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(54) CLIMBING SLIPPER COMPRISING A REINFORCEMENT INSERT

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(57) **ABSTRACT**

The invention proposes a climbing shoe comprising a sole made of an adhesive material, characterized in that the shoe **(10)** comprises a reinforcement insert **(26)**, the contour of which coincides with the contour of the sole, at least in a front portion of the sole.

FIG. 1

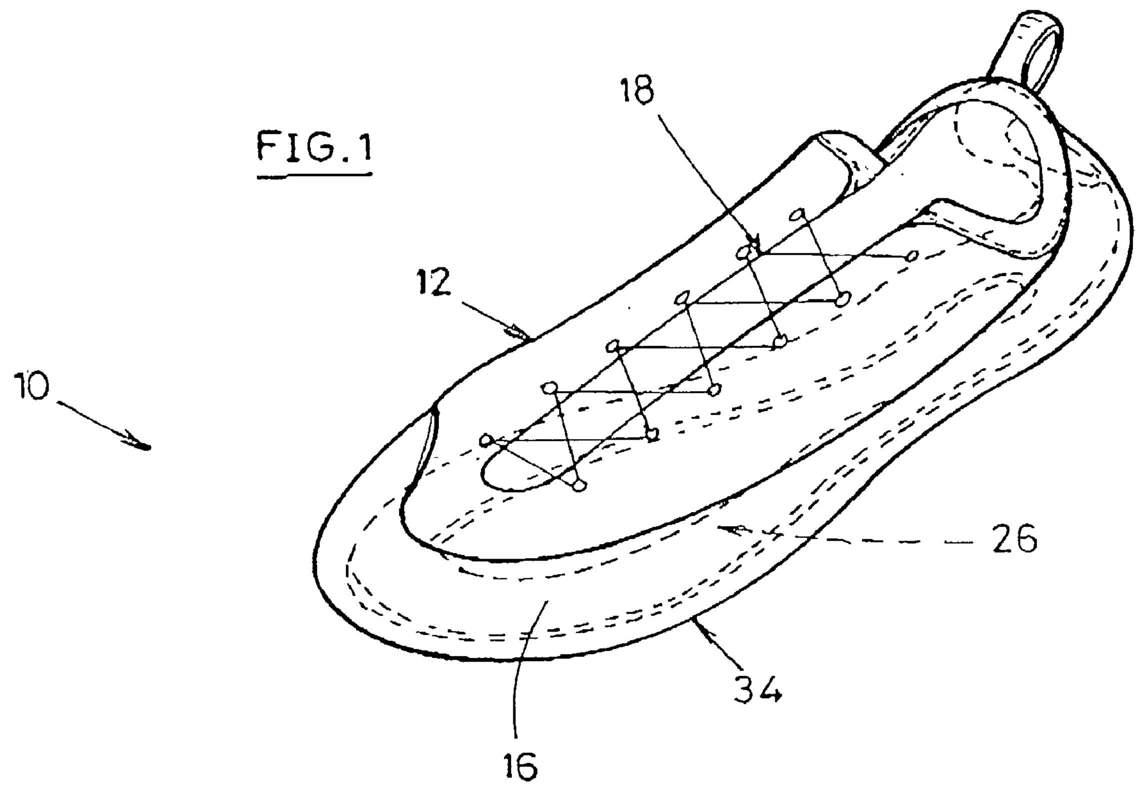


FIG. 2

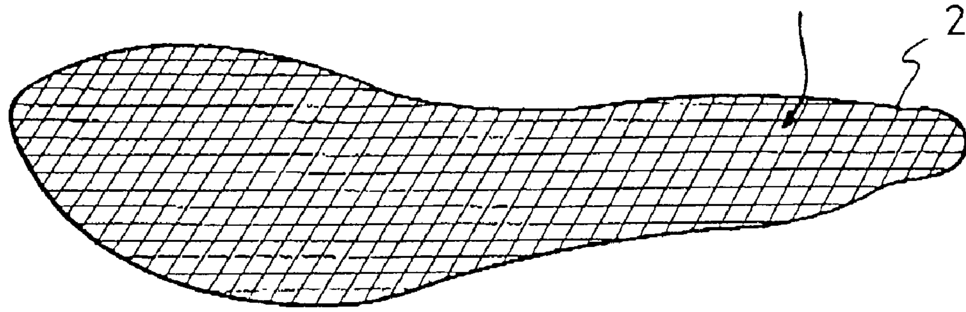


FIG. 3

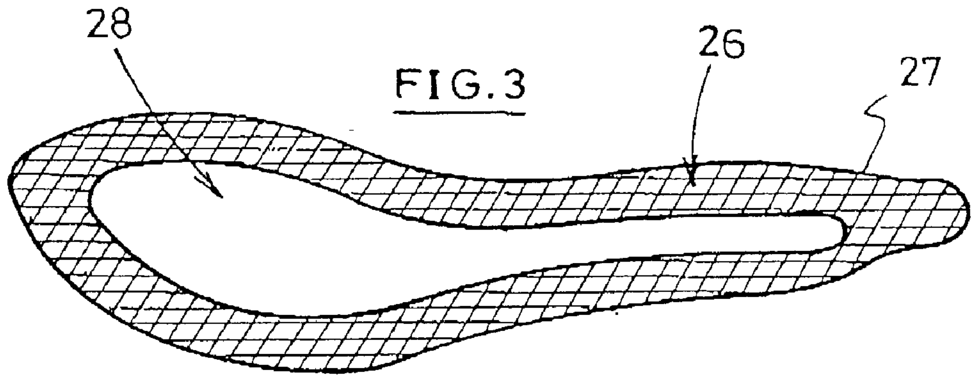


FIG. 4

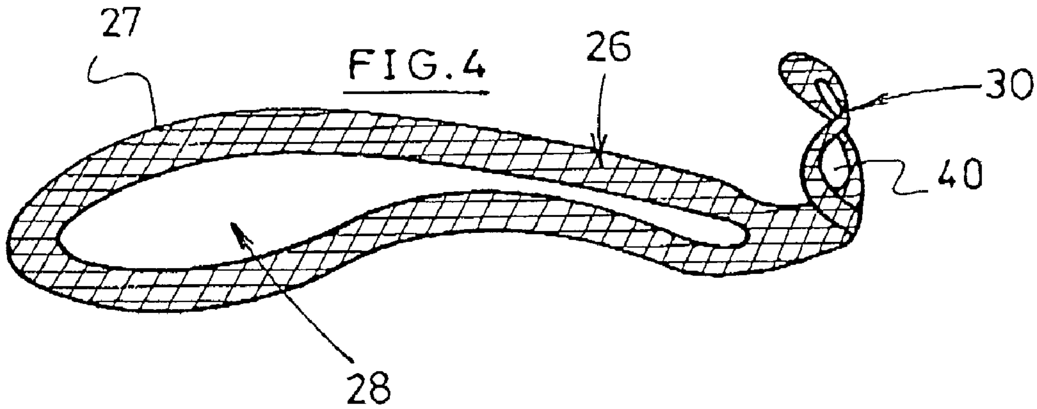


FIG. 5

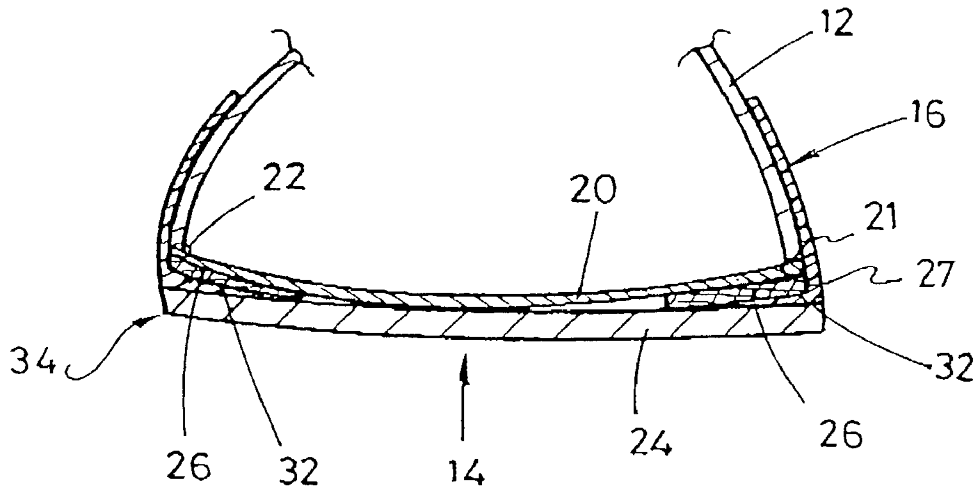


FIG. 6

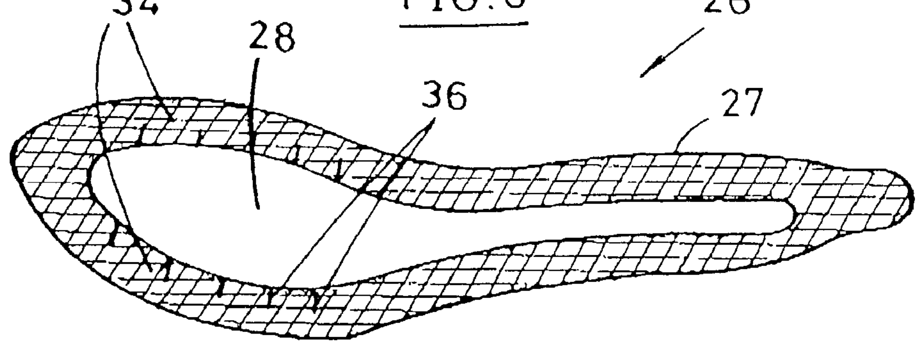


FIG. 7

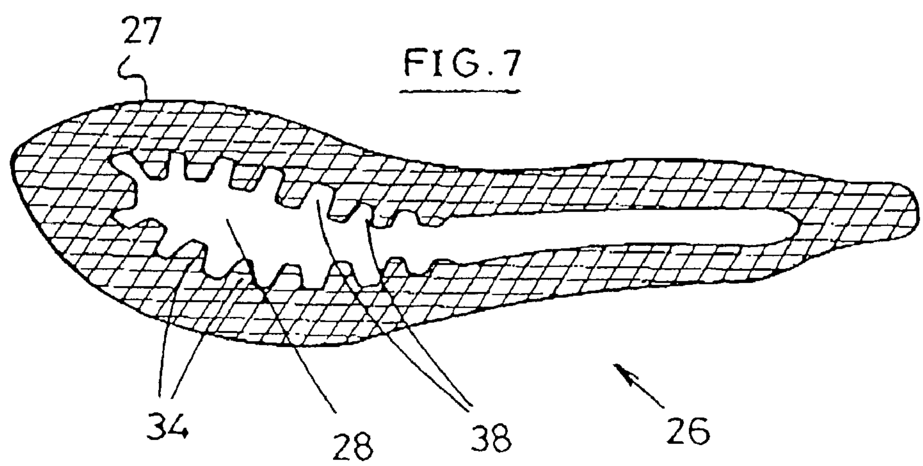


FIG. 8

