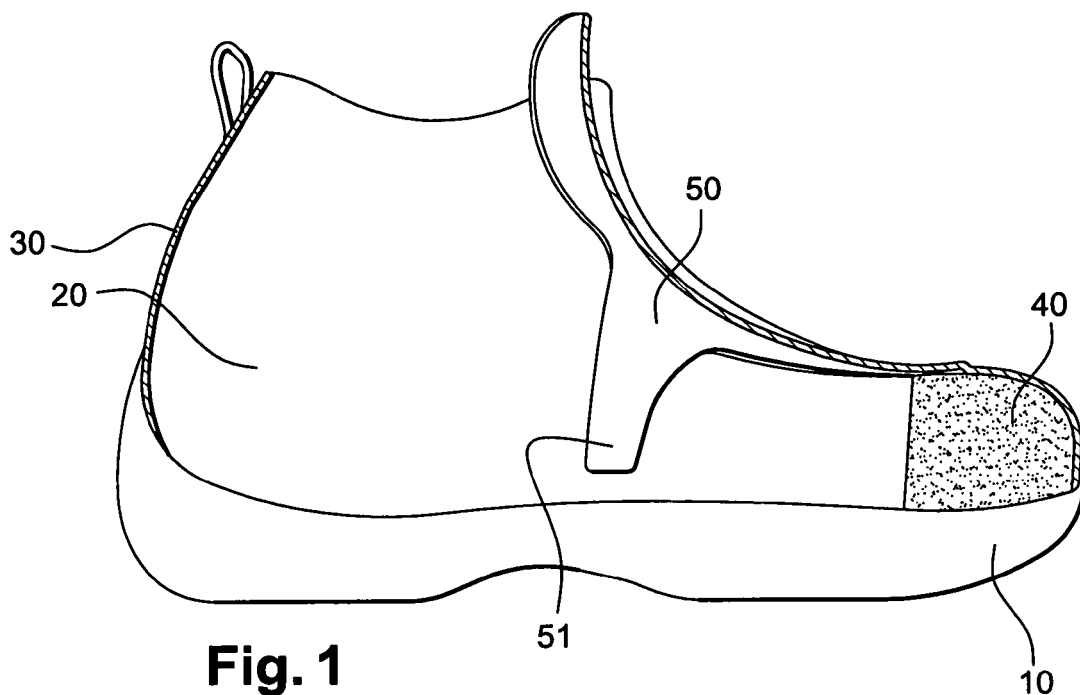


Fig. 1

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The invention relates to protective shoe, notably for use in building sites or manufacturing plants.

2. Related Background Art

[0002] There exist shoes or boots including integral or external toe protectors or toe caps. One can refer for instance to documents US-A-3 841 004 or EP-A-1 502 518 disclosing toe protectors.

[0003] However, these protectors do not protect the metatarsals or other bones in the mid foot. WO 2007/053886 discloses a foot guard for protection of the mid foot. The foot guard includes a plate and connecting means for fitting the plate in use to an upper surface of the shoe. The metatarsal protector of WO-A-2007/053886 is fitted on top of the shoe, with laces for instance. Such protection is not esthetic; it can be omitted or fitted in crooked by the user lacing the shoes.

[0004] US-A-2002/0104174 discloses metatarsal guard inserted in the upper of a safety shoe and defining an arch extending from the sole of the shoe on one side of the wearer's instep to the sole on the other side of the wearer's instep. The metatarsal guard of US-A-2002/0104174 is supported by the shoe sole. A shock received on the metatarsal bones will be absorbed by the guard abutting on shoe sole. The abutment points of the guard are only two; they are made from conventional thermoplastics and are very thin, about 1,75 mm. Under a shock the abutment points of the guard would therefore penetrate the resilient material of the sole. Thus the metatarsal guard of US-A-2002/0104174 would not pass the most demanding safety standards.

