Title: GARMENT MADE OF COMPOSITE MATERIAL

Abstract: Garment (1) made of composite material having a first tubular portion (11) made of a given material, the said first tubular portion (11) having protective members (20, 22, 25, 29) positioned in a given body region and shaped so as to modify locally the perception of the external stresses acting on the said body region.
Garment made of composite material

Description

Technical field

The present invention relates to a garment made of composite material having a substantially tubular shape.

Background art

It is known that each limb of the human body may be regarded as an instrument for performing given tasks such as, for example, walking in the case of the foot or grasping objects in the case of the hand or an arm. It is also known that each limb of the human body may also be used as an investigating means for obtaining information from the surrounding environment (temperature, roughness, hardness, softness, etc.).

In the case of the foot, the task performed is of fundamental importance since normally human activities involve movement and the feet are required to make contact with the ground. Therefore, whenever the ground is acted on by a foot, it is also explored.

It is also known that, during the course of sporting activities, the attainment of performance levels superior to those which can be normally achieved is conditioned by the possibility of subjecting the muscular, skeletal, nervous and vascular apparatus to
intense stress. On the other hand, stressful functioning conditions may also arise in situations which are normally regarded as ordinary, in the case where the foot is affected by an injury or has a serious malformation.

In the case of intense stress acting externally on a healthy limb or foot or stress which is normally regarded as ordinary acting on a limb or on a foot affected by injury or having a malformation, the limb or foot itself is no longer able to produce those internal stimuli which allow the execution of an efficient athletic movement or normal functioning forming the basis of the movement.

The object of the present invention is to provide a garment which allows the user to make contact with the external environment by means of one of his/her limbs and allows the said user to receive, from the outside, stresses compatible with his/her sporting requirements and with his/her physical characteristics.

Disclosure of the invention

According to the present invention a garment made of composite material having a first tubular portion made of a first given material is provided, characterized in that said first tubular portion has protective means positioned in a given body region and shaped so
as to modify the perception of the external stresses acting on the said body region. This garment is characterized in that said protective means comprise at least one damping member shaped so as to be combined in a manner substantially matching the said body region and/or at least one strip made of a second material of a flexible type.

**Brief description of the drawings**

The invention will now be described with reference to the accompanying drawings which illustrate a few non-limiting examples of embodiment thereof, in which:

- Figure 1 is a perspective rear view of a first preferred embodiment of a garment according to the present invention;
- Figure 2 is a front view, on a larger scale, of Figure 1;
- Figure 3 is a plan view, on a smaller scale, of Figure 1;
- Figure 4 is a view of Figure 3 from below; and
- Figure 5 is a view, on a larger scale, of a section of a constructional detail according to a second preferred embodiment of the present invention.

**Detailed description of the preferred embodiment(s)**

In Figure 1, 1 denotes in its entirety a garment made of composite material having a substantially tubular
shape to be positioned in a given zone and, if necessary, in direct contact with the skin. For the sake of convenience of description, the explanation below will refer initially to a stocking made of composite material, i.e. a garment for the foot, without this limiting the validity of the concepts which will be illustrated below. The explicit reference to walking or to running is to be regarded, therefore, as functionally relevant for this particular application, even though the concepts expressed may be easily applied more generally to garments of another kind which are comparable to a stocking in terms of the deformability and adherence to parts of the body on which they are worn.

The stocking 1 comprises a base 10 made of soft and flexible material which is similar to sponge and made using a natural, artificial or mixed yarn, depending on the type of use of the said stocking 1. The stocking comprises a tubular portion 11 which is connected to the base 10 by means of an elbow portion 12 which, during use, covers the heel of the user, extending from the instep of the foot. In turn, the base 10 comprises a further tubular portion 13 which is closed at the front and, on the opposite side with respect to the elbow portion 12, a rounded part 14.
This rounded part 14 is designed to receive and protect the toes of a user.

The tubular portion 13 has a rigidity greater than that of the base, being provided with a helical weave which is visible only in Figure 1 and which, embracing closely the ankle of the user's foot, massages the ankle itself as far as the calf muscle and thus favours the flow of blood from the foot towards the thigh.