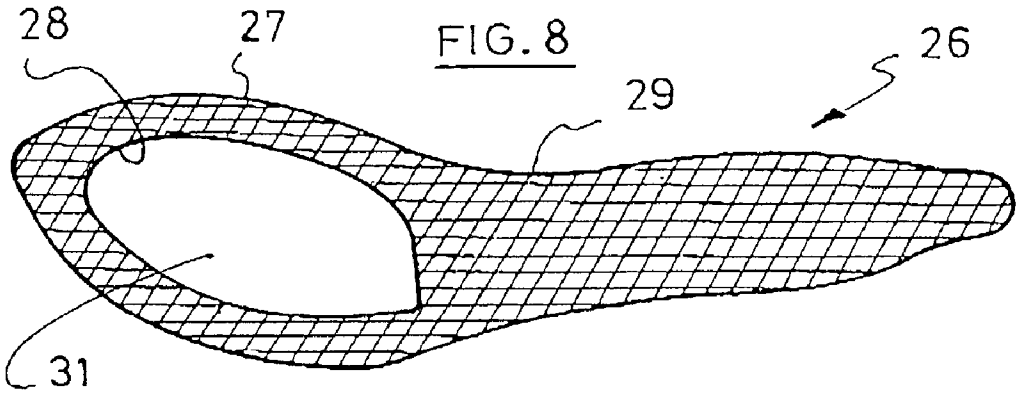
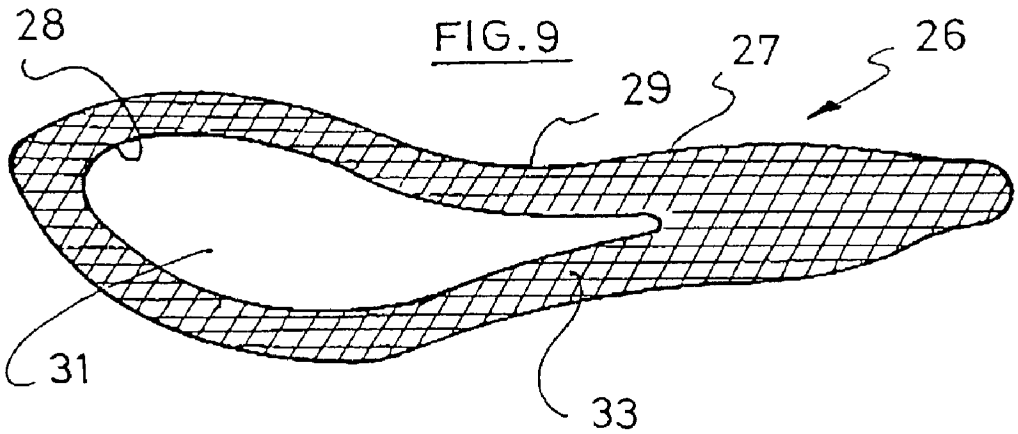


FIG. 9



CLIMBING SLIPPER COMPRISING A REINFORCEMENT INSERT

[0001] The invention relates to the field of climbing shoes.

[0002] Climbing shoes have a relatively simple sole mainly constituted of an outer sole made of a very adhesive, generally rubber-based material.

[0003] U.S. Pat. No. 5,142,797 describes a climbing shoe in which the sole comprises an inner sole and an outer sole, the inner sole being made of a relatively rigid material. This inner sole has a special arch for relaxing the muscles of the plantar arch when the climber takes support on the tip of the shoe. This relatively rigid inner sole therefore has the object of modifying the bending characteristics of the sole over its length.

