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(54) PERSONAL PROTECTION DEVICE

(57) The present disclosure relates to a personal protection device (100) for providing personal protection for a user, wherein said protection device (100) comprises at least one inflatable element (10) able to assume a first rest configuration, or deflated configuration, and a second active configuration, or inflated configuration. The protection device (100) comprises a support structure (20) for supporting the at least one inflatable element (10) and the support structure (20) comprises a guide element (21) connected to said inflatable element so as to guide the inflatable element (10) from the first rest configuration, or deflated configuration, into the second active configuration, or inflated configuration. The present disclosure also relates to a wearable article (1000) comprising a protection device (100) and a method for protection of a user by means of the protection device (100).

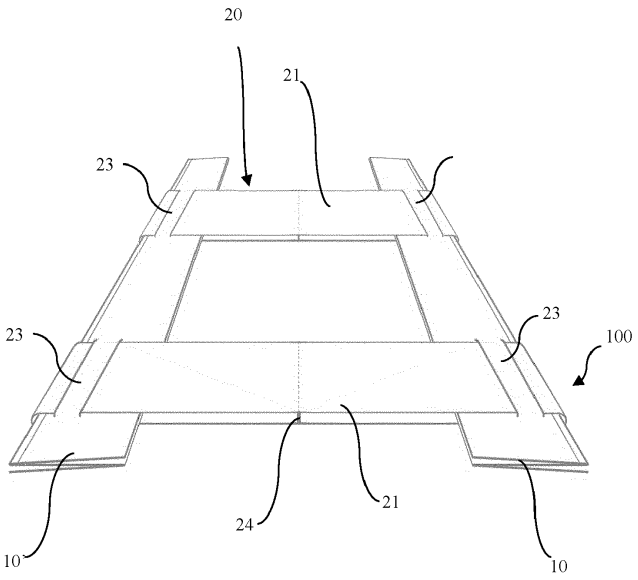

Fig. 1

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Description

[0001] The present disclosure relates in general to a personal protection device for protection of a user, wherein the device is preferably of the wearable type and/or type which can be associated with a wearable article, such as a garment.

[0002] In detail, the present disclosure relates to a protection device which may be a so-called "stand-alone" device or part of a wearable article, such as a garment or other article of clothing. The protection device includes in particular an inflatable body which, in the inflated condition, is configured to protect from impacts and/or falls a motorcycle rider or passenger or similar user, during a sporting activity and/or working activity and/or any other activity.

[0003] Traditionally, a known protection device includes an inflatable element designed to assume a deflated rest condition and an inflated active condition. Generally, the inflatable element includes a knitted body, namely a body made by means of knitting process. Said knitted body is a closed structure defining an inner region or area or chamber. The inflatable element also includes sealing walls which allow the inflation fluid to be contained for a predetermined period of time. The walls consist, for example, of a first sheet, or first wall, and a second sheet, or second wall, which are fixed together along respective perimetral edges. Said first and second sheets made of fluid-tight material cover and line the knitted body on an outer side or outer surface.

[0004] These known devices, while being advantageous from many points of view, are characterized by the main disadvantage that they do not allow efficient ventilation, when they are arranged on a wearable article, such as a jacket or suit, between an outer surface of the wearable article, or garment, and an inner surface thereof, directed, during use, towards the body of a user. In particular, in these known devices, the inflatable element, being at least partly made of fluid-tight material, and arranged so as to occupy entirely a given pocket, or region, of the wearable article, prevents the exchange of air between the aforementioned inner and outer surfaces of the wearable article.

[0005] In order to solve this problem, wearable protection devices which comprise an inflatable body which, in an inactive condition, or deflated condition, is folded onto itself, occupying therefore a limited portion of a pocket, or region, of a garment, have been developed. In this way, when the inflatable body is in the inactive condition, the exchange of air between the outer surface and the inner surface of the wearable article comprising the protection device is allowed, at least in a portion thereof which is not occupied by the inflatable body. In these devices, the inflatable body is configured to expand, for example along an expansion or inflation direction, when it is activated, or inflated, thus occupying a space, or region, greater than that in the inflated condition. In other words, the transition from the inactive condition to the active condition corresponds to unrolling or unfolding of the inflatable body which, in the active condition, is configured to occupy a region, or space, which previously was not occupied in the inactive condition or deflated condition.

[0006] The present disclosure is based on the recognition of the fact that the unrolling or unfolding of the inflatable body is, however, particularly critical in the known devices.

[0007] In particular, the pocket, or insert, of the wearable article in which the inflatable body is inserted makes unfolding of the latter difficult and risks compromising effective protection for a user.

[0008] The risk when using the known protection devices in which the inflatable element is configured to extend, or expand, is that said extension is not performed properly, namely that the inflatable body extends or unfolds only partly, or in a non-uniform manner, leaving unprotected zones of a user's body which the inflatable body is supposed to be configured to protect, thus negatively affecting the general effectiveness of the protection device. In other words the expansion may occur in an incorrect manner.

[0009] The present disclosure proposes providing a personal protection device which is able to overcome the drawbacks mentioned above with reference to the prior art and/or achieve further advantages.

[0010] This is obtained by means of a personal protection device, a wearable article comprising such a personal protection device, and a method for protection of a user by means of a personal protection device as defined in the respective independent claims. Secondary characteristics and particular embodiments of the subject of the present invention are defined in the corresponding dependent claims.

[0011] In particular, the personal protection device according to the present disclosure comprises at least one inflatable element configured to assume a first rest configuration, or deflated configuration, and a second active configuration, or inflated configuration. During the transition from the first rest configuration, or deflated configuration, to the second active configuration, or inflated configuration, the inflatable element increases the useful space for protection. Advantageously, therefore, in the rest configuration, the inflatable element may occupy in the rest condition, or deflated condition, a limited portion of a wearable article, allowing therefore effective ventilation and at the same time ensuring useful protection in the event of danger, being able to expand, or stretch, so as to protect an area of a user's body which is broader or greater than the area occupied in the rest condition.