With reference to Figures 4a and 4b, the base 10 has a bottom part 15 which, during use, makes contact with the sole of the user's foot and which is provided with a front pocket 16 and a rear pocket 17, each of which is located in a given position. The front pocket 16 extends transversely with respect to the longitudinal direction 18 of the base 10, in the region of the forefoot, and the rear pocket 17 is formed longitudinally so as to be arranged, during use, on the user's heel. Between the pockets 16 and 17, the bottom part 15 has at least one additional pocket 19 which is oriented longitudinally on the side of the bottom part 15. In the case of the stocking according to Figure 4a, which resembles a typical right-hand stocking worn on a foot and viewed from below, the pocket 19 consists of a single pocket and is
positioned internally on the sole arch. In the case of the stocking according to Figure 4b which is symmetrical with respect to the longitudinal direction 18, the pockets 19 are two in number, i.e. an inner one, as in the case of the stocking 1 according to Figure 4a, and an outer one arranged symmetrically with respect to the internal pocket 19. These pockets 16, 17, 19 are used to contain in a stable manner pads 20 which have a substantially elliptical shape and are made from a film of elastically deformable material, and have a substantially elliptical shape in plan view. These pads 20 have at least one known chamber (not illustrated) which is defined by the said film, and this chamber contains a viscous gel which, due to its biochemical properties, forms a powerful bactericide. Moreover, the plastic material has chemical and physical properties such as to be breathable so that the combination of film and gel may be particularly suitable for sanitising the environment outside the foot, for example when the foot is contained inside a shoe. The presence of gel inside the pads 20 allows the pressure, which otherwise would act locally on a zone of the foot, to be transformed into a pressure of the hydrostatic type acting over a larger area and
equivalent to that of the pads 20 in contact with the user's foot. The pads 20, reducing the value of the pressure, due to the increase in the resistant area, and making this value uniform owing to the hydrostatic action of the gel, act as damping members. Moreover, pads 20 which are suitably shaped so as be combined in a manner substantially matching the said body zone, are able to substitute the physiological supporting action normally performed by a part of the foot which, for various reasons, is missing or has inadequate dimensions or is not tonic. The pads 20 allow a healthy foot to withstand greater loads and an impaired or otherwise defective foot to be used with the maximum efficiency. Due to the possibility of providing the pads 20 with particular shapes and keeping them in position by means of the pockets 16, 17 and 19, it is possible to provide the foot/pad assembly 20 with the desired form without having to resort to surgery and therefore in a manner which is absolutely painless.

With particular reference to Figures 2 and 3, the stocking 1 also has an additional pair of pockets 21, each of which is designed to contain a pad 22 which differs from the pad 20 only in terms of shape, being circular. The pockets 21 are therefore circular.
Moreover, the pockets 21 are formed in a diametrically opposite position, between the base 10 and the tubular portion 12, so as to be positioned on the malleoli of the user's foot. The damping function is also performed by the pads 22.

These pockets 21 are connected together by a strip 23 arranged on the opposite side to the elbow section and therefore designed to embrace the instep of the user's foot. This strip 23 is made of a material which is more rigid than that of the sponge used for the tubular portion 11 of the stocking 1 so as to have a restraining effect on the user's foot which is therefore guided better during execution of a step, also when the ground is uneven or the muscle of the foot's instep lacks tone.

In connection with that described above, the pads 20 and 22 modify locally the perception of the space and the external stresses acting in given body zones. In the case of the stocking 1, the given body zones form part of the foot and comprise the heel, forefoot, the sides of the said foot and the malleoli.

