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(54) **PROTECTION DEVICE**

(57) The present disclosure relates to a protection device (100) including an inflatable element (101) configured to assume a deflated condition and an inflated condition and comprising a first layer (1a) and a second layer (1b), defining an internal chamber (10), and an intermediate layer (1). The intermediate layer (2) is joined, or fixed, adheringly to a first internal surface (11a) of the first layer (1a), facing towards the internal chamber (10), in first connection regions or areas (12a) and is joined, or fixed, adheringly to a second internal surface (11b) of the second layer (1b), facing towards the internal chamber (10), in second connection regions or areas (12b). The intermediate layer (2) is detached, or free, from the first internal surface (11a), in first detachment regions or areas (13a) and is detached, or free, from the second internal surface (11b) in second detachment regions or areas (13b). The present disclosure also relates to a method for protecting a user of the device (100) and a garment (1000) comprising the device (100).

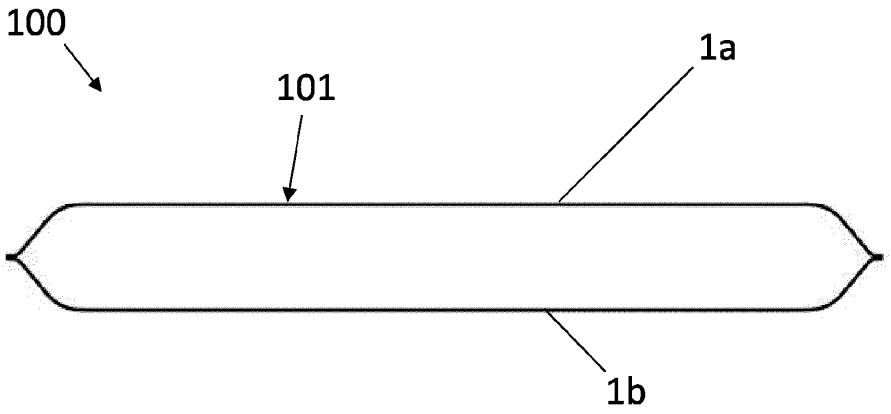

FIG. 1

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Description

[0001] The present invention relates to a protection device comprising an inflatable element for protecting a user. The device may protect a user from knocks or impacts, following falls or sliding, when riding or driving a means of transport, for example a two-wheeled vehicle, or during other types of activity, for example a sports activity or any activity during which a user runs the risk of falls or impacts. The device may also protect a user from low temperatures and therefore may be regarded as a device which is able to perform a protection function in general. The invention relates moreover to a garment comprising the device and to a method for protecting a user of the device.

[0002] It is known in the sector relating to the protection of users to use an inflatable element, commonly known as an airbag, which is able to inflate in the event of knocks or impacts so as to protect a portion of the user's body. Inflation normally takes place by means of an inflation device which comprises a gas generator, for example a container containing a compressed gas which is released inside the airbag in the event of a knock or impact.

[0003] Once inflated, the inflatable element must normally remain in a predetermined shape suitable for ensuring protection of the portion of the user's body to be protected. For this reason it is known to provide an inflatable element which includes a prefabricated knitted body, namely a body made by means of a knitting process. Said knitted body is a closed, or at least tubular, structure defining an internal region or area or chamber. This internal chamber is occupied at least partially by a plurality of joining threads which connect together opposite portions of the knitted body. The fact of manufacturing a single knitted body offers the advantage of limiting the manufacturing waste and minimizing the production time; in fact, the joining threads and meshwork may be realized using a single knitting machine. The joining threads form part of a single thread which is connected to the opposite portions of the knitted body. In particular, the thread passes along alternate sections, and continuously, between a first portion and a second portion of the knitted body. The knitted body is then covered with waterproofing sheets in order to provide a suitable sealing action.

[0004] This solution, although advantageous from many points of view, has a number of limitations. Firstly, the manufacture of a knitted body requires the use of specialized machinery, resulting in corresponding operating and maintenance costs which may be very high. Furthermore, the programming of the machinery for manufacturing the knitted body may be particularly complex and the body obtained is not very versatile for applications of a different type.

[0005] Consequently, the technical problem underlying the present disclosure is that of providing a protection device which is able to satisfy the aforementioned needs with reference to the prior art and overcome the aforementioned drawbacks and/or which is able to achieve further advantages.

[0006] This is obtained by means of a protection device comprising a protection device, a method and a garment according to the respective independent claims. Secondary characteristics of the subject-matter of the present invention are defined in the corresponding dependent claims.

[0007] More particularly, in accordance with the present disclosure a protection device is provided, said device comprising an inflatable element configured to assume a deflated condition and an inflated condition. Moreover, the inflatable element in turn comprises a first layer and a second layer defining an internal chamber of the inflatable element, and an intermediate layer. More particularly, the first layer and the second layer have respectively a first internal surface and a second internal surface which are facing towards the internal chamber and along which the intermediate layer is either fixed, adheringly, or adheres, creating a superficial adherence, in first connection regions or areas and second connection regions or areas, respectively. Furthermore, the intermediate layer is detached, namely is disconnected, separated or free, from the first internal surface and the second internal surface in first detachment regions or areas and second detachment regions, respectively.

[0008] Basically, according to the present disclosure, it is envisaged fixing or joining or joining together or causing to adhere partially the intermediate layer to the first and second layers. The intermediate layer is associated with the first layer and the second layer exclusively in respective first connection regions or areas and second connection regions or areas. In other words, the intermediate layer is adherent or adheres or is fixed by means of adherence to the first layer, in particular to the first internal surface, exclusively, namely solely in said first connection regions or areas and, similarly, is joined, or fixed, adheringly or adheres to the second layer, in particular to the second internal surface, exclusively, namely solely in said second connection regions or areas. Furthermore, it is envisaged that the intermediate layer is detached, namely is disconnected, separated or free, from the first layer and the second layer in respective first detachment regions or areas and second detachment regions or areas.

[0009] In other words, the intermediate layer is partially connected, i.e. partially joined, or fixed, adheringly or adheres both to the first layer and to the second layer. The joint or connection or fixing or adherence between the intermediate layer and the first and second layers is namely present or envisaged exclusively or solely in the respective connection regions or areas. This connection, joint, fixing or adherence is a physical connection which may be realized for example by means of a stitching or an adhesive substance, in such a way as to keep the intermediate layer fixed adheringly or attached to the first and second layers along the connection regions or areas so as to prevent separation or detachment.