[0012] Preferably, in the first configuration, the inflatable element is in a folded or packed configuration, or is folded onto itself, or in general occupies a first space, and in the second configuration the inflatable element is preferably in an extended condition, or occupies a second space greater than the first space.

[0013] The inflatable element is configured to extend

along a distension direction at the moment of inflation. In other words, the inflatable element is preferably configured to stretch out, or unfold, or spread out or expand, along said distension direction, passing from a folded or packed configuration, or configuration where it is folded onto itself, into an extended or unfolded configuration so as to protect a user, for example in the event of a fall or imminent impact.

[0014] The personal protection device according to the present disclosure furthermore comprises a support structure associated with said inflatable element (10) and configured to support the at least one inflatable element. Said support structure comprises at least one guide element which is connected to the at least one inflatable element so as to guide the latter, from the first rest configuration, or deflated configuration, into the second active configuration, or inflated configuration, along the distension direction. In other words, the support structure and in particular the guide element of the latter is configured to ensure guiding during inflation and effective positioning, for example preferably unfolding, of the inflatable element at the moment of inflation. The inflatable element is configured to slide along, or is slidably associated with, said guide element, and said guide element is an elongated element having a development direction which defines a direction of sliding or distension of the inflatable element. The guide element is configured to control distension of the inflatable element along said development direction. In other words, the guide element has a respective development direction (which is a longitudinal direction) defining said distension direction of the inflatable element and controlling the direction of extension of the inflatable element. In yet other words, the support structure and in particular the guide element of the latter has an intrinsic rigidity and a structure which is independent of the inflatable element, and therefore of the respective inflated and/or deflated configuration of the inflatable element, as a result of which the guide element is configured to control and ensure guiding during inflation and effective positioning, for example preferably unfolding, of the inflatable element at the moment of inflation.

[0015] In other words, owing to the geometrical arrangement of the parts as defined above, the "slidable" connection ensures that the inflatable element may be guided by the guide element.

[0016] In detail, the guide element is configured to favour the transition of the inflatable element from the rest condition, or deflated condition, to the active condition, or inflated condition, preferably ensuring effective and uniform unfolding and distension thereof, guiding it so as to extend along the distension direction and therefore favouring easy transition of the latter from a folded or packed configuration, or configuration where it is folded onto itself, to an extended configuration. In this way, advantageously, the inflatable element may ensure effective protection of a body zone of a user. In other words, the guide element is an element which allows the distension, or lateral expansion, of the inflatable element to be controlled.

[0017] In yet other words, according to the present disclosure, the guide element is an elongated element and the inflatable element is configured to slide along, or is slidingly associated with, said guide element. In other words, the guide element has a main development direction which defines a direction of sliding of the inflatable element. Consequently, advantageously, the guide element defines a direction of sliding of the inflatable element, wherein the latter may extend, or unfold or unroll from the deflated or folded-up or packed configuration into the extended configuration.

[0018] It should be noted that preferably the inflatable element is partly attached to, or stably associated with, a portion of the support structure and partly slidingly associated with the guide element, and the distension from the rest condition into the active condition is controlled by the guide element. In other words, preferably said support structure is attached, in a first region, to said inflatable element and connected slidingly in a second region by means of the guide element to the inflatable element. Again preferably, the guide element maintains preferably constantly a same extended condition along said development direction, or longitudinal direction, or sliding direction which does not change depending on the inflated or deflated condition of the inflatable element; on the contrary it is the guide element which conditions, or controls, the direction of distension of the inflatable element from the deflated condition, or first rest configuration, into the inflated condition, or second active configuration.

[0019] According to a preferred aspect of the present disclosure, the guide element is a band or narrow strip and the inflatable element is configured to define an eyelet component, or annular component, in which the guide element is slidably inserted. Expressed differently, the inflatable element is configured to slide, through the eyelet component, or annular component, on the guide element. Advantageously, the eyelet component, or annular component, is configured to slidably constrain the inflatable element, or at least a portion thereof, to the guide element, so that the former may effectively slide on the latter.

[0020] According to a preferred aspect, the personal protection device according to the present disclosure comprises an additional layer attached to a surface of the inflatable element. According to this aspect, said additional layer defines the eyelet component, or annular component, together with the surface of the inflatable element. In other words, according to this aspect, the annular component is an element associated with the inflatable element.

[0021] In accordance with a further aspect of the present disclosure, the inflatable element comprises a first end portion attached to the support structure, and a second end portion, opposite to the first end portion. In the rest configuration, or deflated configuration, the second end portion is at least partially superimposed, or sub-

stantially superimposed, on the first end portion. Said second end portion is configured to cooperate with the guide element. In particular, the second end portion of the inflatable element is slidingly associated with the guide element, for example by means of the eyelet component, or annular component, with which the said second end portion may be provided. In other words, according to this aspect, the first end portion is associated with and constrained to the support structure, while the second end portion is slidingly associated with the guide element so as to be able to slide thereon and pass from a configuration in which it is superimposed, partially superimposed, or in any case arranged close to the first end portion, into a configuration in which it is spaced from, or distant from, or extended, in particular along the distension direction, from the first end portion of the inflatable element.

