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(54) INTELLIGENT SYSTEM FOR GRIP ENHANCEMENT

(57) ***Summary:*** Intelligent system for grip enhancement, according to the invention, it assumes a specific solution, intelligent, actuated thermo-mechanically using a shape memory material, in an automatic manner as a response to variable natural phenomena, which adapts the sole of the footwear in which it is embedded according to the external temperature, of environmental factors and/or of season, so that it facilitates the movement in conditions of high temperature (e.g., dry, firm and grippy environment) and it enhances the grip at low temperature (e.g., moist, soft and slippery environment), in an adequate manner.

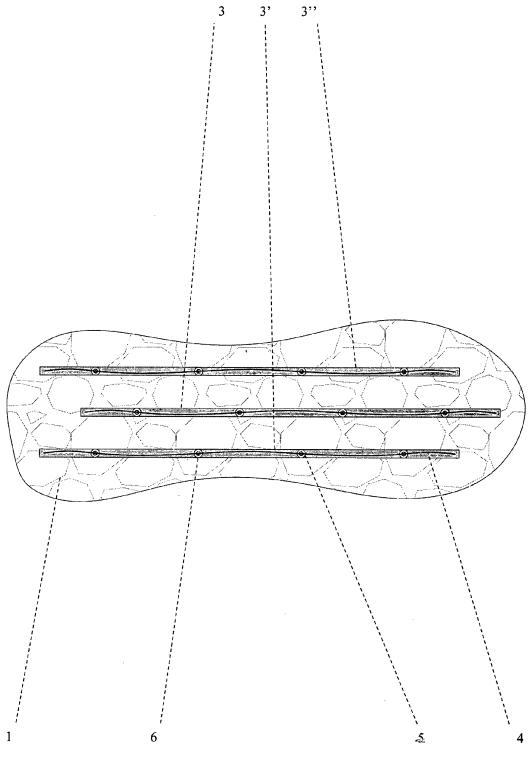

Fig. 1

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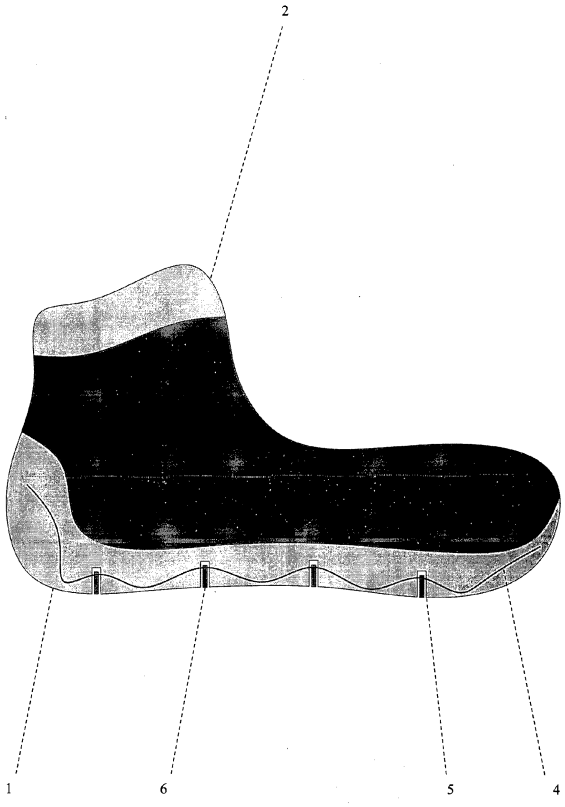

