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(54) **Method for generating an elastic membrane for supporting the whole of the plantar arch integrated in the shoe and the membrane resulting from this method**

(57) Method for generating an elastic membrane (1) for supporting the whole of the plantar arch (2) integrated into the shoe and the resulting membrane, which comprises the following stages:

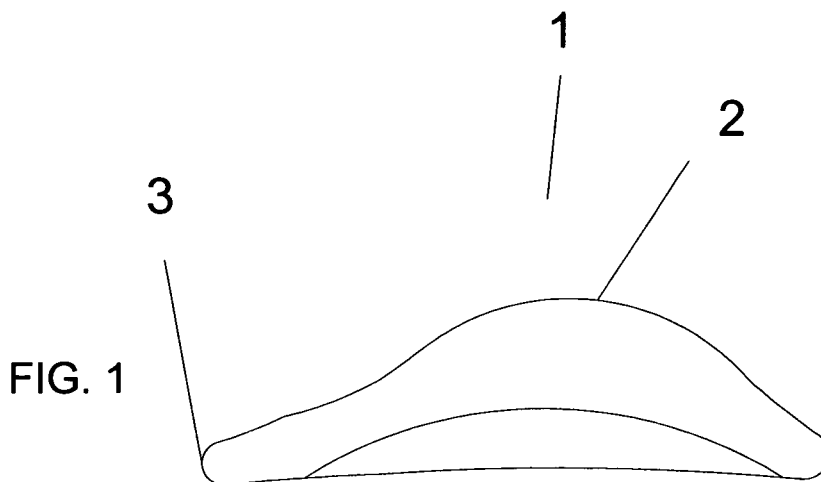
- (a) scanning and identifying the defects that occur in feet by means of a three-dimensional plantar scan of a series of people with the same foot size;
- (b) design of the geometry of the membrane;

(c) validation of the fixing system for the insole and the membrane to the sole of the shoe;

(d) validation of the transpiration system;

(e) validation of the system by means of actual trials of the combination of the sole with the membrane, independently of the shoe.

The resulting membrane is constituted by a plastic and elastic flexible laminar material, missing the toe cap but with heel (3), and it can be provided with fixing elements.



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## Description

[0001] Method for generating an elastic membrane for supporting the whole of the plantar arch integrated in the shoe and the membrane resulting from this method.

## Purpose of the invention

[0002] This invention relates to a method for generating an elastic membrane for supporting the whole of the plantar arch integrated in the shoe and the membrane resulting from this method, so that said membrane has a specific geometric form that adapts to the foot and provides a substantial increase in convenience and comfort for the user, reducing muscle fatigue caused by walking. In addition, this specific form enables an air chamber to be created between the insole and the outsole of the shoe, providing high transpiration for the foot.

## Background of the invention

[0003] Currently there are a great variety of insoles, some for medical purposes, aiming to correct defects in feet and the way of walking and others for the convenience and comfort of the user. The majority of these are flexible in nature in order to easily adjust to the shoe and are made of plastic materials. For examples, the utility model ES0271756 U discloses an insole made of plastic flexible laminar material. However, these insoles are often not sufficiently elastic, so that the foot rests on an element that is too rigid, which sometimes may be excessively heavy. In addition, the fact of incorporating these insoles in the shoe increases the height of the heel and the zone of the plantar arch, taking away part of the space normally designed for housing the foot.

[0004] In order to prevent the problem described above, this invention is for integrating a membrane in the shoe so that it forms an active part thereof, not as a removable insole, but tightly coupled to the shoe. Patent ES1058795 discloses an outsole with an incorporated insole and pluggable ventilation thereunder that comprises a body of sole with a perimeter lateral wall that surrounds the interior space, with a plurality of orifices; and an interchangeable insole, configured and dimensioned to be complementary with the interior housing space formed in the body of the sole. However, the insole described above does not provide complete support to the bottom of the foot, which is one of the fundamental objectives of this invention, since in this way the biomechanical functioning of the foot is improved. The increase in the supporting surface area and the elasticity of the sole will considerably improve the pumping effect necessary to ensure correct venous return, thereby improving the convenience and comfort during use and reducing muscular fatigue caused by walking.

## Description of the invention

[0005] This invention consists of incorporating into the shoe an elastic element with a specific geometry, which adjusts to the foot and has sufficient elasticity. The idea is that this element is integrated into the shoe as an active part thereof and not as an insole or removable element. The advantage of this system is that it does not take away space from the foot, as it is integrated in the shoe and does not increase the height of the heel or of the area of the plantar arch. Consequently, it allows an increase in the supporting surface area, improving the biomechanical functioning of the foot.

[0006] The increase in the surface area and the elasticity of the sole will considerably improve the pumping effect necessary to ensure correct venous return, improving the convenience and comfort during use and reducing muscular fatigue caused by walking.

[0007] To carry out this project, a size 42 shoe was chosen and a three-dimensional plantar scan was performed of the feet of 150 people who had this size of foot. Then, the geometry of the membrane was designed and the system for fixing together the insole with the membrane to the sole of the shoe was validated. The transpiration system was validated by means of actual trials, firstly of the membrane independently from the shoe, and later of the shoe itself.