[0022] In greater detail, according to a preferred aspect of the present disclosure, the second end portion of the inflatable element is configured to slide along the guide element away from the first end portion, along the distension direction. Said movement corresponds to the transition of the inflatable element form the rest configuration, or deflated configuration, to the active configuration, or inflated configuration. In other words, the movement of the second end portion of the inflatable element away from the first end portion defines a distension, or lateral expansion, along the distension direction, of the said inflatable element, which passes from a configuration where it occupies less space, for example being folded up, packed or folded onto itself, to a condition where it occupies more space, for example being stretched or extended, in particular laterally extended, along the distension direction.

[0023] According to a preferred aspect of the present disclosure, the support structure comprises a constraining portion configured to connect the first end portion of the inflatable element to the support structure. Said constraining portion extends in a direction transverse to the distension direction. In other words, according to this aspect, the first end portion is constrained to the support structure along a direction orthogonal to the distension direction of the inflatable element. In this way, the second end portion of the latter may be configured so as to unfold, or stretch, away from the end portion along the distension direction.

[0024] Preferably, according to one aspect of the present disclosure, the support structure comprises an abutting element configured to act as an end stop for the second end portion of the at least one inflatable element. According to this aspect, the abutting element is fixed to an end section of the guide element and has a main development direction substantially transverse to the distension direction. Advantageously, therefore, the support structure comprises an abutting element which is configured to limit sliding along the guide element of the second end portion of the inflatable element.

[0025] According to a further preferred aspect of the present disclosure, the protection device comprises at least two guide elements, arranged parallel to each other and each cooperating with a zone of the inflatable element. According to this preferred aspect, moreover, the second end portion of the inflatable element comprises two eyelet components, or annular components, each configured to accommodate a corresponding guide element of the two guide elements. In this way, the distension, or unfolding, or unrolling of the inflatable element, in particular of its second end portion with respect to its first end portion, is further favoured and facilitated. The zone of the inflatable element may be a chest zone. Therefore one guide element may be provided for a right-hand zone of the chest and one guide element may be provided for a left-hand zone of the chest.

[0026] Preferably, the personal protection device is an impact protection device and comprises a pressurized gas source configured to introduce a gas into the at least one inflatable element for transition of said at least one inflatable element from the rest configuration, or deflated configuration, to the second active configuration, or inflated configuration.

[0027] The present disclosure also relates to a wearable article which includes a personal protection device. According to this aspect, the wearable article comprises an exposed outer surface and an inner surface, opposite to the outer surface, wherein the support structure is associated, in a fixed or removable manner, with this inner surface. Advantageously, the support structure may be for example arranged on a zone of the wearable article designed to cover a back zone of a user, and the guide element may extend towards a chest zone of the said wearable article, while the abutting element may be arranged in a zone configured to cover a sternum zone of the user. The wearable article may also comprise a plurality of inflatable elements, for example two inflatable elements, for example configured to protect, respectively, a right-hand zone of the chest and a left-hand zone of the chest of a user. In this sense at least one abutting element may be placed on a side zone of the chest of the wearable article.

[0028] The present disclosure also relates to a method for protection of a user by means of a personal protection device. Said method comprises a step of providing at least one inflatable element configured to assume at least a first rest configuration, or deflated configuration, and a second active configuration, or inflated configuration. During the transition from the first configuration to the second configuration, the inflatable element is guided by means of a guide element, which is an elongated element having a development direction. The guiding action occurs by causing said at least one portion of the inflatable element to slide along the development direction of the guide element and controlling distension of the inflatable element along said development direction.

[0029] In other words, the guide element has a (predefined) longitudinal extension and a predefined development direction independent of the deflated configura-

tion and the inflated configuration of the inflatable element, and the development direction defines, namely conditions, the distension direction of the inflatable element from the deflated configuration into the inflated configuration.

[0030] 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.

[0031] 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.

[0032] Reference will be made to the figures of the attached drawings in which:

- Figure 1 shows a perspective view of a personal protection device according to a preferred aspect of the present disclosure, wherein an inflatable element is in a first configuration, or rest configuration, or deflated configuration;
- Figure 2 shows a perspective view of a personal protection device according to a preferred aspect of the present disclosure, wherein an inflatable element is in a second configuration, or active configuration, or inflated configuration;
- Figure 3 shows a cross-sectional view of a personal protection device according to a preferred aspect of the present disclosure, wherein an inflatable element is in a second configuration, or active configuration, or inflated configuration;
- Figure 4 shows a further cross-sectional view of a personal protection device according to a preferred aspect of the present disclosure, wherein an inflatable element is in a first configuration, or rest configuration, or deflated configuration;
- Figure 5 shows a further cross-sectional view of a personal protection device according to a preferred aspect of the present disclosure, wherein an inflatable element is in a second configuration, or active configuration, or inflated configuration;
- Figure 6 shows a view of a wearable article comprising a personal protection device according to a preferred aspect of the present disclosure, wherein an inflatable element is in a first configuration, or rest configuration, or deflated configuration;
- Figure 7 shows a view of a wearable article comprising a personal protection device according to a preferred aspect of the present disclosure, wherein an inflatable element is in a second configuration, or active configuration, or inflated configuration;

  Figure 8 shows a view of a personal protection device in the condition when worn, wherein an inflatable element is in a first configuration, or rest configuration, or deflated configuration;
- Figure 9 shows a view of a personal protection device in the condition when worn, wherein an inflatable element is in a second configuration, or active configuration, or inflated configuration.

[0033] With reference to the accompanying drawings, an embodiment of a personal protection device for providing personal protection for a user is indicated by the reference number 100.

[0034] With particular reference to Figures 1, 2, 3, 4, and 5, the protection device 100 according to the present disclosure comprises at least one inflatable element 10. Said at least one inflatable element 10 is able to assume at least a first rest configuration, or deflated configuration, and at least a second active configuration, or inflated configuration.

[0035] The inflatable element 10 comprises a first end portion 11 and a second end portion 12, opposite to the first end portion 11.