[0005] For instance, standard NR-EN-IS020344 request that a weight of 20 kg be dropped from 0,50 m height on a wax foot without crushing it more than a limited depth. To fulfill this standard, metatarsal protection must be supported by several rigid points to ensure adequate stress spread.

[0006] Therefore, there is a need for a protective shoe having toe protection and metatarsal protection which can fulfill the most demanding standard for personal security. Notably there is a need for a protective shoe having metatarsal protection that can not be omitted and that can efficiently protect the foot from hard shocks.

SUMMARY OF THE INVENTION

[0007] The invention provides a solution for increased protection of the foot and notably the mid foot. The invention provides for a metatarsal protection inserted in the shoe to prevent any omission and having at least one point of support on the toe cap. A shock received on the

mid foot would therefore partly be absorbed by the toe cap. The metatarsal protection can have at least three points of support; one point of support on the toe cap and two points of support in the upper or on the sole. Stress spread of heavy loads would therefore be improved and mid foot fully protected. In particular, the invention provides for a protective shoe comprising:

- a sole and an upper;
- a toe protective cap;
- a metatarsal protective member inserted in the upper and having at least one point of support on the toe cap.

[0008] According to embodiments, the shoe of the invention may comprise one or more of the following features:

- the metatarsal member extends in the upper away from the toe cap and comprises lateral tongues extending on either sides of the shoe;
- the lateral tongues of the metatarsal member are supported on the sole of the shoe;
- the sole of the shoe includes a reinforcing member supporting the lateral tongues of the metatarsal member;
- the lateral tongues of the metatarsal member are supported by the upper of the shoe;
- the lateral tongues of the metatarsal member are supported in pockets arranged on the inside of the upper of the shoe;
- the lateral tongues of the metatarsal member have a wave design in cross-section;
- the metatarsal member is free to slide over the toe cap;
- an end of the metatarsal member is inserted in a stepped groove of the toe cap;
- the metatarsal member is made of thermoplastic material;
- the metatarsal member is made of fiber reinforced polymer material;
- the metatarsal member is provided with at least one slot.

[0009] Additional objects, advantages and features of the various aspects of the present invention will become apparent from the following description of its preferred embodiments which is given in conjunction to the accompanying drawings, the description of these embodiments being given as non-limiting examples.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010]

Fig. 1 shows a protective shoe comprising a metatarsal protection according to a first embodiment of the invention;

Fig. 2 shows a protective shoe comprising a metatarsal protection according to a second embodiment of the invention;

Fig. 3 shows a protective shoe comprising a metatarsal protection according to a third embodiment of the invention;

Fig. 4 shows a perspective view of the metatarsal protection according to the invention;

Fig. 5 schematically shows a detail of a cross-section view AA of the lateral tongue of the metatarsal protection according to an embodiment of the invention;

Fig. 6 shows a first embodiment of the support of metatarsal protection by toe cap for a protective shoe according to the invention;

Fig. 7 shows a second embodiment of the support of metatarsal protection by toe cap for a protective shoe according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0011] The invention provides for a protective shoe comprising a toe protective cap and a metatarsal protective member inserted in the upper of the shoe and supported at least by the toe cap. A continuity of the foot protection is therefore provided by the metatarsal protective member overlapping the toe cap.

[0012] The protective shoe of the invention will be described in detailed with reference to figures 1 to 3 which illustrate three possible embodiments of the protective shoe of the invention given by way of example without limitation. The shoe of the invention comprises a sole 10, a sock lining 20 and an upper 30, which are conventional elements for shoes. The shoe of the invention further comprises a toe cap 40 inserted in the upper of the shoe and a metatarsal protective member 50. The metatarsal protective member 50 is also inserted in the upper 30 of the shoe. Thus, mid foot protection can not be forgotten or fitted in crooked by the user of the protective shoes. Safety is therefore increased. Metatarsal protection is also invisible from the exterior and aesthetics of the shoe is not spoiled.