[0004] The invention has the object of proposing a climbing shoe that particularly has improved characteristics of torsional strength. Indeed, the climber quite often needs to take support not on the tip of the shoe but on the lateral edges of the front portion of the sole, on the inner side or on the outer side, which are also called the edges of the shoe. This type of support, markedly offset with respect to the axis of the foot and of the shoe, therefore tends to cause a torsion (or twisting) of the foot and of the shoe about their longitudinal axis.

[0005] To this end, the invention proposes a climbing shoe comprising a sole made of an adhesive material, characterized in that the shoe comprises a reinforcement insert, the contour of which coincides with the contour of the sole, at least in a front portion of the sole.

[0006] Other characteristics and advantages of the invention will appear in reading the detailed description that follows, and with reference to the attached drawings in which:

[0007] **FIG. 1** is a perspective schematic view of a shoe provided with a reinforcement insert according to the teachings of the invention,

[0008] **FIG. 2** shows a planar view of a first example of embodiment of the reinforcement insert,

[0009] **FIG. 3** is a view similar to that of **FIG. 2** showing an insert provided with a central opening,

[0010] **FIG. 4** shows an insert that is additionally provided with an integrated rear stiffener,

[0011] **FIG. 5** is a partial cross-sectional view of the shoe of **FIG. 1**,

[0012] **FIGS. 6, 7** and **8** are planar views of two other alternative embodiments of a reinforcement insert.