[0036] In greater detail, with reference to Figures 1 and 4, in the first rest configuration, or deflated configuration, the at least one inflatable element 10 is in a configuration where it occupies a smaller space, for example being folded up, or packed, or folded onto itself. In detail, in this configuration, or folded configuration, the second end portion 12 is at least partially superimposed, or substantially superimposed, on the first end portion 11. In other words, in this deflated condition, the second end portion 12 is arranged close to the first end portion 11.

[0037] With reference instead to Figures 2, 3 and 5, in the second active configuration, or inflated configuration, it is in a condition where it occupies more space, for example an extended or unfolded configuration. In this inflated configuration the second end portion 12 is located spaced from the first end portion 11 of the inflatable element 10.

[0038] In particular, according to the present invention, the at least one inflatable element 10 is configured to extend along a distension direction A from the folded, or rest, or deflated configuration, into the extended, or active or inflated configuration. In other words, the at least one inflatable element 10 is configured to unfold, or extend, passing from the folded or packed configuration of Figure 1, in which a second end portion thereof 12 is superimposed or substantially superimposed on a first end portion thereof 11, into the expanded configuration in Figure 2, in which said second end portion 12 is extended, or unfolded, or spaced, from said first end portion 11 along the distension direction A.

[0039] The personal protection device 100 according to the present disclosure furthermore comprises a support structure 20 configured to support the at least one inflatable element 10. Basically, the support structure 20 is a structure at least partially associated with the at least one inflatable element 10, and preferably attached thereto. For example, the support structure 20 is a kind of frame and may be configured to associate the at least one inflatable element 10 with a wearable article. In this

sense, the support structure 20 may be associated with said wearable article and configured to support at least one inflatable element 10.

[0040] In other configurations, the support structure 20 may be fixed to a garment or part thereof, for example fixed in a pocket of the garment.

[0041] According to the present disclosure, the support structure 20 comprises at least one guide element 21. Said at least one guide element 21 is connected to the at least one inflatable element 10 and is configured to guide said inflatable element along the distension direction A, from the first rest configuration, or deflated configuration, into the second active configuration, or inflated configuration.

[0042] The at least one guide element 21 is an elongated element of the support structure 20 so as to be able to guide the at least one inflatable element along the distension direction A. Said at least one guide element 21 therefore has its own development direction and is independent of the first rest configuration, or deflated configuration, and of the second active configuration, or inflated configuration of the inflatable element 10. Said at least one inflatable element 21 is able to condition the distension of the inflatable element from the rest configuration, or deflated configuration, into the second active configuration, or inflated configuration.

[0043] Preferably the support structure 20 is attached, in a first region, to said inflatable element 10 and connected slidably in a second region by means of the guide element 21 to the inflatable element 10.

[0044] For example, the guide element 21 is a band or a narrow strip, for example made of fabric. Furthermore, according to this aspect, the at least one inflatable element 10 is configured to slide along said elongated element. A sliding direction which coincides with a distension direction, and which coincides with or is parallel to the development direction of the guide element 21, is therefore defined.

[0045] Preferably, the at least one inflatable element 10, for this purpose, is configured to define an eyelet component 23 or annular component. In other words, the inflatable element 10 is configured to slide along the guide element 21, preferably in the distension direction, through the annular component, inside which the guide element 21 is inserted.

[0046] In order to be able to extend along the distension direction, expanding or stretching out from the first configuration to the second configuration, the inflatable element 10 comprises a first end portion 11 attached to the support structure 20, and a second end portion 12, opposite to the first end portion 11, which is instead configured to cooperate, for example by means of sliding, with the guide element 21.

[0047] In particular, according to a preferred aspect of the present disclosure, the second end portion 12 is slidingly associated with the guide element 21.

[0048] Even more preferably, according to an aspect of the present disclosure, the second end portion 12 of the inflatable element 12, in order to slide along the guide element 21, is provided with the eyelet component 23 or annular component.

[0049] In other words, the first end portion 11 is configured to be associated with the support structure 20, preferably in such a way that, during the transition from the first configuration to the second configuration, a relative position thereof with respect to the said support structure 20 does not change. Expressed in yet other words, the first end portion 11 is fixed, or constrained, to the support structure 20, for example by means of a constraining portion 22 of the latter, wherein said constraining portion 22 extends in a direction which is transverse, or substantially transverse, to the distension direction A.

[0050] In order to extend along the distension direction A, the second end portion 12 is configured to slide away from the first end portion 11 along the distension direction A, in particular along the guide element 21. This movement of the second end portion 12 away from the first end portion 11 of the inflatable element 10 corresponds to the transition of the latter from the first rest configuration, or deflated configuration, to the second active configuration, or inflated configuration.

[0051] The distension of the second end portion 12 of the inflatable element 10 with respect to the first end portion 11 thereof is possible, on the one hand, because the second end portion 12 is configured to cooperate, preferably by means of sliding, with the guide element 21 (which, as mentioned, has its own structure and own respective rigidity) and, on the other hand, because the first end portion 11 is constrained, in a direction orthogonal to the distension direction A, to the support structure 20, in particular to the constraining portion 22 thereof. In other words, the distension, or unfolding, of the inflatable element 10, according to the present disclosure, is allowed by a movement of the second end portion 12 with respect to the first end portion 11, which is instead attached to the support structure 20.

[0052] Advantageously, the guide element 21 and the fact that the second end portion 22 is slidable thereon allows the unfolding, or unrolling, of the inflatable element 10 along the distension direction A, in particular in the case where the inflatable element is arranged in a pocket, or insert of a wearable article, facilitating the distension or unfolding thereof and therefore improving the protection for a user. According to a further preferred aspect of the present disclosure, the support structure 20 comprises an abutting element 24. Said abutting element 24 is configured to act as end stop for the second end portion 12 of the at least one inflatable element 10. In other words, the abutting element 24 is configured to limit sliding of the second end portion 12 of the inflatable element 10 on the guide element 21.