Fig. 2.1

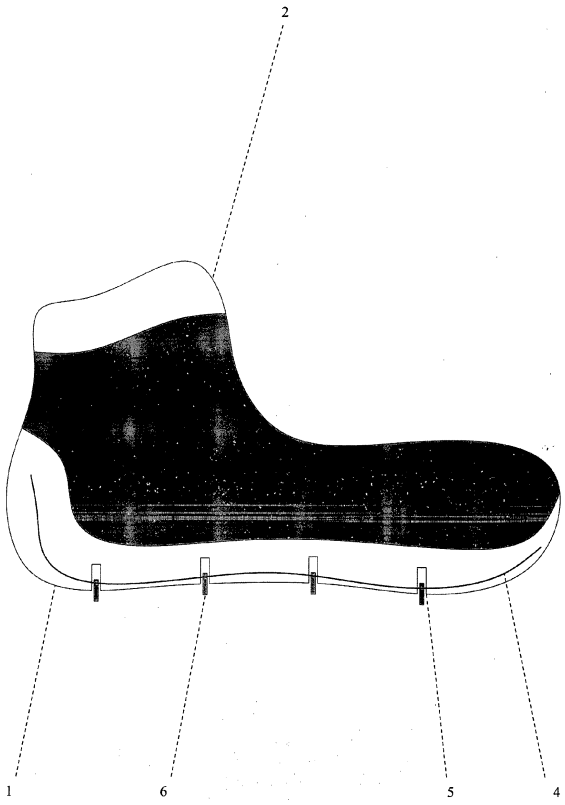

Fig. 2.2

Description

[0001] The invention refers to an intelligent system for grip enhancement of the footwear sole, depending on the temperature of the movement surface and in relation to the environmental conditions, based on the temperature difference, in that it is equipped with a thermo-mechanical conversion mechanism with a specific constructive form.

[0002] In the purpose of grip enhancement of the footwear sole, several solutions are known (JPH04109901A, US5732482A, KR20170142828A) which consists, mainly, of equipment and/or detachable systems and/or incorporated in the sole of the footwear in order to enhance the grip exerted on a surface against which the action of movement is made difficult by destabilizing environmental factors, suitable for the sole and/or unprepared footwear to face different situations and/or challenges.

[0003] Some of the disadvantages of the described solutions are related to that they are compatible with specific models of soles and/or footwear, they require additional energy for implementation and/or activation, they introduce additional effort in movement, they cause premature wear, they deteriorate over time and they do not constitute a universal solution, which is adequate in simultaneously facing the dynamic challenges of a variable weather condition (e.g., aridity, heatwave, humidity, slime, snow and/or ice).

[0004] The invention solves, mainly, the technical problem in that it uses a shape memory material to modify the configuration of the sole and enhancement of the grip, which adapts the sole of the footwear in which it is incorporated, so that it reduces the necessary and usage of footwear with a different destination and/or sole depending on the activity carried out, because it adapts their sole to meet various needs and without using an exhaustible energy source, because it involves a simple, robust construction form and does not have a negative impact on the dimension, mass, shape or wear resistance of the sole and/or the footwear in which it is incorporated in the purpose of grip enhancement.

[0005] Intelligent system for grip enhancement, according to the invention, it surprises the presented disadvantages and problems in that it assumes, mainly, a solution actuated thermo-mechanically in an automatic manner and under different conditions of temperature, as a response to variable natural phenomena, which adapts the sole of the footwear in which it is embedded according to the external temperature, of environmental factors and/or of season, so that it facilitates the movement in conditions of high temperature (e.g., dry, firm and grippy environment) and it enhances the grip at low temperature (e.g., moist, soft and slippery environment), in an adequate manner.

[0006] The invention has the following advantages:

- The system introduces new possibilities for grip enhancement;
- The system presents constructive simplicity and flexibility, but at the same time advantageous dimension, mass and shape, without negatively affecting the movement or the sole of the footwear that incorporates it in the purpose of grip enhancement;
- The system reduces the impact that other solutions introduce on the efficiency of moving with footwears whose sole incorporates them in the purpose of grip enhancement;
- The system facilitates grip enhancement, both depending on the environmental factors and season;
- The system does not depend on additional energy sources;
- The system is robust and easy to maintain so that it does not require special maintenance.