[0010] It is to be understood that the intermediate layer may be joined adheringly or adheres to the first and the second layers, "with superficial adherence". The expression "with superficial adherence" is understood as meaning that, for example, the intermediate layer is joined, connected or fixed adheringly, in a superimposed manner or so as to form at least a double layer structure, to the first layer and to the second layer along the connection regions or areas, namely over the entire surface extension of each of the connection regions or areas. In other words, along the connection regions or areas, namely over the whole surface extension of the connection regions or areas, there is a continuous adherence, i.e. a continuous adhesion or a continuous contact or a continuous joint, which allows the intermediate layer to be connected to or associated in a matching or adhering manner with the first and second layers, respectively, for example by means of a stitching or an adhesive substance.

[0011] Consequently, in the context of the present disclosure, in the connection regions or areas a mono-structure having substantially at least a double layer, or in which the intermediate layer is superimposed so as to adhere to the first layer and is superimposed so as to adhere to the second layer in the respective connection regions, is obtained.

[0012] It is to be understood, furthermore, that the intermediate layer may be connected, namely joined adheringly, or may adhere, with superficial adherence or superimposition, directly to the first layer and the second layer, or that, alternatively, there are further or different interposed intermediate layers, or other form of indirect connection, between the intermediate layer and the first layer or the second layer. What is important is that, for the geometrical arrangement described above, the intermediate layer should be connected only in some zones (i.e. first connection regions or areas) to the first layer and in other zones (i.e. second connection regions or areas) to the second layer, so that as soon as the inflatable element is inflated, intermediate layer portions interposed between two connection regions or areas of the first layer and the second layer act as tension members for the inflatable element and allow the shape of the inflatable element to be controlled.

[0013] In accordance with one embodiment of the present invention, when the inflatable element is in the deflated condition, the first connection regions or areas of the first layer are positioned along the first internal surface in such a way that they are offset and not superimposed with respect to the second connection regions or areas of the second layer. In other words, when the inflatable element is in the deflated condition, the first connection regions or areas and the second connection regions are offset, i.e. are not superimposed on each other.

[0014] In particular, this configuration allows the internal chamber of the inflatable element, when the latter is in the inflated condition, to maintain a thickness greater than zero along the whole of its extension. In other words, when the inflatable element is in the inflated condition, the internal chamber is devoid - namely does not have - zones or regions with zero thickness. In the inflated condition of the inflatable element, the internal chamber, therefore, is devoid - i.e. does not have - zones or regions in which the first internal surface and the second internal surface are in direct contact or lie above one another, separated or spaced only by the intermediate layer. According to this configuration, therefore, the first internal surface and the second internal surface are separated or disconnected along the whole internal chamber of the inflatable element, when the latter is in an inflated condition.

[0015] Furthermore, according to one embodiment of the present invention, the first connection regions or areas are positioned along the first internal surface at a regular distance from each other and, likewise, the second connection regions or areas are positioned along the second internal surface at a regular distance from each other. In other words, the first connection regions or areas and the second connection regions are respectively positioned along the first internal surface or the second internal surface in such a way that they are at a regular distance respectively from the first connection regions or areas or second connection regions or areas which are adjacent, i.e. closer or nearer. Expressed again differently, the first connection regions or areas are arranged in a relationship spaced, by a predefined and regular amount or by a predefined and constant value, from each other and, similarly, the second connection regions or areas are arranged in a relationship spaced, by a predefined and regular amount or by a predefined and constant value, from each other.

[0016] According to an alternative embodiment, at least some of the first connection regions or areas or the second connection regions or areas may also be at a smaller or greater distance from each other than the other first connection regions or areas or second connection regions or areas, and therefore with a different distribution, for example so as to cause the inflatable element to assume a specific shape, for example a curved shape, in the inflated condition. In other words, a first part of the first connection regions or areas or of the second connection regions or areas may be at a regular distance from one another, and a second part of the first connection regions or areas or second connection regions or areas may be at a greater or smaller distance, than the aforementioned regular distance, from the first connection regions or areas or second connection regions or areas which are adjacent, namely closer or nearer, for example in the proximity of a curvature of the inflatable element when in the inflated position.

[0017] In general, the first connection regions or areas or the second connection regions or areas may be located at a distance from each other which varies depending on their position along said first internal surface or second internal surface, so as to cause said inflatable element

to assume a specific shape or curvature or specific thickness, when it is in the inflated condition. In other words, the mutual distribution and distance between the first and second connection regions or areas, on said first internal surface or second internal surface, respectively, may be chosen depending on suitable curvatures or thicknesses which are to be imparted to the inflatable element, in particular in the inflated condition. In fact, the greater the density of connection regions or areas in a given portion of the inflatable element, the smaller is the thickness of the inflatable element, in the inflated condition, in said given portion of the inflatable element.

[0018] According to one embodiment of the present disclosure, the first detachment regions or areas are positioned along the first internal surface so as to alternate with the first connection regions or areas and, similarly, the second detachment regions are areas are positioned along the second internal surface so as to alternate with the second connection regions or areas. Expressed differently, the first detachment regions or areas are spaced along the first internal surface by the first connection regions or areas and, similarly, the second detachment regions or areas are spaced along the second internal surface by the second connection regions or areas. In other words, along the first internal surface and second internal surface, respectively, the first detachment regions or areas and the second detachment regions or areas alternate respectively with the first connection regions or areas and the second connection regions or areas, in such a way that each first detachment region or area and second detachment region or area is located between at least two of the first connection regions or areas and second connection regions or areas, respectively.

[0019] According to one embodiment, the intermediate layer is made of elastic material or elastic fabric. Furthermore, preferably, the intermediate layer is configured to undergo deformation within the elastic range, at least partially, when the inflatable elements assumes the inflated condition. In particular, the portions of the intermediate layer comprised between each first connection region or area and second connection region or area, namely the portions of the intermediate layer which are not fixed either to the first internal surface or to the second internal surface, are configured to deform at least partially within the elastic range when the inflatable element is in the inflated condition.

[0020] According to one embodiment of the present invention, the first layer and the second layer are configured to prevent fluid communication into or out of the internal chamber. In particular, the first and second layers may be made of waterproof material. In other words, a fluid is prevented from entering or exiting the internal chamber owing to the presence of the first layer and the second layer, except for a fluid, for example a pressurised gas, specially configured to allow the inflatable element to pass from the deflated condition into the inflated condition in the event of a knock or impact of a user of the device. Said fluid especially configured to allow the inflatable element to pass from the deflated condition into the inflated condition may be contained, for example, in an inflation device, such as a gas generator, which is suitably connected to the inflatable element according to the techniques which are known to the person skilled in the art.