[0053] According to this aspect, the abutting element 24 is fixed to an end section of the guide element 21 so as to limit therefore the sliding of the second end portion 12 on the latter. Preferably, moreover, the abutting element 24 has a main development direction B which is

transverse, or substantially transverse, to the distension direction A.

[0054] In order to favour further the distension, or unfolding, of the at least one inflatable element 10 along the distension direction A, the support structure 20 may comprise two guide elements 21, arranged preferably parallel to each other and each cooperating with a zone of the at least one inflatable element 10, in particular, with a zone of the second end portion 12 of the inflatable element 10. In this way, unfolding of the inflatable element 10 is favoured along its entire dimension orthogonal to the distension direction A. In other words, according to this preferred aspect, the at least one inflatable element is arranged, in an unfolding direction A, between the two guide elements 21. These two guide elements 21, together with the abutting element 24, define advantageously a confined space for distension or inflation of the at least one inflatable element 10. Advantageously, moreover, in this configuration, the abutting element 24 allows the two guide elements 21 of the at least one inflatable element 10 to be kept spaced, preferably parallel with respect to each other.

[0055] For this purpose, the second end portion 12 comprises two eyelet components, or annular components, each configured to accommodate a corresponding guide element 21 of the two guide elements 21.

[0056] According to a further preferred aspect of the present disclosure, the protection device 100 may comprise two inflatable elements 10, 10', for example configured to protect a body zone of a user, for example a chest zone. According to this aspect, each inflatable element 10, 10' of the two inflatable elements may comprise at least one guide element 21, on which the inflatable element 10 itself is slidable by means of at least one eyelet element 23 or annular element. In this configuration, preferably the inflatable elements 10 are configured to extend along a distension direction A opposite to each other, from the rest configuration, or deflated configuration, into the second active or inflated configuration. In other words, a first inflatable element 10 is configured to extend along this direction A, towards the second inflatable element 10, while the latter is configured to extend along a direction A', wherein said direction A' is opposite to the distension direction A of the first inflatable element 10, as indicated in Figure 3. The distension of each inflatable element 10, 10' is limited by an abutting element 24 arranged between the two inflatable elements 10, 10'. In other words, according to this aspect, the abutting element 24 is an end portion of the at least one guide element 21 of each inflatable element 10, 10'.

[0057] Advantageously, according to this aspect, the abutting element 24 allows distension of each inflatable element 10, 10' along a respective distension direction A, A' to be limited. Furthermore, in this configuration, the abutting element 24 prevents the two inflatable elements 10, 10; from being superimposed, or arranged on top of each other, for example during inflation of the two inflatable elements 10, 10', therefore creating a planar protection surface which does have points where an object may penetrate the body of a user.

[0058] According to a preferred aspect of the present disclosure, the protection device 100 is an impact protection device and more preferably a so-called "stand-alone" device for protection of a user, namely a device which is provided with all the components necessary for inflation thereof. An example of such a device 100 which includes all the aforementioned characteristics is shown in Figures 8 and 9. For this purpose, said personal protection device 100 comprises a pressurized gas source (not shown in the drawings) configured to introduce a gas into the at least one inflatable element 10 for transition thereof from the rest configured, or deflated configuration, to the second active configuration, or inflated configuration. In other words, the pressurized gas source is configured to inflate the at least one inflatable element 10, wherein said inflation involves the transition, from the configuration where said the inflatable element is packed, or folded onto itself, into the unfolded or stretched configuration.

[0059] With particular reference to Figures 6 and 7, the present disclosure relates to a wearable article 1000 comprising a personal protection device 100 as described above. Said wearable article may be a protective garment for a user, for example a jacket, or a suit, for example for motorcycling or skiing, or a protective waistcoat or a pair of trousers.

[0060] Preferably, said wearable article 100 comprises an exposed outer surface and an inner surface, opposite to the outer surface and configured, during use, to be directed towards a user's body. According to this aspect, the support structure 20 is associated with, for example attached to, the inner surface of the wearable article 1000, or, as mentioned, a pocket. A pocket is indicated by means of a broken line in Figures 6 and 7, or in Figures 4 and 5.

[0061] The support structure 20 may be part of the garment or the inner surface thereof.

[0062] For example, the support structure 20, in the case where the wearable article 1000 is a waistcoat or a jacket, may be arranged on a back zone of the wearable article 100. According to this aspect, the at least one guide element 21 may extend from this back zone as far as a chest zone of the said wearable article 1000, where the abutting element 24 may also be arranged.

[0063] The wearable article 1000 may comprise a personal protection device 100 with two inflatable elements 10, for example a first inflatable element configured to protect, during use, a right-hand zone of the chest of a user and a second inflatable element configured to protect, during use, a left-hand zone of the chest of a user.

[0064] Finally the present disclosure relates to a method for protection of a user by means of a personal protection device 100.

[0065] During the description of said method, the personal protection device 100 and its elements will not be further described in detail, and maintain the same refer-

ence numbers indicated above.

[0066] In particular, the method comprises a step of providing at least one inflatable element 10 configured to assume at least a first rest configuration, or deflated configuration, which occupies less space, and a second active configuration, or inflated configuration, which occupies more space.

[0067] The method involves the step of mounting said inflatable element 10 on a support structure 20 which comprises at least one guide element 21.

[0068] Furthermore, the method involves a step of inflating the at least one inflatable element 10 from the first rest configuration into the second active configuration. This step preferably causes distension of the at least one inflatable element 10 from a condition, in which at least one portion thereof is folded onto a further portion of the inflatable element 10, into a configuration where this portion is extended with respect to the further inflatable portion 10.