[0007] Below is further given an embodiment of the invention in connection with the following figures:

- Fig. 1 - Intelligent system for grip enhancement, incorporated in the sole of a footwear, view from below;
- Fig. 2.1 - Structure of an intelligent system for grip enhancement (variant) in *inactive* state, incorporated in the sole of footwear at high temperature, side view;
- Fig. 2.2 - Structure of an intelligent system for grip enhancement (variant) in *active* state, incorporated in the sole of a footwear at low temperature, side view;
- Fig. 3.1 - Structure of an intelligent system for grip enhancement (variant) in *inactive* state, incorporated in the sole of a footwear at high temperature, side view;
- Fig. 3.2 - Structure of an intelligent system for grip enhancement (variant) in *active* state, incorporated in the sole of a footwear at low temperature, side view;

[0008] Intelligent system for grip enhancement, is characterized mainly, in that it is intended for the incorporation in the support sole 1 of any footwear 2, which involves, as the case may be, one or more longitudinal canals 3, 3', 3", disposed parallel and incorporated in the flexible material of the support sole 1, which each house one actuation wire 4 made of an intelligent material of metallic nature with the shape memory property (e.g., nitinol [NiTi]), which reacts from the point of view of the shape to thermal variations, as the case may be, depending on the manner in which its shape is memorized, so that it is placed freely, but with the ends fixed between the limits of the longitudinal canal 3, which presents, as the case may be, one or more many orifices 5 that houses one sliding crampon 6 fixed to the actuation wire 4 that crosses it through its upper end, supports it and for which it constitutes the mechanism for actuation and determination of the sliding movement, so that in the *inactive* state, at normal ground temperature, the shape of the actuation wire 4 is determined by a high temperature for

which, as the case may be, either its length is elongated, its shape is wavy, and the sliding crampon 6 is raised to the upper limit of the orifice 5 (figure 2.1) and respectively, either its length is short, its shape is elongated and the sliding crampon 6 is raised to the upper limit of the orifice 5 (figure 3.1), and in *active* state, at ground temperature below 0 degrees (e.g. snow and/or ice), the shape of the actuation wire 4 is determined by a low temperature for which, as the case may be, either its length is short, its shape is elongated and the sliding crampon 6 is lowered to the lower limit of the orifice 5 (figure 2.2) and respectively, either its length is elongated, its shape is wavy and the sliding crampon 6 is lowered to the lower limit of the orifice 5 (figure 3.2), in order to enhance the grip that the sole of the footwear ensures relative to the travel surface with which it is in contact and on which, as the case may be, one or more sliding crampons 6 exert additional pressure and grip following the automatic activation of the intelligent system for grip enhancement.

[0009] Intelligent system for grip enhancement, according to the invention, can be reproduced with the same performances and characteristics whenever is necessary, a fact that constitutes an argument in favor of meeting the criterion of industrial applicability.

Claims

1. Intelligent system for grip enhancement, **characterized in that** it is intended for the incorporation in the sole (1) of any footwear (2), which involves, as the case may be, one or more longitudinal canals (3), (3'), (3"), disposed parallel and incorporated in the flexible material of the support sole (1), which each house one actuation wire (4) made of an intelligent material of metallic nature with the shape memory property, which reacts from an elastic point of view to thermal variations, as the case may be, depending on the manner in which its shape is memorized, so that it is placed freely, but with the ends fixed between the limits of the longitudinal canal (3), which presents, as the case may be, one or more many orifices (5) that houses one sliding crampon (6) fixed to the actuation wire (4) that crosses it through its upper end, supports it and for which it constitutes the mechanism for actuation and determination of the sliding movement, in order to enhance the grip that the sole of the footwear ensures relative to the travel surface with which it is in contact and on which, as the case may be, one or more sliding crampons (6) exert additional pressure and grip following the automatic activation of the system.

2. Intelligent system for grip enhancement, according to claim 1, **characterized in that** the shape of the actuation wire (4) in the *inactive* state is determined by a high temperature, so that its length is elongated, its shape is wavy and for which the sliding crampon (6) is raised to the upper limit of the orifice (5), and in *active* state is determined by a low temperature, so its length is short, its shape is elongated and the sliding crampon (6) is lowered to the lower limit of the orifice (5) (figure 2.1, figure 2.2).

3. Intelligent system for grip enhancement, according to claim 1, **characterized in that** the shape of the drive wire (4) in the *inactive* state is determined by a high temperature, so that its length is short, its shape is elongated and for which the sliding crampon (6) is raised to the upper limit of the orifice (5), and in *active* state is determined by a lowered temperature, so that its length is elongated, its shape is wavy and the sliding crampon (6) is lowered to the lower limit of the orifice (5) (figure 3.1, figure 3.2).