[0013] Further, the metatarsal protective member 50 of the inventive shoe has at least one point of support on the toe cap 40. An end of the metatarsal protective member 50 is resting over the top of the toe cap 40. The toe cap is conventionally made from metallic or any other rigid material. A shock on the mid foot will therefore be absorbed by the metatarsal protective member itself but also by the toe cap. Such stress spread increases protection of the foot.

[0014] As seen in figures 1, 2 and 3, the metatarsal member 50 extends in the upper of the shoe substantially over the whole length of the front upper, i.e. the metatarsal protective member extends between the sock lining and the upper from the toe cap to the opening of the shoe. The entire foot is therefore protected.

[0015] Figure 4 is showing a perspective view of the metatarsal protection according to the invention. The

metatarsal protective member 50 of the inventive shoe also comprises lateral tongues 51 extending on either sides of the shoe. The lateral tongues 51 are integral with the metatarsal protective member 50 which has a substantially cross bend shape. The metatarsal protective member can be made from any conventional thermoplastic materials such as Polycarbonate, ABS, HDPE, PP or PVC, or from composite material such as fiber reinforced plastic polymer; reinforcing material such as carbon, glass or aramid fabric can be used with any appropriate thermoplastic matrix. For instance, self reinforced polypropylene composite (polypropylene fibres in a polypropylene matrix) is well suited for the protective member of the invention because this material is light and ductile; it can undergo high stress without breaking while being flexible and light to wear. Moreover, in case of rupture, self reinforced polypropylene composite will not produce any needles like carbon or other fibres would; injury of the wearer is therefore avoided.

[0016] By using such composite material, thickness of the metatarsal protective member can be limited without jeopardizing protection of mid foot. The thickness of the metatarsal protective member can be comprises between about 1,5 mm to 2,5 mm when using composite material when the thickness is about 3,0 mm when using conventional thermoplastic to ensure equivalent shock resistance.

[0017] The lateral tongues 51 of the metatarsal protective member 50 are adding two support points on either side of the shoe. Stress of heavy loads can be spread over the entire foot and injury can be limited. The lateral tongues 51 can be supported on the sole of the shoe (figure 1) or by the upper 30 of the shoe (figure 2), for instance within pockets 31 arranged on the inside of the upper 30. When the lateral tongues 51 are supported on the sole of the shoe, a reinforcing member 11 can be arranged in the sole to compensate for the sole resiliency (figure 3) and ensure a better stress spread from the metatarsal protective member 50 under a shock. The reinforcing member 11 can be a rod extending traversal in the sole; it is preferably embedded in the shoe sole such that the wearer can not feel it. The reinforcing member 11 of the sole 10 can be made from a composite material or a polymer material such as polyurethane with a shore hardness of about 70 Shore A or more. The reinforcing member 11 could also be a metallic rod but metal should be avoided for nonmagnetic equipment. Polyurethane is advantageous when the sole is made from polymer material because of compatibility issues. The width of the reinforcing member 11 should be large enough to ensure strong support for the lateral tongues 51 but small enough not to obstruct flexibility of the shoe; reinforcing member 11 being about the same width as the end of the lateral tongues is appropriate.

[0018] The metatarsal protective member of the inventive shoe has three strong support points, one support point on the metallic toe cap and two lateral support points in the upper itself or on the sole. The stress applied to

the lateral support points is balanced from one lateral point to the other and can be overtaken by the shoe laces or the sole. When the lateral tongues are supported by pockets arranged inside the upper (figure 2), because the upper is held tight by the shoe laces whenever the shoe is carried on, stress applied on top of the shoe is uniformly spread and foot is efficiently protected from heavy loads. When the lateral tongues are supported by the sole (figures 1 or 3), stress applied on top of the shoe will be overtaken by the sole. To limit sinking of the lateral tongues 51 in the resilient material of the sole 10, reinforcing member 11 can be provided (figure 3) and/or the lateral tongues 51 can have a specific design such as illustrated in figure 5.