[0069] The method furthermore involves guiding, by means of the guide element 21 of the support structure 20, the distension of this portion of the inflatable element 10 with respect to the further portion thereof. Essentially, the guide element 21 is an element configured to control, or guide, distension of a portion of the inflatable element 10 with respect to a further portion thereof.

[0070] According to a preferred aspect, the inflatable element portion configured to undergo distension is a second end portion 12 of the inflatable element 10, while the other portion is a first end portion 11 of the said inflatable element 10. According to this aspect, the step of inflating the inflatable element 10 involves constraining the first end portion 11 of the inflatable element to a constraining portion of the support structure. Preferably, this constraining action is performed a direction transverse to the distension direction A.

[0071] Furthermore, according to this aspect, the inflation step involves sliding the second end portion 12 along the guide element 21, in the distension direction A, away from the first end portion 11.

[0072] In order to perform inflation of the inflatable element 10, the protection device according to the present invention is able to cooperate with special activation and inflation means (not shown).

[0073] Alternatively, these means may comprise gas generators of the pyrotechnical or hybrid type or of other types known in the state of the art,

Operation of said inflation means is controlled by a control unit depending on the detection of the user's condition; for example, said control unit may implement an impact prediction algorithm which allows early identification of the event and a reliable prediction thereof by means of sensors and a unit for processing the signals produced by the said sensors.

[0074] The aforementioned detection and activation means may also be incorporated in the protection device according to the present invention or located on the outside thereof.

[0075] Basically, it is to be understood that the impact detection and activation means of the inflatable element 10 may be either means associated with the user on the outside of the personal protection device or means incorporated in the latter.

[0076] It should also be noted that the activation methods, while being an aspect of particular importance for effective operation of the device, will not be described in further detail since they are methods which are essentially already known to the person skilled in the art.

[0077] The protection device may also comprise a deflation valve communicating on one side with the internal chamber of the inflatable element and on the other side with the external environment, in order to allow the deflation of the inflatable element 10 following activation and when a protective action is no longer required. Activation of the deflation valve may be controlled by an electronic control unit, which opens the deflation valve once a predefined time interval from activation of the inflation means has lapsed. Alternatively, the deflation valve may be manually operated.

[0078] 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 provided below.

Claims

1. A personal protection device (100) for personal protection of a user, wherein said protection device (100) comprises at least one inflatable element (10) able to assume a first rest configuration, or deflated configuration, and a second active configuration, or inflated configuration, said protection device (100) comprising a support structure (20) associated with said inflatable element (10) and configured to support said at least one inflatable element (10); said support structure (20) comprising a guide element (21) connected to said inflatable element (10) so as to guide said at least one inflatable element (10) from said first rest configuration, or deflated configuration, into said second active configuration, or inflated configuration, wherein said inflatable element (10) is configured to slide along, or is slidingly associated with, said guide element (21), and said guide element (21) is an elongated element having a development direction which defines a sliding direction and distension direction (A) of the inflatable element (10), said guide element (21) being configured to control the distension of the inflatable element (10) along said development direction.

2. Personal protection device (100) according to the preceding claim, wherein said support structure (20) is attached in a first region to said inflatable element

(10) and slidably connected in a second region by means of the guide element (21) to the inflatable element (10).

3. Personal protection device (100) according to claim 1 or 2, wherein in said first rest configuration, or deflated configuration, said inflatable element (10) is in a folded or packed configuration, or is folded onto itself, or occupies a first space, and wherein in said second active configuration, or inflated configuration, said inflatable element (10) is in a stretched condition, or occupies a second space greater than said first space, and wherein said inflatable element (10) is configured to extend along a distension direction (A) from the rest configuration, or deflated configuration, into the second active configuration, or inflated configuration; and said guide element is configured to guide said inflatable element along said distension direction (A).

4. Personal protection device (100) according to any one of the preceding claims, wherein the development direction is independent of the first rest configuration, or deflated configuration, and of the second active configuration, or inflated configuration, of the inflatable element (10).

5. Personal protection device (100) according to any one of the preceding claims, wherein said guide element is a band or narrow strip and said inflatable element (10) is configured to define an eyelet component (23) or annular component, wherein said guide element (21) is slidably inserted into said eyelet component (23) or annular component.

6. Protection device (100) according to the preceding claim, comprising an additional layer attached to a surface of said at least one inflatable element (10), the additional layer defining said eyelet component (23), or annular component, with said surface of the inflatable element (10).

7. Personal protection device (100) according to any one of the preceding claims, wherein said at least one inflatable element (10) comprises a first end portion (11) attached to said support structure (20) and a second end portion (12) opposite to said first end portion (11), wherein, in said first rest configuration, or deflated configuration, of said at least one inflatable element (10), said second end portion (12) is at least partially superimposed, or substantially superimposed, on said first end portion (11), said second end portion (12) being configured to cooperate with said guide element.

8. Protection device (100) according to the preceding claim, wherein said second end portion (12) of said at least one inflatable element (10) is slidingly associated with said guide element (21).

9. Protection device (100) according to the preceding claim and claim 5, wherein said second end portion (12) of said at least one inflatable element (10) is provided with said eyelet component (23) or annular component.

10. Protection device (100) according to any one of claims 7 to 9, wherein said second end portion (12) is configured to slide along said guide element (21) away from said first end portion (11) along said distension direction (A), said movement corresponding to a transition of said inflatable element (10) from said first rest configuration, or deflated configuration, to said second active configuration, or inflated configuration.

11. Protection device (100) according to any one of claims 7 to 10, wherein said support structure (20) comprises a constraining portion (22) configured to connect said first end portion (11) of said at least one inflatable element (10) to said support structure (20) wherein said constraining portion extends in a direction transverse to said distension direction (A).