[0021] It is pointed out, moreover, that the first layer and the second layer may have a varied yielding behaviour or elasticity so as to cause curving of the inflated element once it is in the inflated condition (for example by combining a more elastic layer on one side with a less elastic layer on the other side). It is understood that, once in the inflated condition, the inflatable element will "arch" or "curve" towards the less yielding or less elastic layer.

[0022] According to one embodiment, therefore, the protection device comprises an inflation device connected to the inflatable element and configured to cause it to pass from the deflated condition into the inflated condition, for example by means of the flow of a pressurised gas from the inflation device to the internal chamber of the inflatable element.

[0023] According to one embodiment of the present invention, the first layer and the second layer have respectively a first outer edge and a second outer edge which are positioned along the external perimeter and are joined together so as to form the internal chamber. In other words, the first outer layer and the second outer layer are fixed or connected together along the first outer edge and the second outer edge, for example by means of a stitching, in such a way as to form the internal chamber.

[0024] Furthermore. in accordance with the present disclosure a method for protecting a user of the aforementioned protection device is provided, said method comprising the following steps. The inflatable element is initially in a deflated condition and then, for example following a knock or an impact or if there is the need for protection against the cold, the inflation device inflates the inflatable element so as to cause it to assume the inflated condition. The inflatable element is in a first instant, or initially, in a deflated condition and, in a second instant, following the first instant, the inflatable element assumes the inflated condition as a result of the gas introduced into the internal chamber by the inflation device, inflating it so as to cause it to pass into the inflated condition. In particular, the intermediate layer is configured to act as a tension member so as to keep the first layer and the second layer at the most at a predetermined maximum distance, when the inflatable element is in the inflated condition. In particular, the portions of the intermediate layer comprised between each first connection region or area and second connection region or area, namely the portions of the intermediate layer which are not joined, or fixed, or do not adhere or are not attached, either to the first or the second internal surface, are configured act as tension members and to keep the first layer and the second layer at the most at a predetermined maximum distance when the inflatable element is in the in-

flated condition. In other words, the intermediate layer is configured to keep the inflatable element in a predetermined shape when it is in the inflated condition.

[0025] According to one embodiment of the present protection method, the intermediate layer is configured to deform at least partially elastically when the inflatable element is in the inflated condition. In particular, the portions of the intermediate layer comprised between each first connection region or area and second connection region or area, namely the portions of the intermediate layer which are not fixed either to the first internal surface or to the second internal surface, are configured to deform at least partially within the elastic range when the inflatable element is in the inflated condition.

[0026] Furthermore, in accordance with the present disclosure, a garment, for example a motorcycling suit, is obtained, said garment comprising the aforementioned personal protection device, preferably configured to protect a user from knocks or impacts, or to protect a user from low temperatures, according to the aforementioned protection method.

[0027] The main advantage of the invention consists in the fact that the inflatable element, when it is in the inflated condition, may retain the desired shape suitable for ensuring protection of a region of the user's body, without the need to use the external containment layers envisaged by the solutions of the prior art, which would require costly and complex production processes and/or without using joining threads between the first layer and second layer.

[0028] A further advantage of the invention consists in the possibility of using the protection device for protecting a user from low temperatures, by means of the formation of a thermally insulating layer formed by the said inflatable element, when it is in the inflated condition. In other words, the inflatable element, when it is in the inflated condition, may act as a thermally insulating layer between the body of a user and an external environment, thus protecting the user from the cold. In particular, the absence of zero thickness zones or regions along the internal chamber of the inflatable element in the inflated condition, as described in one of the embodiments of the present invention, may allow optimum thermal insulation by the protection device.

[0029] Further advantages, characteristic features and modes of use forming the subject of the present disclosure will become clear from the following detailed description of embodiments thereof, provided by way of a non-limiting example.

[0030] It is in any case clear that each embodiment forming the subject of the present disclosure may have one or more of the advantages listed above; in any case it is not required that each embodiment should have simultaneously all the advantages listed.

[0031] Reference will be made to the figures of the attached drawings in which:

- Figure 1 shows a side view of a protection device according to an embodiment of the present invention;
- Figure 2 shows a cross-sectioned side view of the device according to Figure 1;
- Figure 3 shows a view of a first internal surface of a first layer of the device according to Figure 1;
- Figure 4 shows a view of a second internal surface of a second layer of the device according to Figure 1;
- Figure 5 shows a view of a first internal surface with two projected cross-sectional side views of the device according to Figure 1;
- Figure 6 shows a perspective view of a cross-section of the device according to Figure 1;
- Figure 7 shows a view of a garment comprising a device according to an embodiment of the present invention;
- Figure 8 shows a partially sectioned view of the device according to Figure 1, in which the intermediate layer is shown transparent.

[0032] With reference to the attached figures, the reference number 100 denotes a protection device comprising an inflatable element 101 configured to assume a deflated condition and an inflated condition. The present disclosure also relates to a garment including said personal protection device. The protection device may be a wearable protection device, i.e. one which is configured to be worn also without a garment.

[0033] Protection devices including airbags and protective garments which include said airbags are protection devices which are known for the person skilled in the art and therefore are not further described in the present patent application. In particular, the inflation device is in fluid communication with the inflatable element so as to convey, once activated, inflation fluid (e.g. pressurised gas) into the inflatable element and allow inflation thereof. The inflation device is connected to a control unit by means of which it is possible to activate inflation, namely the emission of the inflation fluid. With regard to inflation, in order to perform inflation of the inflatable element, in the event of a fall and/or sliding and/or a sudden impact involving a user or a vehicle being ridden/driven, the inflation device is adapted to cooperate with special activation means (normally consisting of the aforementioned control unit and sensors) which are operationally connected for example to the canister-shaped gas generator.

[0034] It should also be noted that the activation modes, although being an aspect of particular importance for efficient operation of the device, will not be further described in greater detail since they are methods which are essentially already known to a person skilled

in the art of protection of a person from sudden impacts.

[0035] Alternatively, the protection device may be understood as being a protection device, in general, for example for protection against the cold, and therefore intended to assume an inflated condition for protection against the cold.

[0036] According to the present disclosure, the inflatable element 101 comprises a first layer 1a and a second layer 1b, which define an internal chamber 10 of the inflatable element 101, and an intermediate layer 2. The protection device 100 is characterized in that the first layer 1a has a first internal surface 11a and the second layer 1b has a second internal surface 11b, where the first internal surface 11a and the second internal surface 11b are facing towards said internal chamber 10. The first internal surface 11a and the second internal surface 1b face one another and surround the internal chamber 10.