[0019] Figure 5 shows a specific design of the lateral tongues 51 that can be used when the lateral tongues are either supported by the upper 30 of the shoe or on the sole 10 with or without reinforcing member 11. Figure 5 is a detailed view of a small section of a lateral tongue. According to this embodiment, the lateral tongues 51 have a wave or sine design; such design makes it possible to increase surface contact between protective member and shoe upper for better stress spread. With such a design, the lateral tongues 51 may resist heavier shock without rupture.

[0020] In addition, metatarsal protective member 50 of the inventive shoe does not reduce the user comfort. As mentioned above, weight and thickness of metatarsal protection is limited by appropriate material selection. The width of the lateral tongues 51 is also relatively small; the end of the tongue may be comprised between about 1 cm to 5 cm. This small width compared to the prior art improves the user's comfort. Moreover, flexibility of the foot movement is not disturbed. The metatarsal protective member 50 may also include at least one slot 52 to improve flexibility of the shoe. Figure 4 shows three slots 52 having crescent shape and different size but it should be understood that number, shape and size of the slots depend on the shoe size, the material chosen for the protective member and the application.

[0021] The metatarsal protective member 50 is supported by toe cap 40 but both elements are not tightly connected. Notably, metatarsal member 50 is free to slide over toe cap 40. Foot movement is not obstructed by the inventive shoe.

[0022] Figures 6 and 7 are showing two possible embodiments for the free sliding of the metatarsal member 50 on top of the toe cap 40. According to one embodiment (figure 6) an end of the metatarsal member 50 is inserted in a stepped groove 41 of the toe cap 40. According to a second embodiment (figure 7) an end of the metatarsal member 50 is simply resting on top of the toe cap 40. The upper 30 of the shoe simply overlap the end of the metatarsal member 50 supported by the toe cap 40. Because the upper 30 is flexible, it does not obstruct free sliding of the metatarsal member 50 relative to the toe cap 40, but prevents any excessive shift of the metatarsal member relative to the toe cap. Such arrangement pro-

vides that metatarsal member 50 always partly overlap toe cap while allowing relative movement of the protective members 40 and 50. Security and comfort of the user are therefore achieved.

[0023] The above description of the invention is intended to be illustrative and not limiting. Various changes or modifications in the embodiments described may occur to those skilled in the art without departing from the spirit or scope of the invention.

[0024] For example, the metatarsal protective member of the inventive shoe is not limited to composite material but can be made from any plastic or non plastic material.

[0025] Further, the shoe illustrated in figures 1 and 2 is an ankle shoe but the invention also applies to low shoes or boots.

Claims

1. A protective shoe comprising:
 - a sole (10) and an upper (30);
 - a toe protective cap (40);
 - a metatarsal protective member (50) inserted in the upper and having at least one point of support on the toe cap.
2. The shoe of claim 1, wherein the metatarsal member (50) extends in the upper away from the toe cap (40) and comprises lateral tongues (51) extending on either sides of the shoe.
3. The shoe of claim 2, wherein the lateral tongues (51) of the metatarsal member are supported on the sole (10) of the shoe.
4. The shoe of claim 3, wherein the sole (10) of the shoe includes a reinforcing member (11) supporting the lateral tongues (51) of the metatarsal member.
5. The shoe of claim 2, wherein the lateral tongues (51) of the metatarsal member are supported by the upper (30) of the shoe.
6. The shoe of claim 5, wherein the lateral tongues (51) of the metatarsal member are supported in pockets (31) arranged on the inside of the upper (30) of the shoe.
7. The shoe of any one of claims 2 to 6, wherein the lateral tongues (51) of the metatarsal member have a wave design in cross-section.
8. The shoe of any one of claims 1 to 7, wherein the metatarsal member (50) is free to slide over the toe cap (40).
9. The shoe of claim 8, wherein an end of the metatarsal

member (50) is inserted in a stepped groove (41) of the toe cap.