[0013] **FIGS. 1 and 5** show a climbing shoe **10** that, as known, is mainly composed of an upper **12**, in this case a flexible low upper, a sole **14** and a protective outer lateral strip **16** that follows the lower edge of the upper **12**, at least in the front portion of the shoe. Certain types of climbing shoes are called ballerinas, and the invention also applies to this type of shoe.

[0014] The upper **12** is a flexible upper, adapted to be adjusted to the foot, and it comprises, for example, a lacing system **18** to facilitate insertion of the foot in the shoe **10** and the tightening of the shoe on the foot. The upper **12** here is a low upper that does not rise above the ankle, but the invention could be applied within the scope of a shoe with a high upper. The upper can be made of any type of flexible material, particularly leather or fabrics. It can also be made of a tri-dimensional woven material that promotes the evacuation of perspiration.

[0015] First, the sole **14** comprises an insole **20** that is, for example, assembled to the upper according to the ströbel technique. As can be seen in **FIG. 5**, the insole **20** is thus attached edge to edge to the lower edge of the upper **12** by a stitching **22**. For a climbing shoe, this insole **20** quite often comes directly in contact with the user's foot in order to avoid multiplying the thicknesses that can hinder the climber's sensitivity to the perception of the terrain. In a traditional shoe, this insole **20** is directly covered by an outer sole **24**. The outer sole is made of a material that has a very high adhesiveness and a good flexibility, for example, a rubber-based material. This outer sole **24** generally has a thickness on the order of 4 mm, at least in the front portion of the sole **14**. The traditional sole **14** is therefore a sole that is substantially flexible. Indeed, the nature of the materials used and their low thickness make the sole hardly resistant to deformation with respect to the forces that are imposed on it. In a traditional shoe, it is therefore the muscles from the user's foot that absorb almost all of the forces due to the supports. In traditional shoes, one can find, between the outer sole and the insole, pressure distribution elements located either at the center of the front portion, or at an edge of the shoe. Nevertheless, these localized distribution elements have very low mechanical features whose main role is to distribute the overpressure due, for example, to a support on a rough terrain. Given their low mechanical properties, these pressure distribution elements cannot impart an overall true rigidity to the sole.

[0016] On the contrary, the shoe **10** according to the invention comprises a reinforcement insert **26** in order to better control the deformations of the sole when in support.

[0017] According to a first embodiment of the invention shown in **FIG. 2**, the insert **26** is in the form of a planar plate element having a peripheral contour **27** substantially identical to the peripheral contour **21** of the first insole **20**, at least in the front portion of the sole **14**.

[0018] In the examples of embodiment shown, the reinforcement **26** extends over the entire length of the sole, i.e., up to a zone of the heel of the sole. This configuration is particularly efficient as it allows for a better distribution of the torsional stress. Nevertheless, one can also envision making the invention with an insert that extends only over the front portion of the sole as long as it follows the contour thereof.

[0019] In the rear portion of the sole **14**, the contour **27** of the insert **26** shown in **FIG. 2** can have a contour that is different from that **21** of the insole **20**, for example, by having a smaller width.

[0020] This insert **26** can be made of different types of materials as long as they have sufficient rigidity, i.e., greater than that of the material of the adhesive sole. The material forming the insert will preferably have a modulus of elasticity (Young's modulus) greater than 1 GPa. The insert could thus be made by means of an injected plastic, such as polyethylene, polyamide, or rigid polyurethane. In order to increase their mechanical properties, these plastics can be filled with fiber. Naturally, any other material having the desired properties of rigidity can be used.

[0021] The insert can also be made by compression molding, for example, by using a thermosetting resin filled with fibers.

[0022] However, the best compromise in weight and rigidity is obtained by using highly efficient composite materials, such as fiber webs (preferably woven) impregnated with a polymer resin (for instance, a polyester resin or an epoxy resin). The fiber webs are preferably glass fabrics or carbon fabrics. Different types of weaving and fiber orientation can be envisioned. Likewise, the weight of the fibers used can be adapted to the performances one wishes to obtain. These highly efficient composite materials (they have a modulus of elasticity on the order of 15-120 Gpa) are more expensive than the aforementioned materials, but they allow obtaining a lighter insert having equivalent mechanical properties.