[0037] Furthermore, the intermediate layer 2 is interposed between the first internal surface 11a of the first layer and the second internal surface 11b of the second layer 1b. Furthermore, the intermediate layer 2 is joined, or fixed, adheringly or adheres to the first internal surface 11a in first connection regions or areas 12a and is joined, or fixed, adheringly or adheres to the second internal surface 11b in second connection regions or areas 12b Furthermore the intermediate layer 2 is detached from the first internal surface 11a, namely disconnected, separated or free from the first internal surface 11a, in first detachment regions or areas 13a and is detached from the second internal surface 11b, namely is disconnected, separated or free from the second internal surface 11b, in second detachment regions or areas 13b. Figure 8 shows the protection device from which the first layer 1a has been partially removed and in which the intermediate layer 2 is shown as though transparent. In this figure it is possible to discern the first connection regions or areas 12a which, in the figure, are those on the upper side, and the second connection regions or areas 12b.

[0038] In other words, according to the present disclosure, the intermediate layer 2 is partially joined, or fixed, adheringly or adheres to the first internal surface 11a and to the second internal surface 11b. In fact, the intermediate layer 2 is joined adheringly to the first internal surface 11a exclusively or solely in first connection regions or areas 12a and is joined adheringly, or adheres, to the second internal surface 11b exclusively or solely in the second connection regions or areas 12b. In these connection zones a mono-structure at least with a double layer is obtained.

[0039] According to a preferred embodiment, the intermediate layer 2 is joined or fixed, adheringly or adheres with superficial adherence to the first layer 1a and to the second layer 1b, in particular to the first internal surface 11a and to the second internal surface 11b, "with superficial adherence". In other words, the intermediate layer 2 is connected or fixed or adheres or is attached, adjacently or so as to be adjacent, to the first internal surface 11a and to the second internal surface 11b, along the first connection regions or areas 12a and along the second connection regions or areas 12b, respectively. In other words, the intermediate layer 2 is connected or fixed or adheres or is attached, adjacently or so as to be adjacent, to the first internal surface 11a and to the second internal surface 11b, respectively over the entire surface extension of each of the first connection regions or areas 12a and over the ensure surface extension of the second connection regions or areas 12b. In other words, along the first and second connection regions or areas. 12a and 12b, namely over the entire surface extension of each of the first and second connection regions or areas 12a and 12b there is a continuous adherence, i.e. a continuous adhesion or a continuous contact or a continuous joint between the intermediate layer 2 and the first surface 11a and the second surface 11b, respectively. This therefore allows the intermediate layer 2 to be connected adheringly or to adhere in a matching manner to the first layer 1a and to the second layer 1b, in particular to the first surface 11a and to the second surface 11b, respectively, for example by means of a stitching or an adhesive substance.

[0040] According to a preferred embodiment, the first connection regions or areas 12a are positioned on the first internal surface 11a in such a way that they are offset or not superimposed with respect to the second connection regions or areas 12b when the inflatable element 101 is in the deflated condition.

[0041] Preferably, the first connection regions or areas 12a are positioned at a regular distance from one another along the first internal surface 11a, and the second connection regions or areas 12b are preferably positioned at a regular distance from one another along the first internal surface 11b.

[0042] According to a preferred embodiment, the first detachment regions or areas 13a are positioned on the first internal surface 11a in such a way that they alternate with the first connection regions or areas 12a and, preferably, the second detachment regions or areas 13b are positioned on the second internal surface 11b in such a way that they alternate with the second connection regions or areas 12b.

[0043] According to a preferred embodiment, the intermediate layer 2 is made of elastic material or elastic fabric.

[0044] Preferably, the intermediate layer 2 is configured to deform at least partially in an elastic manner when the inflatable element 101 passes from the deflated condition into the inflated condition. In particular, preferably the portions of the intermediate layer 2 comprised between each first connection region or area 12a and second connection region or area 12b, namely the portions of the intermediate layer 2 which are not fixed either to the first internal surface 11a or to the second internal surface 11b, are configured to deform at least partially within the elastic range when the inflatable element 101 is in the inflated condition.

[0045] According to one embodiment of the present invention, the first layer 1a and the second layer 1b are configured to prevent fluid communication into and out of the internal chamber 10 of the inflatable element 101. In particular, the first layer 1a and the second layer 1b are configured to prevent undesirable fluid communication into or out of the internal chamber 10.

[0046] Preferably, the first layer 1a and said second layer 1b are made of impermeable material or material such as to allow retention of the inflation fluid for a suitable period of time.

[0047] According to a preferred embodiment, the first layer 1a and the second layer 1b are joined together along the outer edges so as to form the internal chamber 10. In other words, the first layer 1a and the second layer 1b have, respectively, a first outer edge and a second outer edge which are positioned along the external perimeter and which are joined or connected together, for example by means of a stitching or by means of gluing or other technique available to a person skilled in the art, so as to form the internal chamber 10. It may be understood that, in accordance with this embodiment, the inflatable element 101 may be made with three layers, one being an intermediate layer connected alternately and along sections with the remaining layers, and a perimetral stitching or other perimetral connection means.

[0048] According to a preferred embodiment, the protection device 100 comprises an inflation device associated with the inflatable element 101 and configured to cause the inflatable 101 to pass from the deflated condition into the inflated condition, for example by means of the flow of a pressurised gas from the inflation device towards the internal chamber 10 of the inflatable element. Preferably, the inflation device is connected to or in fluid communication with the inflatable element 101, more specifically with the internal chamber 10 and is configured to blow pressurised gas into the internal chamber 10 of the inflatable element 101 in order to cause the inflatable element 101 to switch from the deflated condition into the inflated condition.

[0049] With reference to the embodiments described, a method for protecting a user of the device 100 may be carried out based on the following steps. The inflatable element 101 is initially in a deflated condition and then, for example following a knock or an impact or if there is the need to protect the user from the cold, it is inflated by the inflation device so as to assume the inflated condition. Expressed differently, the method for protecting a user of the device 100, which includes an inflatable element 101 as described hitherto, may envisage providing said device 100 in which the inflatable element 101 is in a deflated condition and then, for example following an impact or a knock, inflating by means of an inflation device the inflatable element 101 so that it assumes an inflated condition. Furthermore, the intermediate layer 2 is configured to act as a tension member so as to keep the first layer 1a and the second layer 1b at the most at a predetermined distance, when the inflatable element 101 is in the inflated condition. In particular, the portions of the intermediate layer 2 comprised between each first connection region or area 12a and each second connection region or area 12b, namely the portions of the intermediate layer which are not joined, or fixed, or do not adhere or are not attached either to the first internal surface 11a or to the second internal surface 11b, are configured act as tension members and to keep the first layer 1a and the second layer 1b at the most at a predetermined maximum distance when the inflatable element 101 is in the inflated condition. In other words, the intermediate layer 2 is configured to keep the inflatable element 101 in a predetermined shape when it is in the inflated condition.