10. The shoe of any one of claims 1 to 9, wherein the metatarsal member (50) is made of thermoplastic material. 5
11. The shoe of any one of claims 1 to 9, wherein the metatarsal member (50) is made of fiber reinforced polymer material. 10
12. The shoe of any one of claims 1 to 11, wherein the metatarsal member (50) is provided with at least one slot (52). 15

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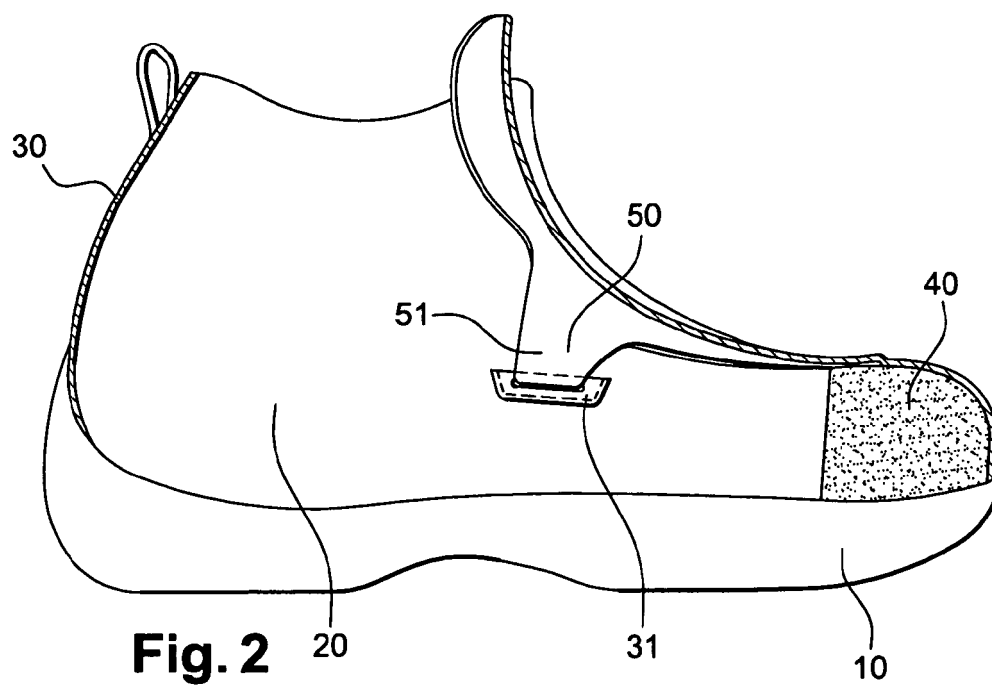
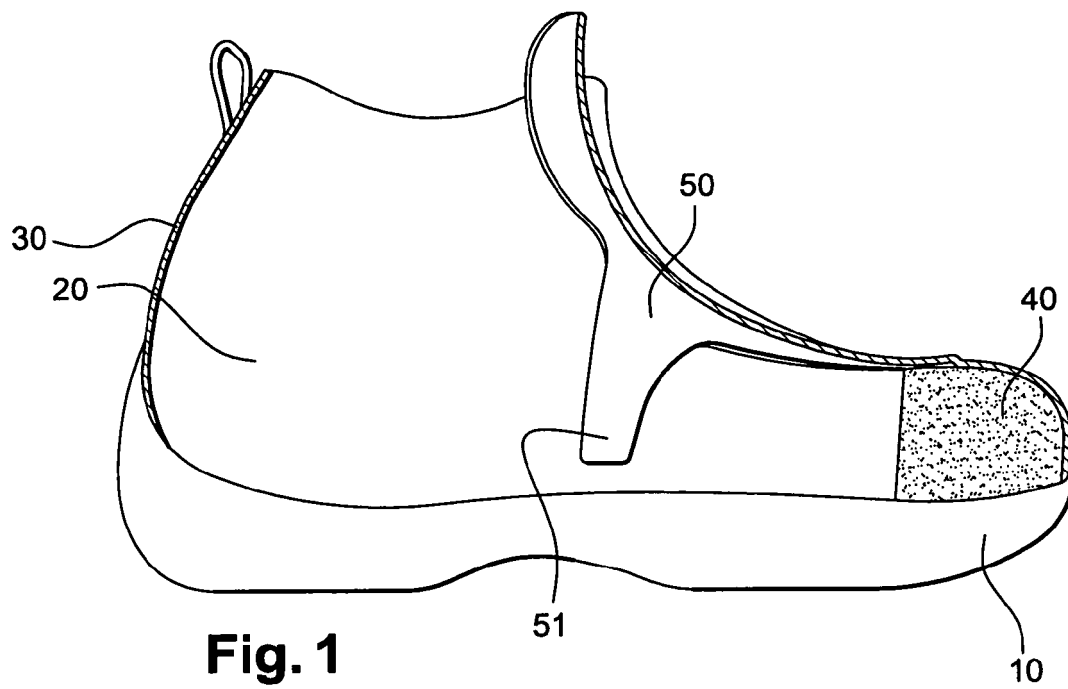
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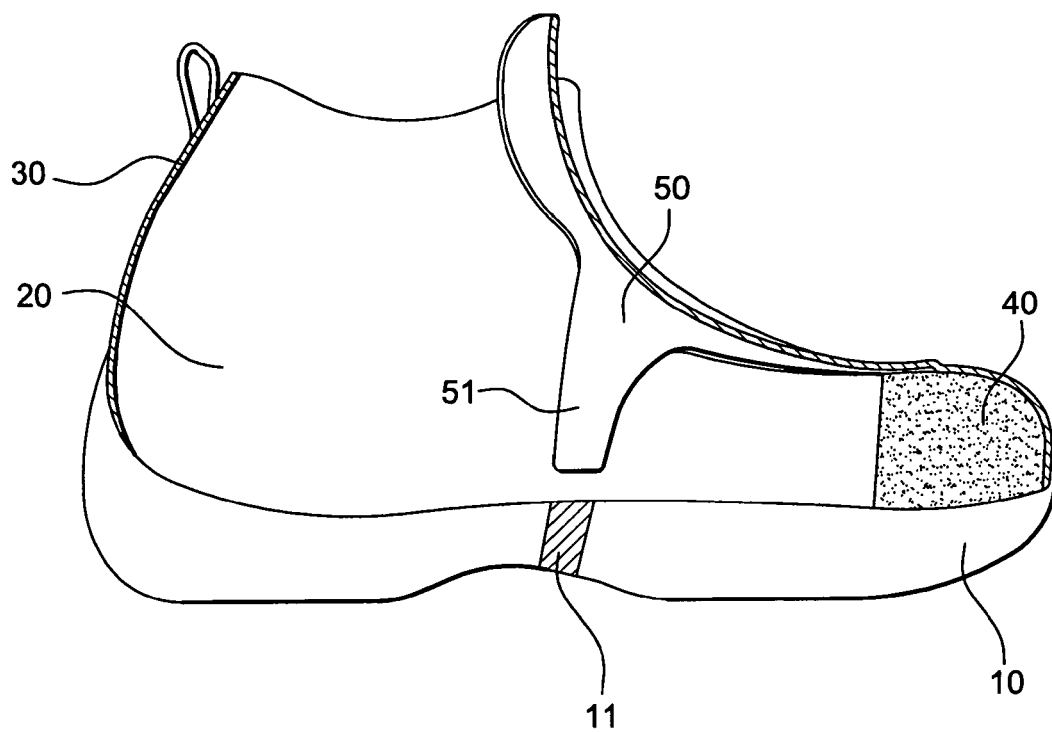