The base 10, moreover, has at least one strip 25 applied internally to the bottom part 15. In particular, with reference to Figures 4a and 4b, the bottom part 15 has two strips 25 which are made using
yarns comprising metal and/or carbon fibres or materials with similar mechanical properties. In particular, these yarns have a high tensile strength so that the strips 25 are more rigid than the spongy material of the said bottom portion 15. The strips 25 are formed so as to be raised inside the tubular portion 11. Given that a receptor sensitive to the internal stimuli of a body is referred to as being proprioceptive, the purpose of these strips 25 is to reinforce the bottom portion 15 and highlight deformation thereof, so that each flexing of the foot results in a given behaviour of the strips 25, which can be recognised by the user over time. The purpose is that of accentuating the signal which the user receives on the sole of the foot depending on situation in which the said foot finds itself in a particular instant. In other words, the strips 25 constitute a device which amplifies the proprioceptive capacity of the sole of the foot. Therefore, the strips 25 may be regarded as protective devices positioned in a given body region and shaped so as to modify locally the perception of the external stresses and in particular the sole of a user's foot.

It is important to note that the rounded part 14 may be selectively shaped as in Figure 4a, reproducing at
the front the shape of the toes, or as shown in Figure 4b. In this latter case the foot 10 will be substantially symmetrical with respect to a longitudinal median plane of the foot.

With reference to Figures 2 and 3, the stocking 1 has, on the upper part 26 of the base 10, a slit 27 closed by a portion of fabric 28 made of a material of limited thickness compared to the sponge from which the rest of the base 10 is made. In particular, this fabric portion 28 is made of a yarn consisting of microfibres or the like or in any case a high-strength yarn. Owing to the use of these materials, it is possible to form the upper part 26 with much smaller thicknesses, while maintaining the same mechanical strength and resistance to wear. As a result, it is possible to compensate for the increase in dimensions due to insertion of the pads 20 inside the pockets 16, 17, 19.

Obviously, the choice of gel contained in the pads 20 and 22 and the corresponding thickness, as well as the choice as to the respective positions, depends on the type of activity performed.

Use of the stocking 1 may be clearly understood from that illustrated above and does not require further explanations.
In connection with that described above, the stocking 1 is particularly suitable for the practice of physical activities or ordinary movements performed by persons suffering from injuries or with physical malformations.

From that described above it is obvious that more than one material must be used in order to produce the stocking 1, whence the definition of a garment made of composite material and, in particular, a stocking 1 made of composite material.

The use of the pads 20 also reduces the likelihood of minor traumas affecting the heel and the front part of the foot in sports where there is the risk of a violent reaction following a jump, as, for example, in the case of volleyball, basketball, some specialised athletic activities such as the triple jump and hurdles, step dancing and aerobics. Finally, the use of the pads 20 in order to support the medial arch of the foot results in advantages for the blood circulation and skeletal muscle as well as an improvement in the equilibrium during movement.

This latter advantage is undoubtedly due also to the strips 25 which, in some cases could also be applied externally and/or made of silicone or similar materials and hence applied by means of direct
deposition onto the material of the bottom part 15 or by means of application using a given adhesive substance.

In the case of a garment 1 of another kind, comparable to the stocking 1 in terms of its close fit over the part of the body on which it is worn (such as, among other parts, the knee joints, elbow joints, chest and various muscular areas, back, legs and buttocks), and irrespective of the purpose for which it is worn, i.e. as clothing or instead for protection, the presence of the gel pads prevents the effects of sores, which, as is known, are due to a reduction in the blood flow as a result of excessive specific pressure on a given zone of the foot, minimises the consequences of knocks and also helps improve considerably the sensation of well-being on the part of the person.