[0050] According to one aspect of the present invention, the connection regions or areas and the detachment regions or areas may be selected so as to obtain a specific shape of the inflatable element 101 in the inflated condition. For example, there may be zones which in the inflated condition are more or less inflated, depending on the density of connection regions or areas and the length of the portions of the intermediate layer 2 which are interposed between the first and second layers.

[0051] Preferably, the intermediate layer 2 is configured to deform at least partially in an elastic manner, i.e. within the elastic range, when the inflatable element 101 is in the inflated condition.

[0052] With reference to the attached figures, the reference number 1000 denotes overall a garment comprising a protection device 100 according to any one of the embodiments described above. Furthermore, the garment 1000 may be configured to protect a user according to the protection method described above.

[0053] The subject-matter of the present disclosure has been described hitherto with reference to its embodiments. It is to be understood that other embodiments relating to the same inventive idea may exist, all of these falling within the scope of protection of the claims which are attached below.

Claims

1. Protection device (100) including an inflatable element (101), wherein said inflatable element (101) is configured to assume a deflated condition and an inflated condition, and wherein said inflatable element (101) comprises:

   - a first layer (1a) and a second layer (1b) defining an internal chamber (10) of said inflatable element (101) and
   - an intermediate layer (2),

   wherein said first layer (1a) has a first internal surface (11a) and said second layer (1b) has a second internal surface (11b), wherein said first internal surface (11a) and said second internal surface (11b)

are facing towards said internal chamber (10), and said intermediate layer (2) is interposed between the first internal surface (11a) of said first layer (1a) and the second internal surface (11b) of said second layer (1b), and wherein said intermediate layer (2) is joined adheringly, or adheres, to said first internal surface (11a) in first connection regions or areas (12a) and is joined adheringly, or adheres, to said second internal surface (11b) in second connection regions or areas (12b), and wherein said intermediate layer (2) is detached, or free, from said first internal surface (11a) in first detachment regions or areas (13a) and is detached, or free, from said second internal surface (11b) in second detachment regions or areas (13b).

2. Protection device (100) according to the preceding claim, wherein said intermediate layer (2) is joined adheringly, or adheres, to said first internal surface (11a) exclusively in said first connection regions or areas (12a) and is joined adheringly, or adheres, to said second internal surface (11b) exclusively in said second connection regions or areas (12b).

3. Protection device (100) according to claim 1 or 2, wherein said intermediate layer (2) is fixed adheringly or adheres, so as to be superimposed on or form at least a double-layer structure with said first internal surface (11a) and said second internal surface (11b), respectively, over the entire surface extension of each of said first connection regions or areas (12a) and over the entire surface extension of each of said second connection regions or areas (12b).

4. Protection device (100) according to any one of the preceding claims, wherein said first connection regions or areas (12a) are positioned on said first internal surface (11a) offset or not superimposed with respect to said second connection regions or areas (12b) when said inflatable element (101) is in an inflated condition.

5. Protection device (100) according to any one of the preceding claims, wherein said first connection regions or areas (12a) are positioned at a regular distance from each other along said first internal surface (11a), and wherein said second connection regions or areas (12b) are positioned at a regular distance from each other along said first internal surface (11b).

6. Protection device (100) according to claim 4 or 5, wherein said first detachment regions or areas (13a) alternate on said first internal surface (11a) with said first connection regions or areas (12a), and wherein said second detachment regions or areas (13b) alternate on said second internal surface (11b) with said second connection regions or areas (12b).

7. Protection device (100) according to any one of the preceding claims, wherein said intermediate layer (2) is made of elastic material or elastic fabric or yielding material.

8. Protection device (100) according to the preceding claim, wherein said intermediate layer (2) is configured to deform at least partially in an elastic manner when said inflatable element (101) passes from the deflated condition to the inflated condition.

9. Protection device (100) according to any one of the preceding claims, wherein said first layer (1a) and said second layer (1b) are configured to prevent fluid communication into and out of said internal chamber (10).

10. Protection device (100) according to the preceding claim, wherein said first layer (1a) and said second layer (1b) are made of waterproof material.

11. Protection device (100) according to any one of the preceding claims, wherein said first layer (1a) and said second layer (1b) are joined along the outer edges so as to form said internal chamber (10).

12. Protection device (100) according to any one of the preceding claims, comprising an inflation device associated with said inflatable element (101) and configured to inflate said inflatable element (101) from said deflated condition to said inflated condition.

13. Method for protecting a user of a protection device (100) according to any one of the preceding claims, comprising the following steps:

- said inflatable element (101) is initially in the deflated condition;
- said inflatable element (101) is inflated into said inflated condition;

and wherein portions of said intermediate layer (2) comprised between first connection regions or areas (12a) and second connection regions or areas (12b) act as tension members for keeping said first layer (1a) and said second layer (1b) at a predetermined distance, when said inflatable element (101) has assumed said inflated condition.

14. Method according to the preceding claim in combination with claim 6, wherein said intermediate layer (2) is deformed at least partially in an elastic manner when said inflatable element (101) assumes said inflated condition.

15. Garment (1000) comprising a protection device

(100) according to any one of claims 1 to 12.