12. Protection device (100) according to any one of claims 7 to 11, wherein said support structure (20) comprises an abutting element (24) configured to act as an end stop for said second end portion (12) of said at least one inflatable element (10), wherein said abutting element (24) is attached to an end section of said guide element (21) and has a main development direction (B) substantially transverse to said distension direction (A).

13. Protection device (100) according to the preceding claim in combination with any one of claims 7 to 12, wherein said second end portion (12) comprises two eyelet components (23), or annular components, each configured to accommodate a corresponding guide element of said two guide elements.

14. Protection device (100) according to any one of the preceding claims, comprising at least two guide elements arranged parallel to each other and each cooperating with a respective zone of said inflatable element.

15. Protection device (100) according to any one of the preceding claims, wherein said protection device (100) is an impact protection device and includes a pressurized gas source configured to introduce a gas into said at least one inflatable element (10) for transition of said at least one inflatable element (10) from said first rest configuration, or deflated configuration, to said second active configuration, or inflated configuration.

16. Wearable article (1000) including a protection device (100) according to any one of the preceding claims.

17. Wearable article (1000) according to the preceding claim, comprising an exposed outer surface and an inner surface, opposite said outer surface, wherein said support structure (20) is associated with said inner surface, or said support structure (20) is a part of said inner surface.

18. Method for protection of a user by means of a personal protection device (100), comprising the steps of:

providing at least one inflatable element (10) configured to assume at least a first rest configuration, or deflated configuration, and a second active configuration, or inflated configuration,
mounting the inflatable element (10) on a support structure (20) comprising at least one guide element (21), said guide element (21) being an elongated element having a development direction;
said method comprising a step of inflating said at least one inflatable element (10) from said first rest configuration, or deflated configuration, into said second active configuration, or inflated configuration,
and wherein the method involves guiding, by means of the guide element, at least a portion of the inflatable element between the first rest configuration and the second active configuration, causing sliding of said at least one portion of the inflatable element (10) along the development direction of said guide element (21) and controlling distension of the inflatable element (10) along said development direction by means of the guide element (21).

19. Method according to the preceding claim, wherein said step of inflating said at least one inflatable element (10) results in distension of the inflatable element between a condition in which said at least one portion of the inflatable element is folded onto another portion of the inflatable element and a condition in which said portion of the inflatable element is stretched with respect to said other portion of the inflatable element, and said guiding step is a guiding step along a distension direction.

20. Method according to claim 19, wherein said inflatable element portion is a second end portion (12) of said at least one inflatable element (10) and said other portion is a first end portion (11) of said at least one inflatable element (10), and wherein said step of inflating said at least one inflatable element (10) involves constraining the first end portion (11) of said at least one inflatable element (10) to a constraining portion (22) of said support structure (20) along a direction transverse to said distension direction (A); and
sliding the second end portion (12) along said guide element away from said first end portion (11) in said distension direction (A).

21. Method according to any one of claims from 17 to 20, wherein the method is performed by means of a protection device according to any one of the preceding claims 1 to 15.