Fig. 3

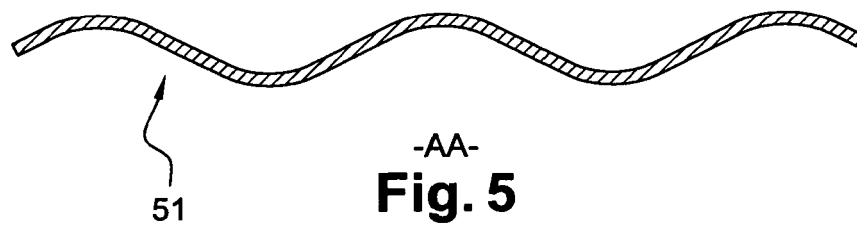
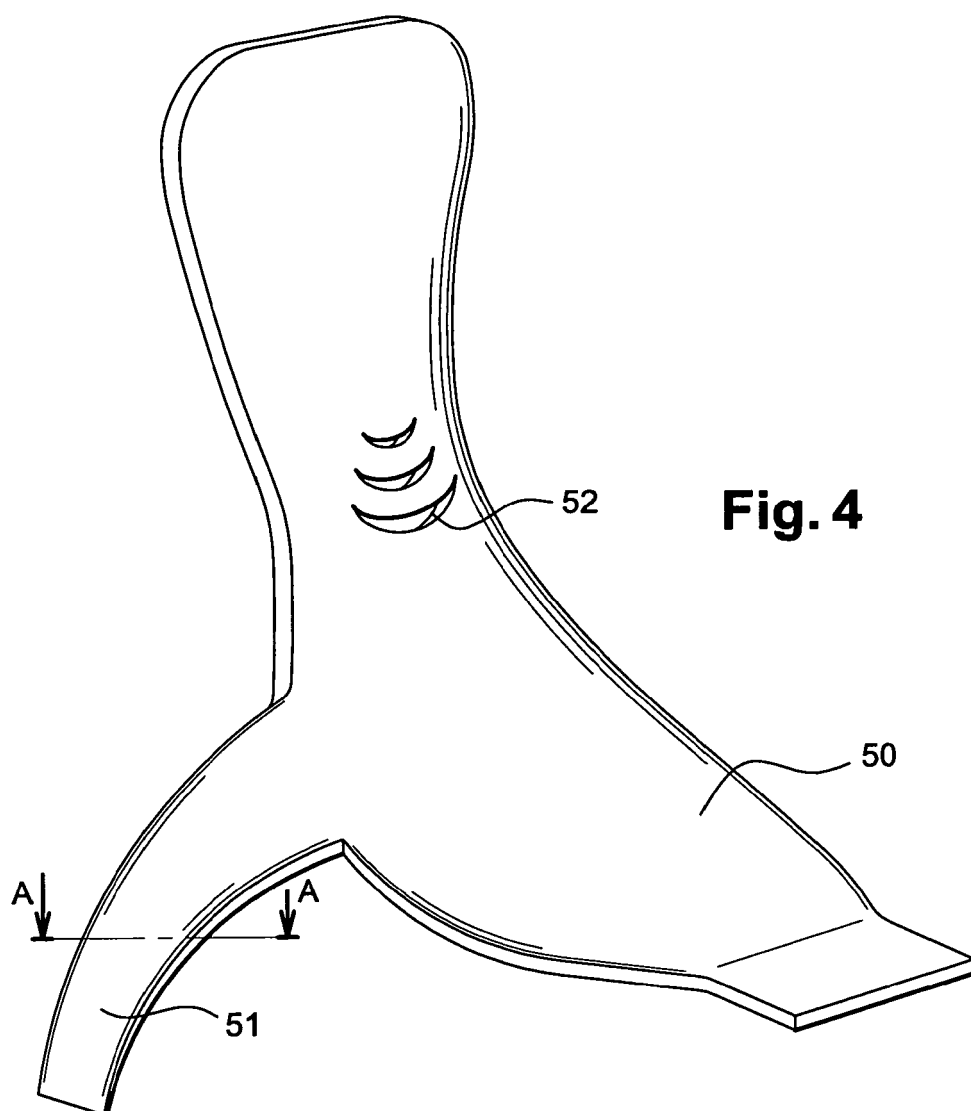