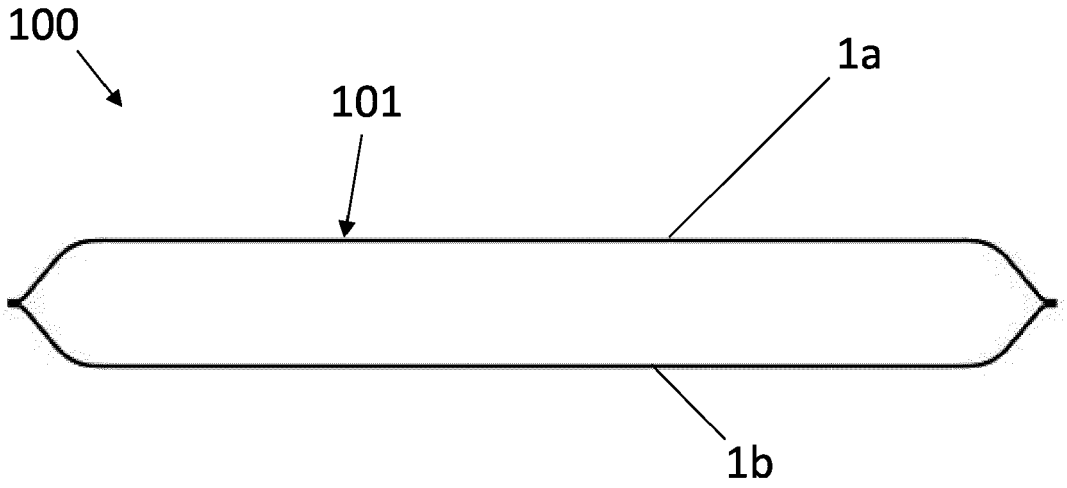

FIG. 1

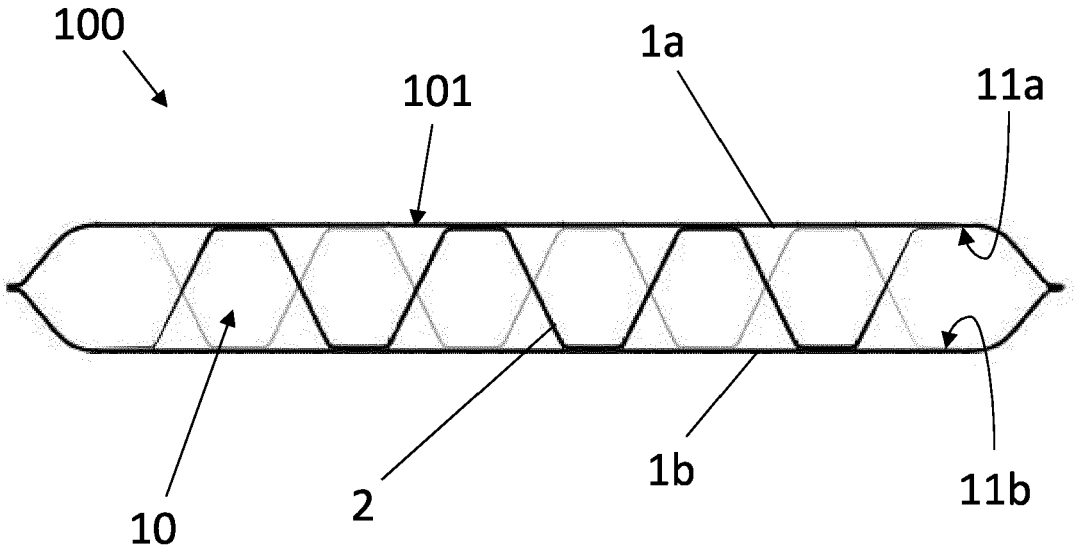

FIG. 2

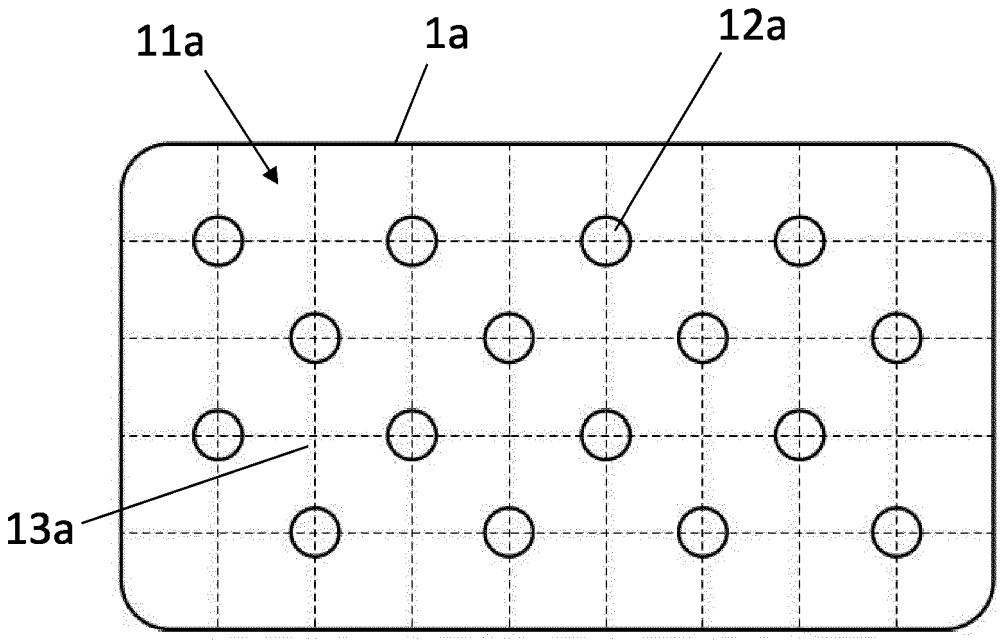

FIG. 3

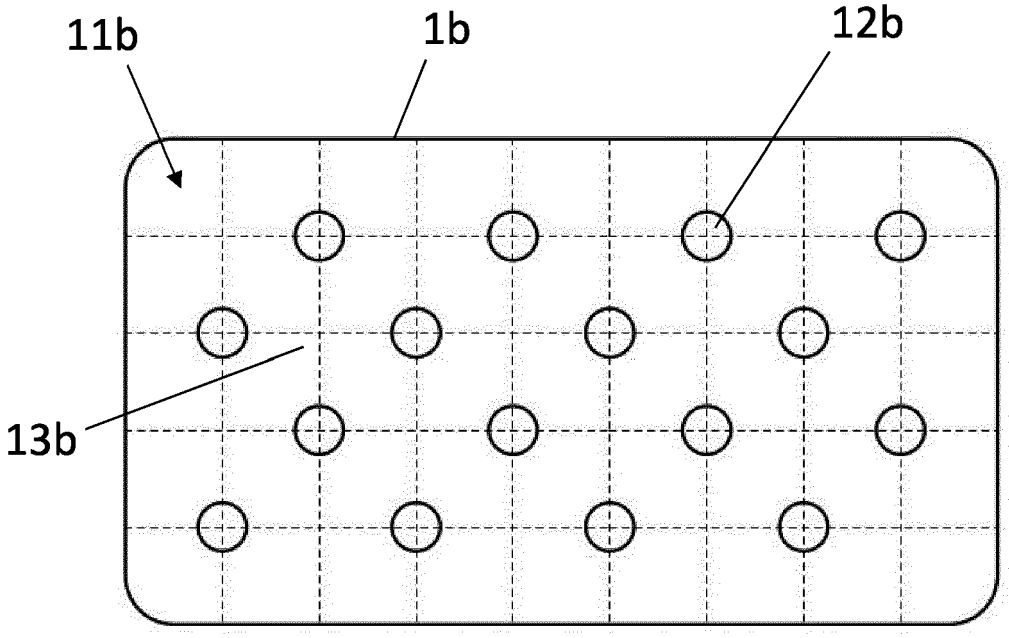

FIG. 4

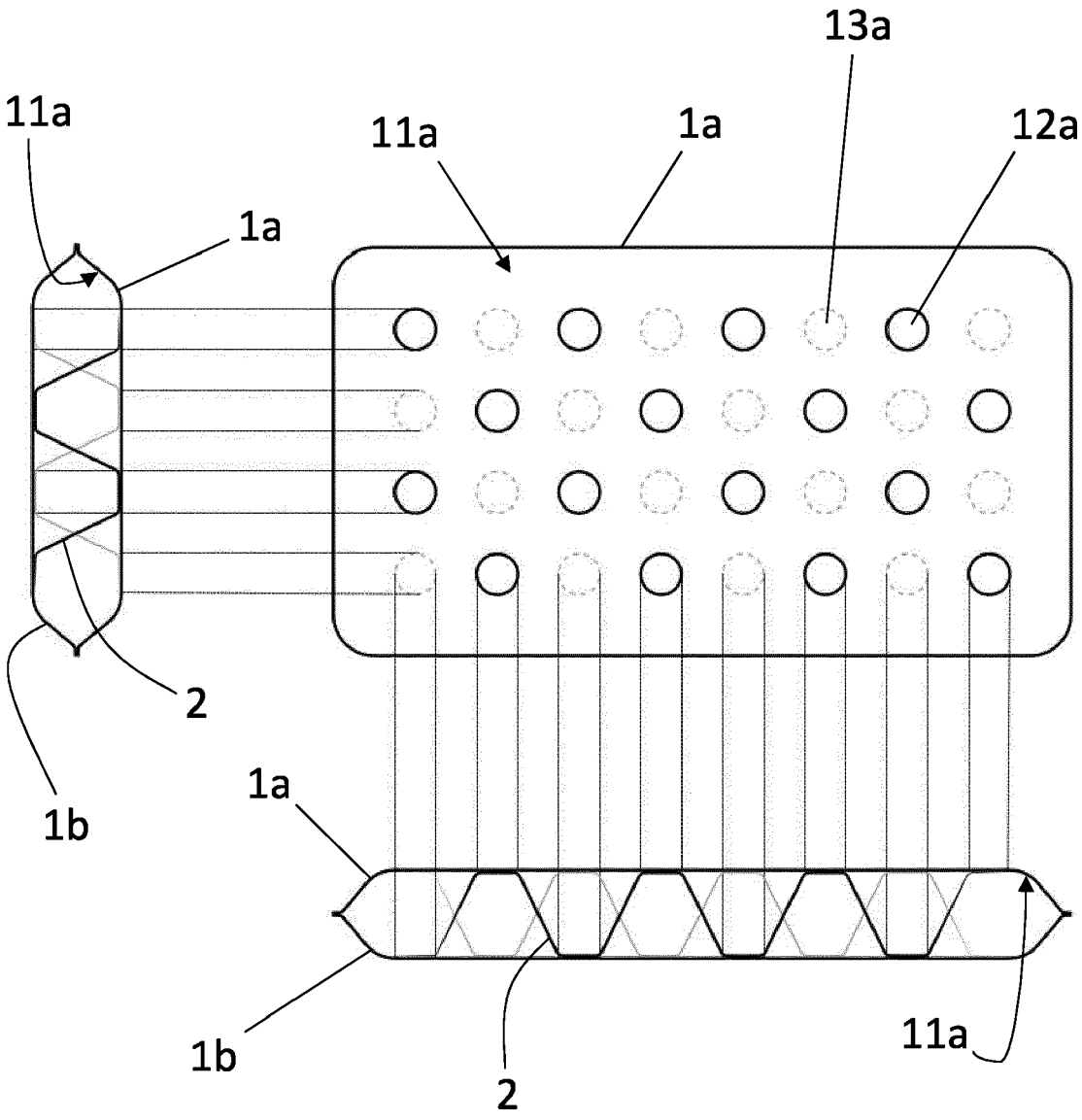

FIG. 5

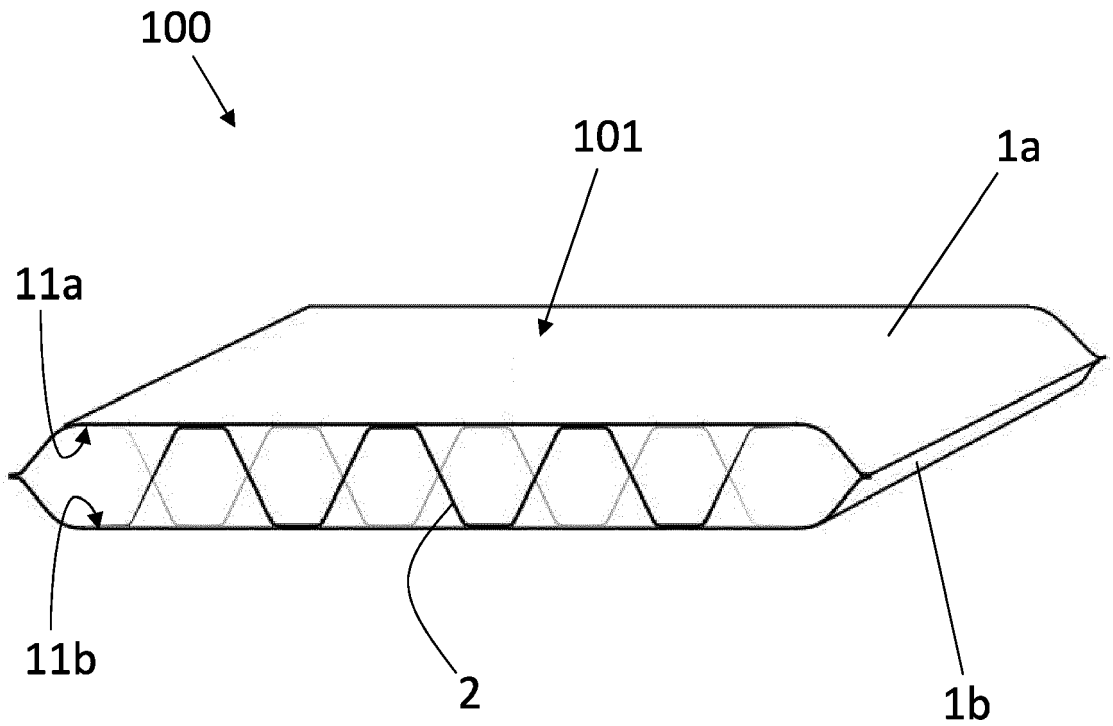

FIG. 6