[0008] Thus, the method consists of scanning and identifying the defects found in feet, providing a test result bank, which enable the creation of a membrane type. When integrated into the system of the shoe, it brings a comfort that exceeds that of the various existing brands currently available on the market.

[0009] The purpose of this project is to develop a new line of footwear that enables a substantial increase in convenience and comfort in use, reducing muscular fatigue caused by walking, adjusting the sole in the interior of the shoe to the foot of the user. It is a shoe that is suitable for all types of adults, in good health or with incipient problems, for which it is a preventative solution, accommodative and providing substantial improvement.

[0010] It is important to take into account that these are not interchangeable insoles. This is a membrane with a hollow and an elastic integrated in the shoe between the mid-sole and the insole and not a removable insole. Of course, it can be changed in the event of wear or deterioration. The characteristic form of the membrane and the material employed is such that when supporting the foot, the membrane yields and ensures that the whole sole of the foot is supported on the sole of the shoe, improving the user's comfort with respect to current footwear. On lifting the foot, the membrane recovers its original position, creating an air chamber between the membrane and the sole or insole of the shoe.

[0011] The invention is not a solid piece, such as traditional insoles, but a laminate that leaves a hollow space between the sole and the insole, in contrast to the solid or robust pieces of conventional insoles. In addition, it

provides higher elasticity or less resistance to the pressure of the foot, achieving correct functioning and less weight than insoles.

**[0012]** The hollow or cavity created by the characteristic form of the membrane when not bearing weight is full of air. Upon the pressing down of the foot and the yielding of the membrane, the air housed in this cavity is displaced, leaving either through the sole of the shoe or through the orifice or orifices provided in the interior sides of the shoe for this purpose, and protected by a membrane that enables the flow, exchange and renewal of air contained in the hollow of the plantar arch and inhibiting the passage of water from the exterior to the interior.

### Description of the drawings

**[0013]** In order to complete the description and with the purpose of helping to achieve a better understanding of the characteristics of the invention, in accordance with a preferred example of practical embodiment thereof, a set of illustrative and non-limitative drawings is included as an integral part of said description, representing the following:

Figure 1. - shows an exterior side view of the membrane, where the area of the heel (3) and the area of the plantar arch with the elevated arch (2) can be seen.

Figure 2. - shows a frontal view of the membrane (1).

Figure 3. - shows an interior side view of the membrane, seen from the opposite side to that in Figure 1.

Figure 4. - shows a top-down view of the membrane.

### Preferred embodiment of the invention

**[0014]** This invention relates to a method for generating an elastic membrane which gives support to the whole plantar arch integrated in the shoe as well as the membrane resulting from this method. The method comprises at least the following stages:

- (a) scanning and identifying the defects that occur in feet by means of a three-dimensional plantar scan of a series of people with the same foot size;
- (b) design of the geometry of the membrane;
- (c) validation of the fixing system for the insole assembly with the membrane to the sole of the shoe;
- (d) validation of the transpiration system;
- (e) validation of the system by means of actual trials of the membrane independently from the shoe and of the shoe itself.

**[0015]** According to the method disclosed above, a membrane (1) is obtained with characteristics that improve the quality and comfort of the insole assembly with respect to those already available, in addition to increasing the surface area for support of the foot, which is completely supported on the insole that acquires the arched

form of the membrane (1). Also, this is a membrane made up of a laminate, in contrast to the solid or robust pieces of existing insoles, providing elasticity or less resistance to the pressure of the foot, thereby achieving a correct functioning. The membrane (1) is constituted by a plastic and elastic flexible laminar material, which is preferably a composite of polypropylene with carbon loads. The membrane has a geometric form missing the toe cap but with heel (3). In the area of the plantar arch, it features an elevated arch (2), which achieves complete support of the sole of the foot. Thanks to this arch (2), and once the membrane (1) in the insole and the shoe are integrated, an air chamber is created between the lower part of the membrane (1) and the upper part of the sole when it is not bearing a weight, which yields when supporting the foot. Consequently, air is expelled through the sole of the shoe or through orifices of the interior side of the shoe, protected with a membrane allowing the flow, exchange and renewal of air contained in the hollow of the plantar arch and preventing the passage of water from the exterior to the interior.

**[0016]** In another possible embodiment of the invention, the membrane can be provided with any fixing element, preferably by way of a tongue, flap or any other that is suitable.