[0023] Due to its geometry and the specific rigidity of the materials composing it, the insert **26** allows for a very substantial increase in the strength of the shoe when the climber takes support on a surface only with the edges **34** of the shoe, i.e., with the lateral edges of the front portion of the sole. Indeed, due to the fact that the reinforcement insert **26** extends laterally up to the edges of the sole **14**, the support forces imposed on the edges are directly absorbed by the insert. These forces that impose torsional stress on the sole are transmitted toward the rear of the sole, it is toward the part of the foot that transmits the support forces toward the climber's leg. One obtains a better deformability of the sole, in contrast to a localized pressure distribution element, and one better relaxes the forces to be provided by the foot muscles.

[0024] In addition, the fact that the insert extends up to the specific spot of the support, i.e., up to the level of the edges **34**, allows the outer sole to better fulfill its adhesive role. Indeed, the material of this outer sole is necessarily relatively deformable. Under stress of the support, therefore, the material, without the insert, would tend to deform excessively, to the point of hindering the adhesiveness of the support. On the contrary, since the edge **34** is reinforced by the insert according to the invention, the deformation of the material of the outer sole at the level of the support is limited, and the material can fulfill its function of adhesiveness to its best ability. The same advantage is naturally found in relation to the adhesive role that is occasionally fulfilled by the protective strip **16**, which strip is generally made of the same material as that of the outer sole **24** or of a similar material.

[0025] **FIG. 3** shows a particularly interesting embodiment of the invention. Indeed, one can see that this second embodiment of a reinforcement insert **26** differs from the first by the presence of a central opening **28** that, as shown, extends over the front portion of the sole **14** but also over a good portion of the rear portion thereof. Due to the presence of this opening **28**, the insert **26** is presented, at least in the front portion of the sole, as a peripheral frame having a substantially constant width which follows the outer contour of the sole **14** almost exactly, particularly in the front portion thereof, but which is cut out in the center. The width of the peripheral frame is comprised, for example, between 4 and 20 mm. Naturally, the width of the peripheral frame can also vary.

[0026] The presence of the central opening **28** has the advantage of reinforcing the strength of the sole **14** at the level of the lateral edges (edges **36**), without downgrading too substantially the capacity of the sole to transmit sensory information to the foot with respect to the micro-reliefs of the surface on which the foot takes support. Indeed, in its central portion, the one corresponding to the central opening **28**, the sole **14** has the same capacity to deform as a traditional sole, at least along a direction perpendicular to the plane of the sole. Due to this central portion, the climber can thus feel the roughness of the terrain on which he takes support without this roughness being filtered by the presence of an insert covering the entire forefoot. With this configuration, the insert **26** maintains a good portion of its capacities to improve the torsional strength of the sole. In fact, one can see that the central opening **28** could extend only over the front portion of the sole where most of the sensory perception occurs, since the central and rear portions of the insert can be solid to reinforce the anti-torsional effect of the insert.

[0027] In **FIGS. 6 and 7**, two alternative embodiments of the invention are shown, their object being to confer to the insert **26** a progressive rigidity between the lateral contour **27**, that is desired to be rigid, and the central portion corresponding to the opening **28**. This object can be achieved by providing that the insert have strips **34** extending along a radial direction towards the "center" of the opening **28** in the plane of the insert. In the example of **FIG. 6**, these strips **34** are obtained simply by providing, in the peripheral frame of the insert surrounding the central opening **28**, cutouts **36** having a substantially radial orientation that open out on the inner edge demarcating the opening **28**. Naturally, these cutouts **36** do not extend up to the outer edge of the insert. In the example of **FIG. 7**, the strips **34** are spaced apart by interstices **38**, and they extend toward the center over a greater length. The strips **34** have a substantially trapezoidal shape, i.e., their width decreases and is minimal at their free inner radial end. Naturally, the strips could still have other shapes, for example, a triangular shape. In any case, the strips **34** work by bending along a direction perpendicular to the plane of the sole, their outer radial end being "anchored" to the peripheral frame of the insert **26**, and their inner radial end along the deformations of the sole at the center of the opening **28**. Thus, one obtains a rigidity that decreases radially from the outside toward the inside of the central opening **28**.