Fig. 6

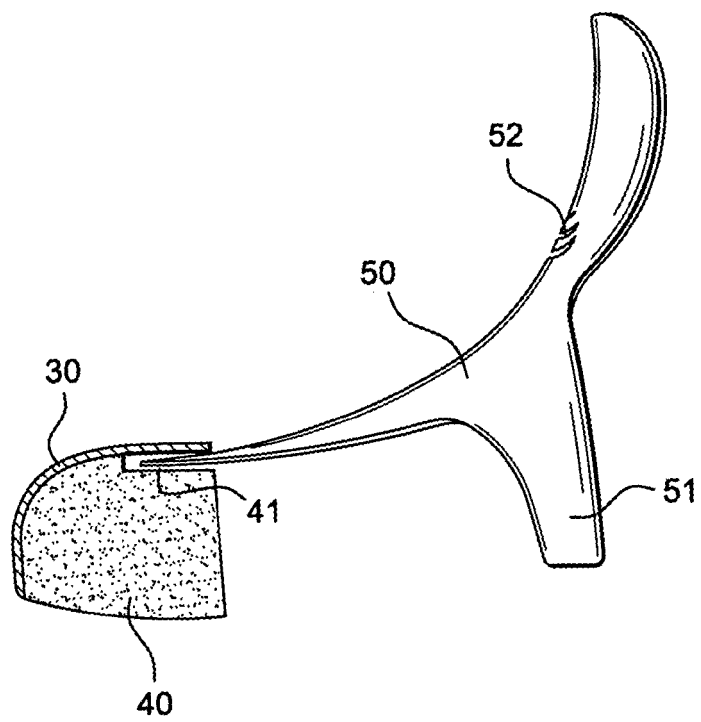
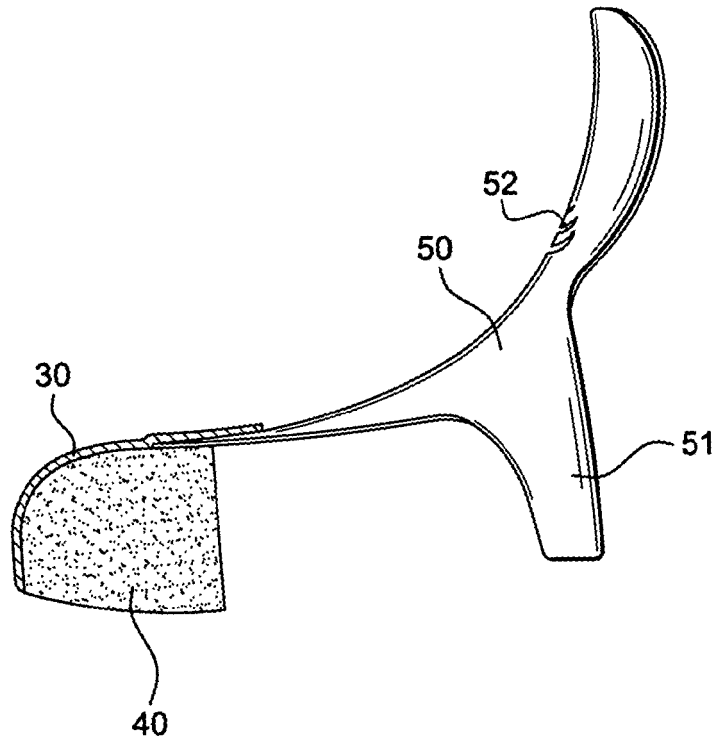


Fig. 7





DOCUMENTS CONSIDERED TO BE RELEVANT			
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 19 May 2008	Examiner Herry, Manuel
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document	

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 07 29 1598

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The members are as contained in the European Patent Office EDP file on
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