It should be noted, moreover, that owing to the reduced thickness with which the pockets for the pads 20/22 may be made, it is possible to produce garments 1 provided with a number of pockets located in different positions, which exceed the user's requirement at the time of purchase of the product, so that the user has the possibility of choosing where to apply the said pads depending on his/her present and future needs.
The possibility described above assumes particular importance when the gel contained in the said pads has given chemical or pharmacological properties or contains a perspiration-facilitating or perspiration-dependent path. Therefore, the gel could be designed to release locally pharmaceutical substances for relieving pain or for achieving similar results. In this case the garment 1 is particularly suitable for use intended for therapeutic or also aesthetic purposes. Mention is made here in particular to particular applications for persons who have physical malformations which are congenital or acquired following surgical operations, such as, for example, partial or total removal of the breast. Obviously, in this case, the garment 1 will be a bra - known and not illustrated - which must have at least one pocket functionally similar to the pockets 16, 17 and 19 for a pad substantially identical to the pads 20 and 22. These pockets may be formed on the inside or outside of the cups - known and not illustrated - of the bra in accordance with the specific requirements. Finally, it is obvious that the stocking 1 described and illustrated here may be subject to modifications without thereby departing from the protective scope of the present invention.
For example, in the case where, differently from that described above, the user has a given, precisely located requirement/pathology or, more simply, prefers to have the pad 20/22 in a desired position immediately after donning the garment, it could be advantageous to fasten pads, similar to the pads 20 and 22, to the garment 1 itself, without this modifying the mechanical or chemical characteristics of the pad 20 or 22.

With reference to Figure 5, in which the fabric 28 has been shown in cross-section, in a deliberately simplified form and on a much larger scale, the garment 1 houses the gel which is applied directly - or via a film containing it - to the fabric 28 of the garment 1 in the same way as the strips 25. In any case, the fabric 28 and the pad 29 are combined by means of adhesion to the fibres 30 of the fabric 28, irrespective as to how the adhesive effect is achieved and as to whether or not the pads 29 comprise a lining film. It is pointed out, in fact, that the adhesive properties which the gel itself intrinsically possesses could also be exploited. This adhesive action may be provided on any one of the surfaces of the fabric 28 and may be direct or indirect. In the latter case it may be determined by
the use of an adhesive chosen specifically so as not to inhibit or modify the biological, chemical or physical properties of the said gel.

It should be noted that, in any case, the adhesion is complete and that the external surface of the pad 28 adheres to the profile of the fabric 28 and assumes the form thereof in reverse.

Obviously, with reference to the adhesion, that which has been described above is applicable both for the pads 20, 22 and for the strips 25 described above.

It hardly needed be mentioned that, in this case also, the direct application of the pad to the garment 1 is particularly suitable for the abovementioned applications and in particular for improving the quality of life of persons who have the said physical malformations. It should be noted, in fact, that integration of the pad 29 in the garment 1 prevents the displacement of the pad from the desired location once the garment 1 itself has been put on and also prevents the gel pads from being misplaced. This feature is particularly advantageous for applications involving garments such as bras - known and not shown - of the additive or prosthetic type. Integration of the pad 29 may be performed on the inside and/or outside of the garment in accordance with specific
requirements, even though in any case integration of the pad 29 will be achieved using adhesive means.
Claims

1. Garment (1) made of composite material having a first tubular portion (11) made of a first given material, characterized in that said first tubular portion (11) has protective means (20, 22, 25, 29) positioned in a given body region and shaped so as to modify locally the perception of the external stresses acting on the said body region.

2. Garment according to Claim 1, characterized in that the said protective means (22) comprise at least one damping member (20, 22).

3. Garment according to Claim 2, characterized in that the said damping member (20, 22) is shaped so as to be combined in a manner substantially matching the said body region.

4. Garment according to least one of the preceding claims, characterized in that the said damping member (20, 22) is shaped externally so as to define, together with the said body region, a volume of given geometrical shape.

5. Garment according to any one of the preceding claims, characterized in that the said damping member (20, 22) comprises a first pad (20, 22) designed to distribute the pressure exerted from the outside in a substantially hydrostatic manner over the said body
6. Garment according to Claim 5, characterized in that the said first pad (20, 22) has at least one chamber containing gel.

7. Garment according to Claim 5, characterized in that said chamber is defined by a film made of elastically deformable material.

8. Garment according to Claim 7, characterized in that said film has first biological, chemical and physical characteristics such as to be permeable to sweat.

9. Garment according to any one of Claims 7 and 8, characterized in that said gel has second biochemical characteristics such as to be a bactericide.

10. Garment according to any one of the preceding claims, characterized in that it comprises at least one pocket (16, 17, 19) formed in the said given body region.