### Claims

1. Method for generating an elastic membrane for supporting the whole of the plantar arch integrated in the shoe, **characterised in that** it comprises the following stages:
  - (a) scanning and identifying the defects that occur in feet by means of a three-dimensional plantar scan of a series of people with the same foot size;
  - (b) design of the geometry of the membrane;
  - (c) validation of the fixing system for the insole and the membrane to the sole of the shoe;
  - (d) validation of the transpiration system;
  - (e) validation of the system by means of actual trials of the combination of the sole with the membrane, independently of the shoe.
2. Membrane resulting from the method disclosed in claim 1, **characterised in that** it is constituted by a plastic and elastic flexible laminar material that features a geometric form missing the toe cap and with the shape of the heel (3), reaching to the back part of the shoe, so that it raises the heel and improves the functioning of the insole assembly and with an elevated arch (2) in the area of the plantar arch due to which it provides complete support to the sole of the foot, and where there is an air chamber between the lower part of the membrane (1) and the upper part of the sole when it is bearing weight, yielding on

supporting the foot and causing the air to leave through the sole of the shoe or through orifices in the interior side of the shoe, protected by a membrane allowing the flow, exchange and renewal of air contained in the hollow of the plantar arch, furthermore preventing the passage of water from the exterior to the interior. 5

3. Membrane resulting from the method disclosed in claim 1, according to claim 2, **characterised in that** it has an appropriate fixing element, preferably by way of a flap. 10

4. Membrane resulting from the method disclosed in claim 1, according to claim 2, **characterised in that** the plastic material, elastic and transpirable, with which it is made is preferably a composite of polypropylene with carbon loads. 15

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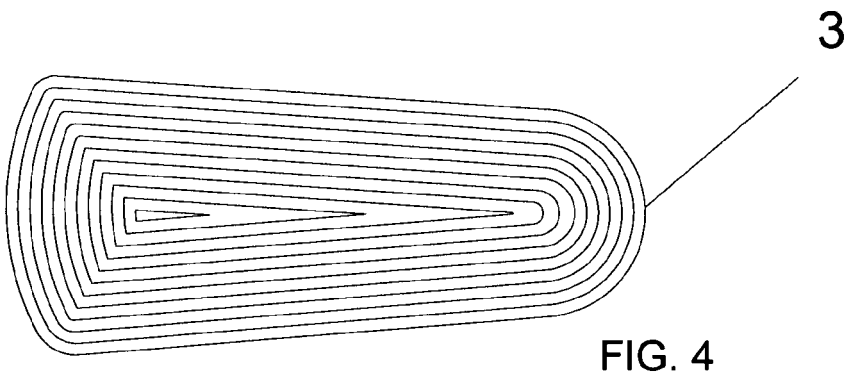
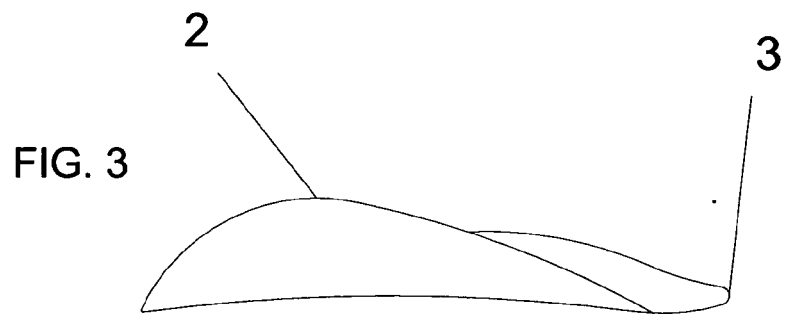
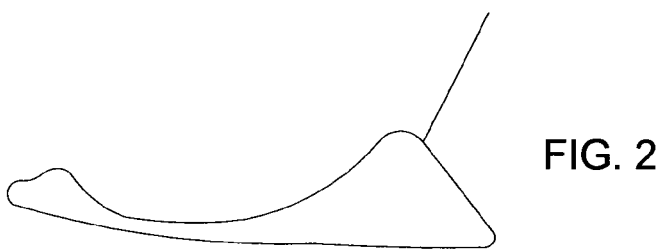
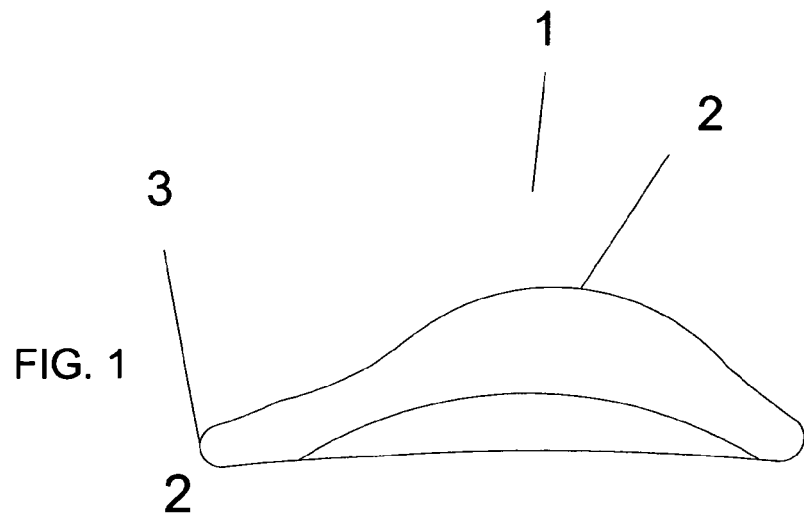
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EUROPEAN SEARCH REPORT

Application Number  
EP 08 01 3585

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Place of search Munich		Date of completion of the search 5 December 2008	Examiner Herry, Manuel	
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ANNEX TO THE EUROPEAN SEARCH REPORT  
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