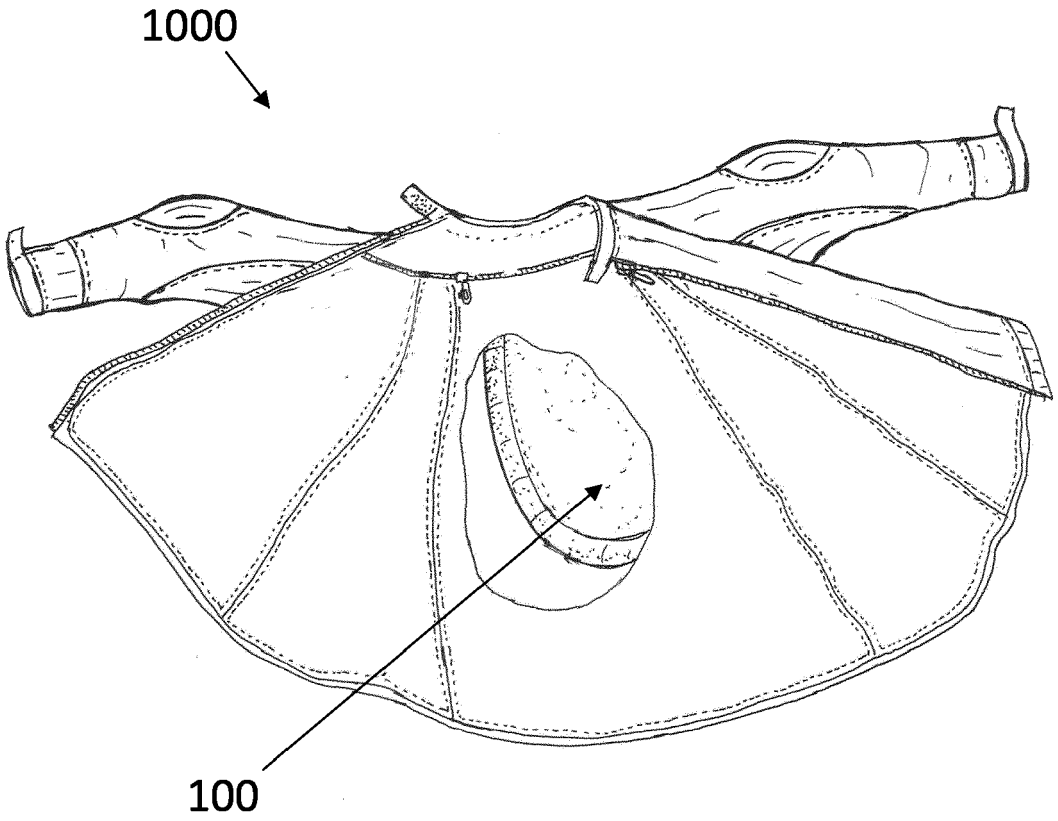

FIG. 7

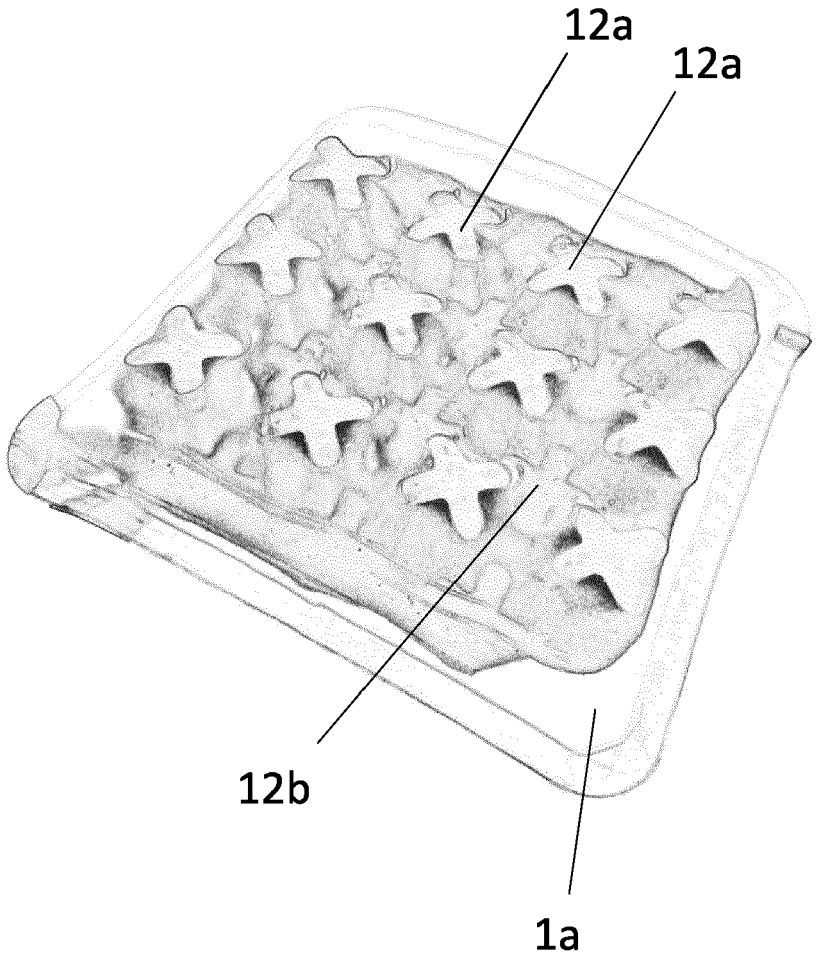

FIG. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 22 19 8950

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X Y A	IT RM20 080 656 A1 (DAINESE SPA) 10 June 2010 (2010-06-10) * paragraph [0062] - paragraph [0143]; figures 1-22 *	1,2,5, 7-13,15 4 3,6,14	INV. A41D13/018
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			A41D A44C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	6 February 2023	Arboreanu, Antoniu

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06-02-2023

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