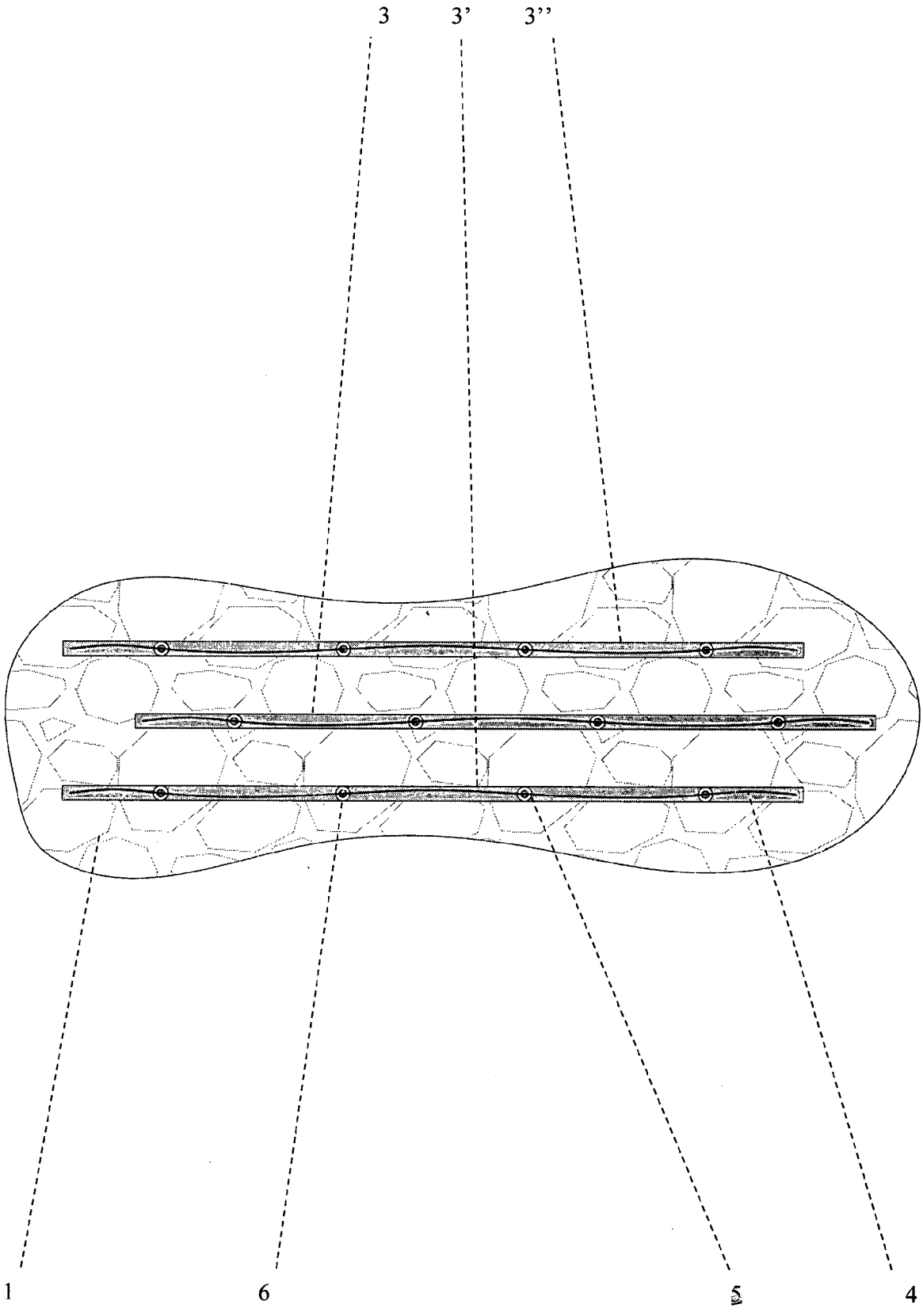

Fig. 1

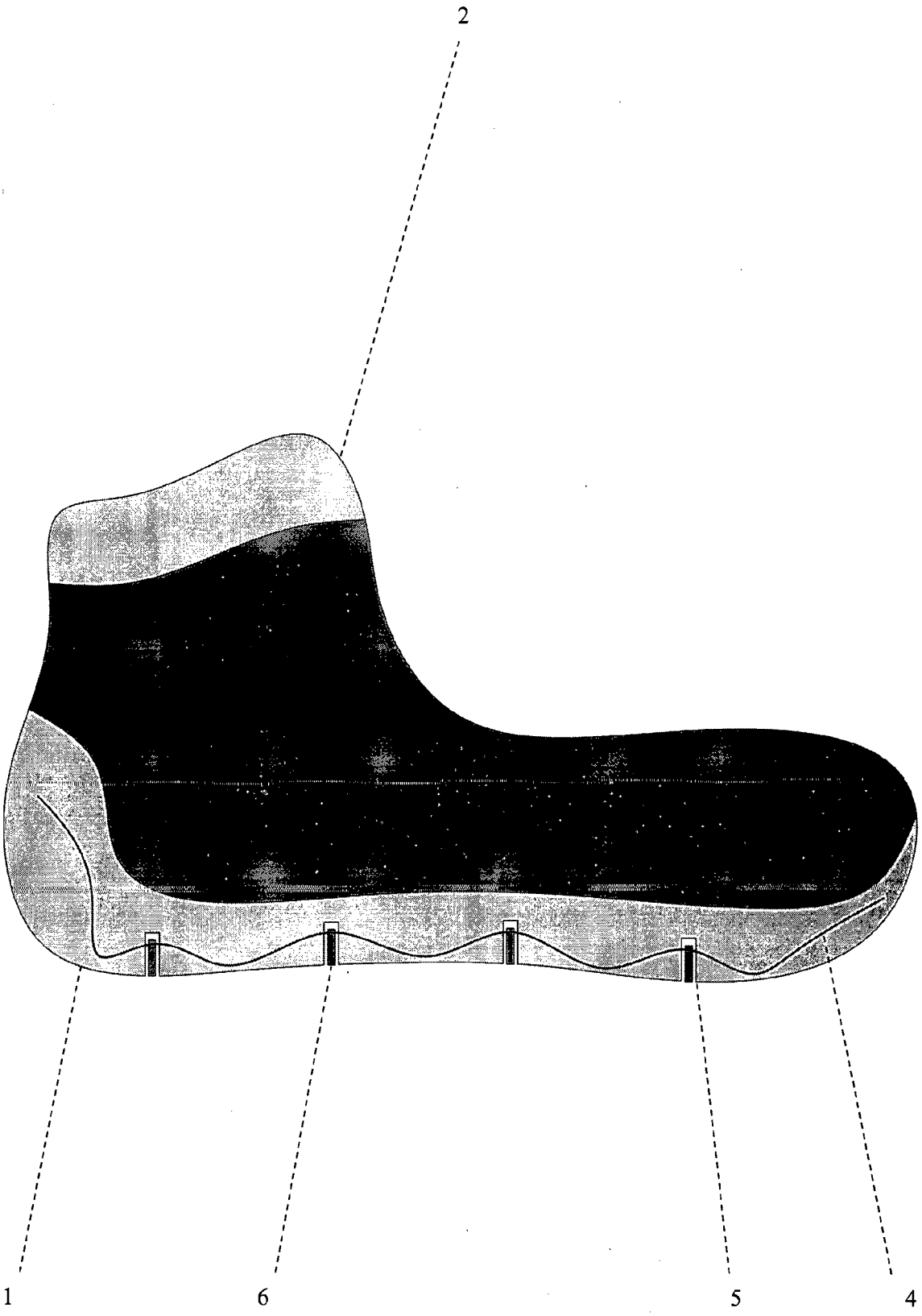

Fig. 2.1

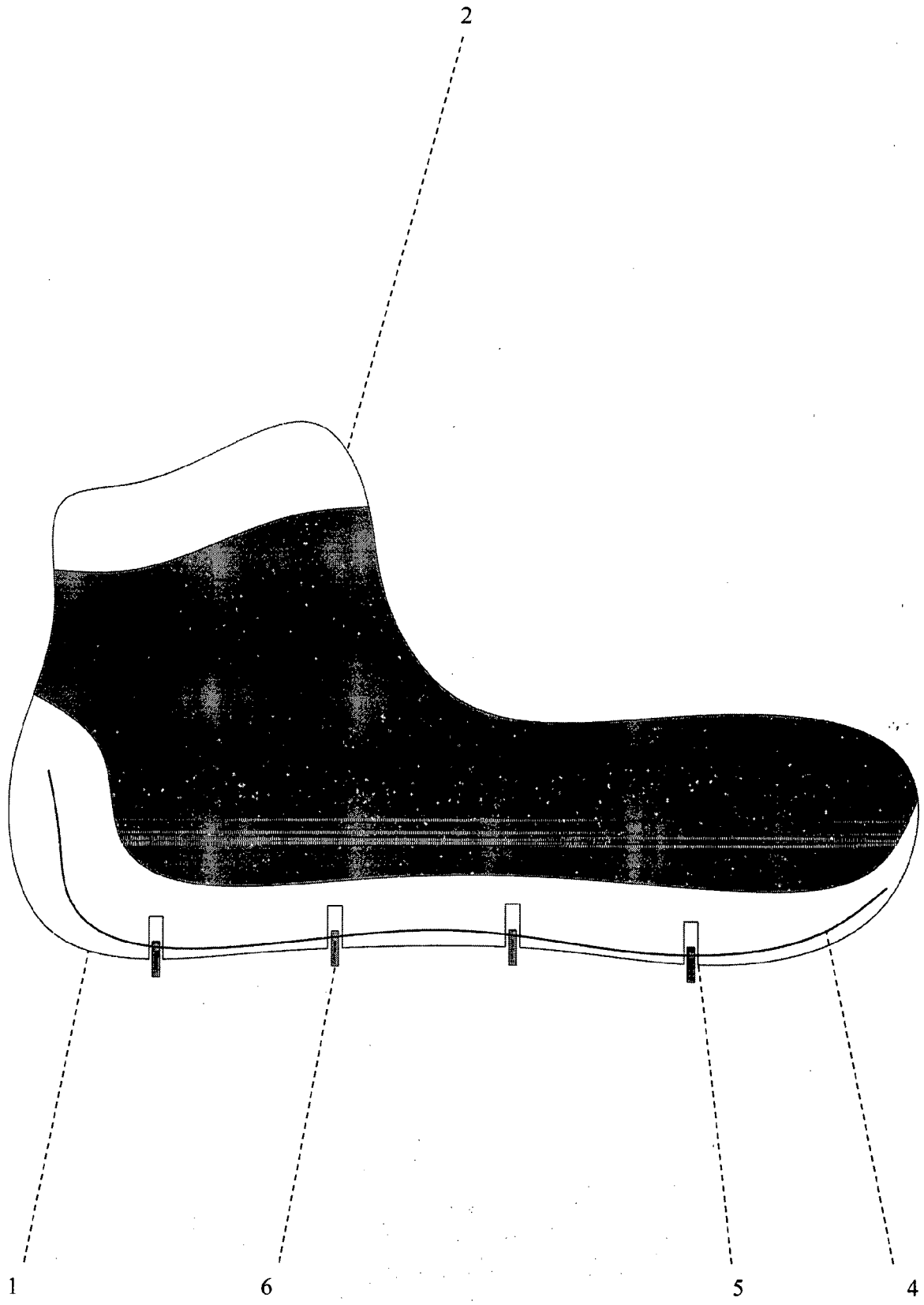

Fig. 2.2

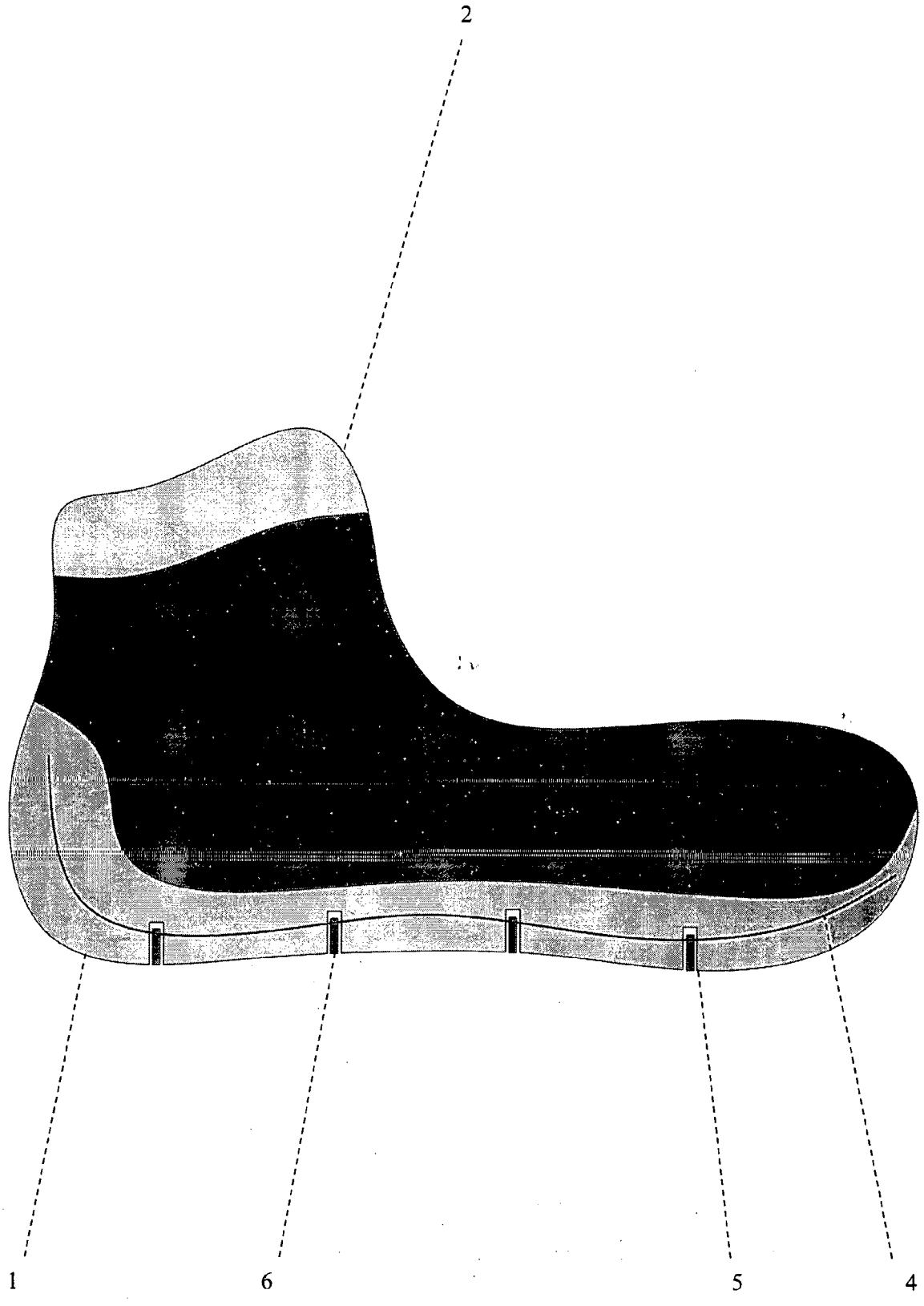

Fig. 3.1

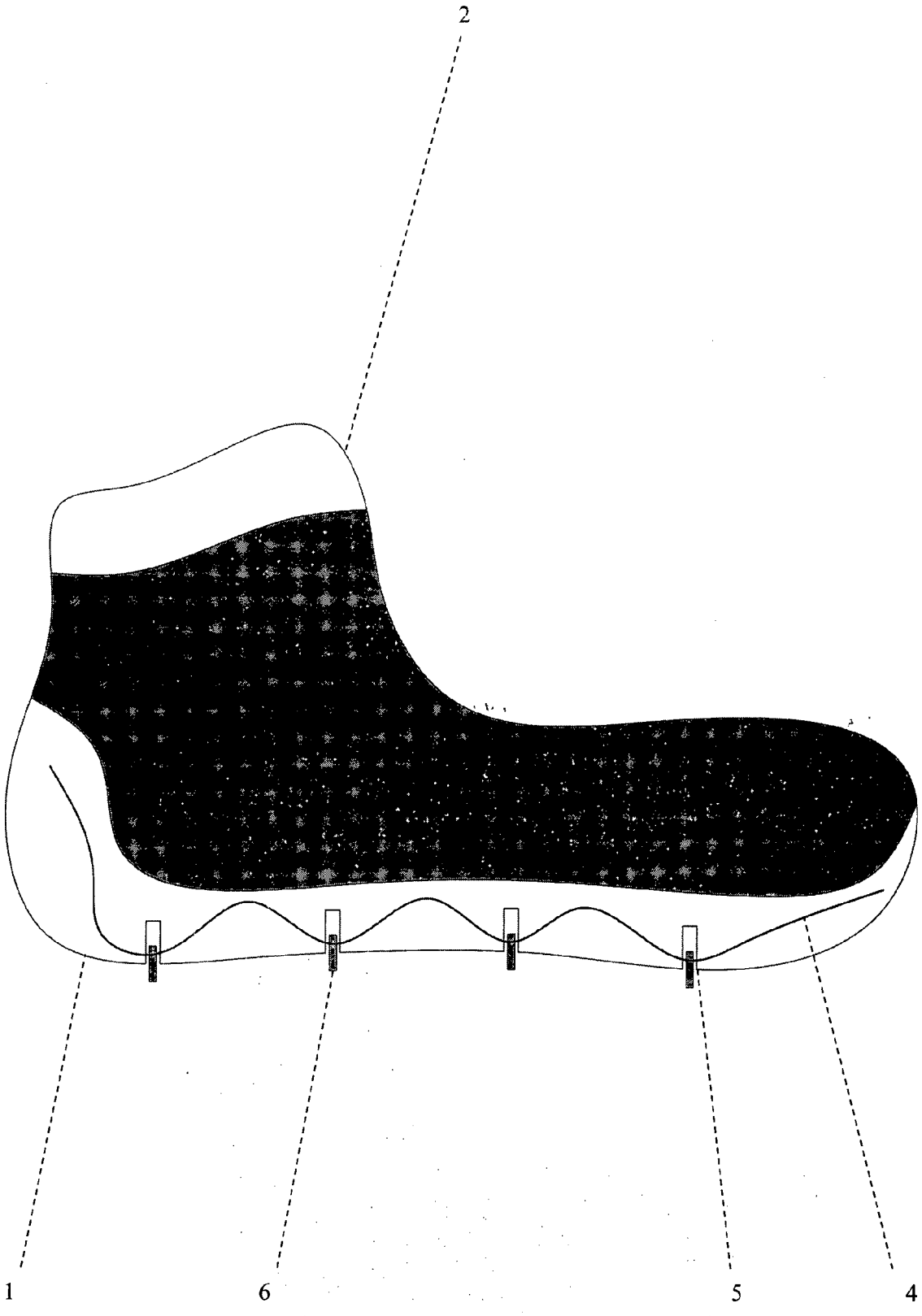

Fig. 3.2

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EUROPEAN SEARCH REPORT

Application Number
EP 23 46 4005

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	KR 2013 0080199 A (ROTA SPORTS CO LTD [KR]) 12 July 2013 (2013-07-12) * the whole document *	1-3	INV. A43C15/14
A	KR 2013 0107454 A (KO BI HO [KR]) 2 October 2013 (2013-10-02) * the whole document *	1-3	
A	JP S57 153602 A (AZUMA TAKAO) 22 September 1982 (1982-09-22) * the whole document *	1-3	

TECHNICAL FIELDS SEARCHED (IPC)

A43C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	21 August 2023	Cianci, Sabino

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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21-08-2023

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REFERENCES CITED IN THE DESCRIPTION

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- US 5732482 A **[0002]**
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