[0028] One could also provide that the differential rigidity along the radial direction be formed by a variation in the thickness of the insert along this direction. In any case, such a design avoids a rough variation in the rigidity of the sole at the level of the edge of the central opening **28**.

[0029] In **FIG. 4, a** reinforcement insert is shown which is similar to that of **FIG. 3**, but whose rear portion is extended by a stiffener **30**. The stiffener **30** rises vertically, along a direction substantially perpendicular to the plane of the sole, to cover the rear of the user's heel. By associating the stiffener **30** with the insert, the capacity of the shoe to transmit the torsional forces from the foot to the leg is substantially strengthened. In the example shown, the stiffener **30** has a small width at the level of its low portion for connecting to the rest of the insert **26**, and it flares out at the top. In addition, one can see that the stiffener is cut out in its center **40** in order to limit contact with the Achilles tendon, which is a particularly sensitive area of the foot. The insert

26 with its stiffener 30 forms a tri-dimensional element. In order to facilitate construction, they can be made of two elements (the sole portion of the insert being therefore substantially planar) assembled one to the other, for example, by gluing.

[0030] The stiffener 30 can be designed so as to exert, through a spring effect, a pressure force on the rear portion of the heel. This pressure force will contribute a better hold of the shoe on the foot. Indeed, a climber rarely takes support on the heel and, during certain movements, the heel of the shoe tends to come off of the foot. The stiffener, by having a spring effect, will always allow maintaining the heel of the shoe in contact with the foot, thus preventing any hint of the shoe coming off.

[0031] In all of the examples described until now, the portion of the insert corresponding to the sole is planar. However, one can provide that this portion of the insert have a tri-dimensional shape that is adapted, at least partially, to the shape of the foot. It will be rather easy to obtain if the insert is made by molding, whether by injection or by compression. In addition, by giving a highly tri-dimensional nature to the rear portion of the insert, one can substantially increase the rigidity of this rear portion, and therefore the capacity of the sole to resist torsional stresses and to relay the forces toward the climber's leg. On the other hand, it is advantageous that a front portion of the insert be kept relatively planar in order to maintain a certain flexibility in this part of the sole.

[0032] **FIG. 5** shows a particularly advantageous assembly method for the shoe provided with a reinforcement insert according to the invention.

[0033] One can thus see that the insert is pressed directly against the lower surface of the insole **20**. Furthermore, one can see that the lateral protective strip **16** that essentially extends along the lower edge of the upper **12**, comprises a folded portion **32** that at least partially covers the insert **26** from underneath. The outer sole **24** is then attached underneath. With this construction, the edge of the insert is completely hidden by the protective strip **16**.

[0034] The insert according to the invention therefore allows having a shoe in which the transmission of the torsional forces occurs through a homogenous work of the sole assembly, without overly stiffening the latter in the direction of its bending, which allows for a precise control of the supports. In the inserts provided with a central opening, the frame effect of the insert ensures a very good hold of the edges of the shoe, while maintaining a very good capacity for the climber to feel the nature and roughness of the surface on which he takes support.

[0035] **FIG. 8** also represents an example of an embodiment that allows giving an effect of progressive rigidity between the opening **28** and the peripheral or lateral contour **27** of the insert. In this case, the insert **26** is provided with an opening **28** only in its front zone, i.e., substantially up to the front limit zone of the plantar arch **29**. In this opening **28**, an insert **31** made of EVA or similar material is housed, having a rigidity that is reduced with respect to that of the insert **26** and allowing to progressively vary the rigidity between the peripheral contour **27** and the central portion itself of the opening **28**.

[0036] The EVA insert **31** can have a rigidity corresponding to that of the insole **20** or it can be slightly more rigid depending on the effect desired. It can also be less rigid.

[0037] The effects, improved feelings and sensory perceptions are the same as those described in connection with **FIGS. 3 and 4**. In fact, the EVA insert **31** is partly added to compensate for the thickness of the insert. If the latter is very thin (for instance, if it is made of a carbon composite), there is no need to add this insert **31**.

[0038] The more flexible EVA insert **31** can also give more flexibility to and increase longitivity (resistance to wear) of the rubber outer sole **24**.