11. Garment according to Claims 5 and 10, characterized in that the said pocket (16, 17, 19) is shaped so as to contain and retain internally the said first pad (20, 22).

12. Garment according to Claim 1, characterized in that the said protective means (25) comprise at least one strip (25) made of a second given material of the
flexible type.

13. Garment according to Claim 12, characterized in that said strip (25) has a cross-section of given form, shaped so as to be raised towards the inside of the said first portion (11).

14. Garment according to Claim 13, characterized in that the said strip (25) is made using yarns comprising metal and/or carbon fibres or materials with similar mechanical properties.

15. Garment according to Claim 13, characterized in that the said strip (25) is made of a material such as silicone or the like.

16. Garment according to any one of the preceding claims, characterized in that the respective fabric (28) and the said protective means (20, 22, 25, 29) are joined together by means of a direct or indirect adhesive action obtained using a given adhesive substance.

17. Garment according to Claims 15 and 16, characterized in that the said silicone strip (25) is obtained by means of deposition onto said fabric (28).

18. Stocking made of composite material, said stocking being characterized in that it comprises a first tubular portion (11) as described with reference to Claims 1 to 17 and a second tubular portion (13)
connected to the said first tubular portion (11) by an elbow-shaped section (12).

19. Stocking according to Claim 18, characterized in that said first tubular portion (11) terminates in a closing section (14) arranged on the opposite side to the said shaped section, so as to protect the toes of a user.

20. Stocking according to Claim 19, characterized in that it comprises two strips (35) which run substantially parallel to each other from the said elbow section (12) to the said closing section (14).

21. Stocking according to Claim 19, characterized in that the said given body zone comprises the sole of a user's foot.

22. Stocking according to any one of Claims 18 to 21, characterized in that the said second tubular portion has a helical-shaped weave oriented so as to favour the flow of blood from the elbow section (12) to the said second portion.

23. Stocking according to any one of Claims 18 to 22, characterized in that the said protective means (20, 22) comprise a second damping member (22).

24. Stocking according to Claims 19 to 21 and 23, characterized in that the said second damping member (22) comprises a pair of second pads (22) which are
diametrically opposite to each other, the second pads being arranged between the said first and second tubular portions (11, 13) so as to be positioned on the malleoli of a user.

25. Stocking according to Claim 24, characterized in that the said second pads are joined together by a strip (23) arranged on the opposite side to the said elbow section (12), so as to exert a restraining effect on the instep of a user's foot.

26. Stocking according to any one of Claims 18 to 25, characterized in that it has a slit (27) which is closed by a fabric portion (28) which is made of a second given material and has a reduced thickness compared to the thickness of the remaining part of the said first tubular portion (11).

27. Stocking according to Claim 26, characterized in that the said second given material comprises a yarn consisting of a microfibre.

28. Bra made of composite material, said bra being characterized in that it comprises at least one pocket (16, 17, 19) shaped so as to contain and retain internally a first pad (20, 22) comprising gel for additive or prosthetic purposes.

29. Bra made of composite material, said bra being characterized in that it comprises at least one pad
(29) comprising gel and suitable for applications of an additive or prosthetic nature.

30. Bra according to Claim 28, characterized in that it comprises at least one pad (29) comprising gel applied using adhesive means.

31. Garment made of composite material, as described and illustrated with reference to the accompanying figures.

32. Stocking made of composite material, as described and illustrated with reference to the accompanying figures.

33. Bra made of composite material, as described and illustrated with reference to the accompanying figures.
**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**

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According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

| Minimum documentation searched (classification system followed by classification symbols) |
| IPC 7 A61F A41B A41C A41D A62F |

| Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched |

| Electronic data base consulted during the international search (name of data base and, where practical, search terms used) |
| EPO-Internal, WPI Data, PAJ |

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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**X** Further documents are listed in the continuation of box C.  

**X** Patent family members are listed in annex.

**Date of the actual completion of the international search**

20 September 2000

**Date of mailing of the international search report**

09/10/2000

**Authorized officer**

Seabra, L
### DOCUMENTS CONSIDERED TO BE RELEVANT

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