[0039] In the example of **FIG. 8**, the insert **26** is form-molded, i.e., according to the shape of the foot, especially in the zone of the plantar arch **29**.

[0040] **FIG. 9** shows another example of embodiment, similar to **FIG. 8**, which is more particularly adapted to be used with a planar insert **26**.

[0041] In this case, the opening **28** extends up to the level of the heel while demarcating a peripheral frame of a substantially constant width. Thus, the opening **28** has substantially the shape of a tear drop.

[0042] Because of this shape, the insert **26** has, at the level of the plantar arch, two V-shaped arms **33** that allow a good adaptation of the insert **26** to the shape of the foot and to the morphology of the plantar arch, in spite of the use of a planar insert.

[0043] As in the preceding case, an insert **31** made of a less rigid material, such as EVA, is housed in the opening **28**.

[0044] In both cases, the combined construction of the rigid insert **26**/"flexible" insert **31** allows an optimal reconciliation of the feeling of the rock and the foot support/edge setting.

[0045] Compared to the embodiment of **FIG. 3**, the "shorter" opening **28** of **FIG. 9** enables having a shoe that is stiffer at the rear and, conversely, in the case of **FIG. 3**, the shoe will be more flexible and therefore more adaptable.

[0046] Naturally, the invention is not limited to the previously described examples of embodiments given by way of non-limiting examples, but it encompasses all similar or equivalent embodiments.

1. Climbing shoe comprising a sole **(14, 24)** made of an adhesive material, characterized in that the shoe **(10)** comprises a reinforcement insert **(26)**, the contour **(27)** of which coincides with the contour of the sole **(14, 20, 24)**, at least in a front portion of the sole **(14, 20, 24)**.

2. Climbing shoe according to claim 1, characterized in that the reinforcement insert **(26)** extends rearwardly up to a heel zone of the shoe.

3. Climbing shoe according to one of claims **1** or **2**, characterized in that the reinforcement insert **(26)** is made of a material that is more rigid than the adhesive material of the sole **(24)**.

4. Climbing shoe according to claim 3, characterized in that the reinforcement insert **(26)** is made of plastic.

5. Climbing shoe according to claim 3, characterized in that the reinforcement insert **(26)** is made of a composite material.

6. Climbing shoe according to claim 4, characterized in that the reinforcement insert **(26)** is made of a composite material comprising woven fibers embedded in a polymer resin.

7. Climbing shoe according to any of the preceding claims, characterized in that the reinforcement insert **(26)** has a central opening **(28)**, at least in a front portion.

8. Climbing shoe according to claim 7, characterized in that the reinforcement insert **(26)** has a rigidity that decreases radially from the outside toward the inside of the central opening **(28)**.

9. Climbing shoe according to claim 7, characterized in that the reinforcement insert **(26)** comprises radial strips **(34)** that extend toward the inside of the central opening **(28)**.

10. Climbing shoe according to any of the preceding claims, characterized in that the reinforcement insert **(26)** comprises a rear stiffener **(30)** that rises along the rear surface of the heel.

11. Climbing shoe according to claim 10, characterized in that the stiffener **(30)** is cut out.

12. Climbing shoe according to any of the preceding claims, characterized in that the reinforcement insert **(26)** is constituted of a planar plate element.

13. Climbing shoe according to any of claims **1-11**, characterized in that the reinforcement insert **(26)** is constituted of a tri-dimensional element.

14. Climbing shoe according to any of the preceding claims, characterized in that the reinforcement insert **(26)** is comprised between an insole **(20)** and an outer sole **(24)**.

15. Climbing shoe according to claim 14, characterized in that the insole **(20)** is sewn edge to edge to the lower contour of the upper **(12)** of the shoe, according to the Ströbel technique.

16. Climbing shoe according to one of claims **14** or **15**, characterized in that the upper **(12)** is protected by an outer lateral strip **(16)**, at least in its front portion, and /in that/ the outer lateral strip **(16)** is folded under the sole such that the insert **(26)** is inserted between the insole **(20)** and the fold **(32)** of the outer lateral strip **(16)**.

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