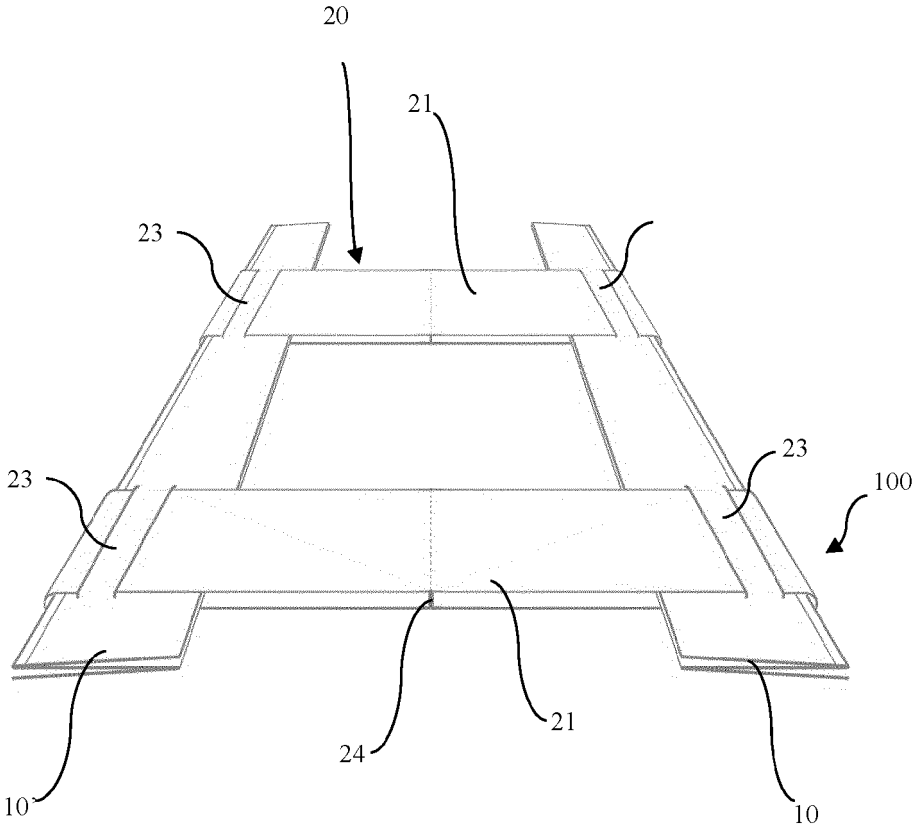

Fig. 1

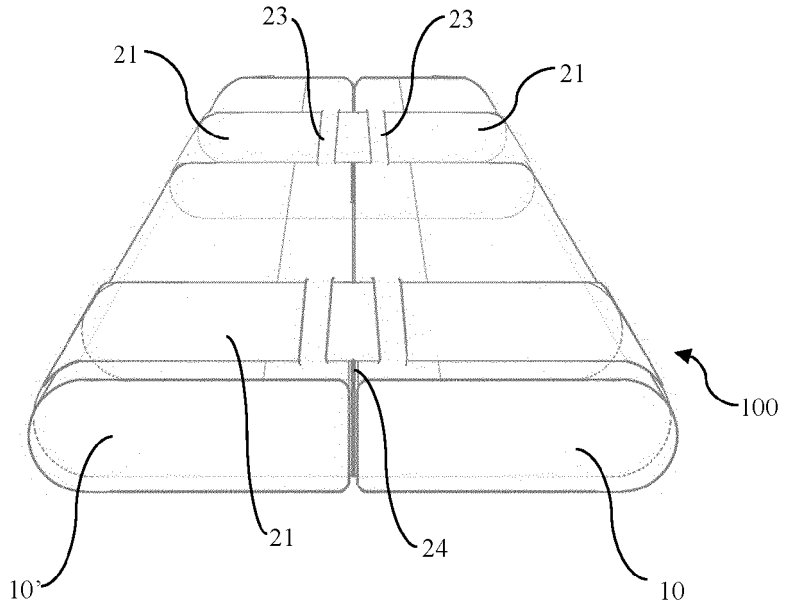

Fig. 2

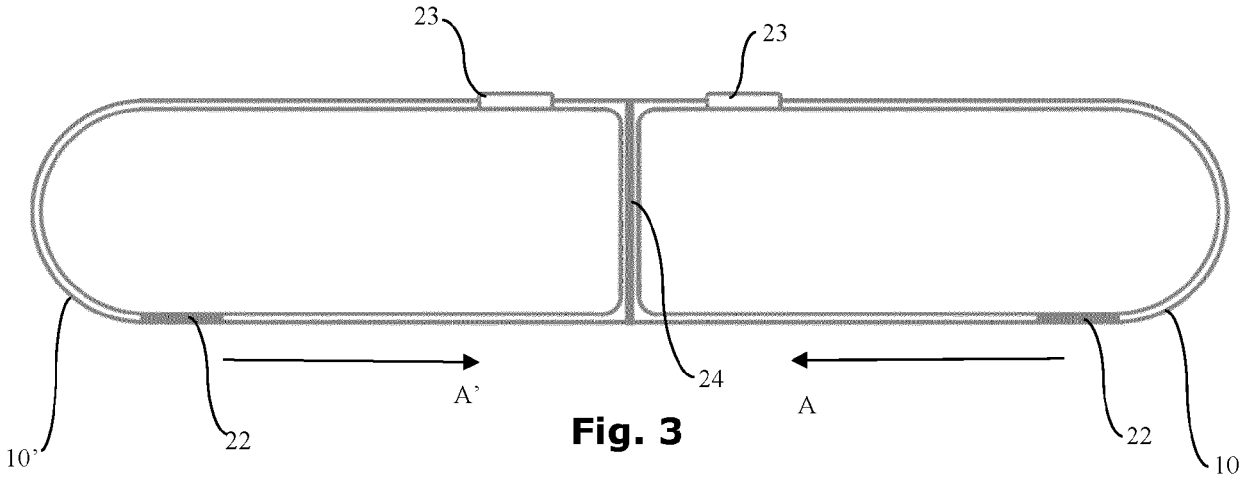

Fig. 3

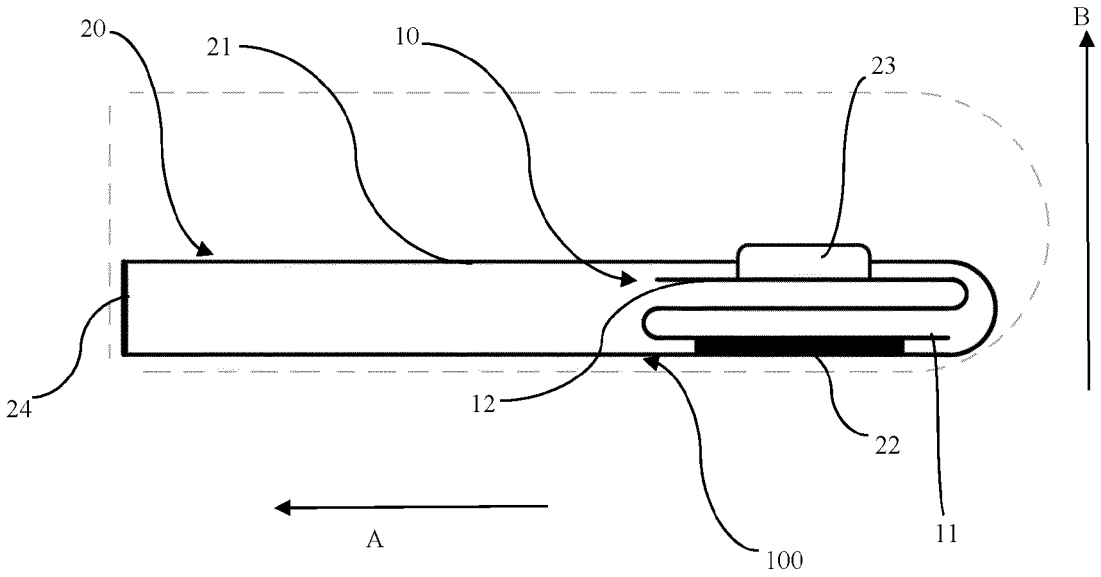

Fig. 4

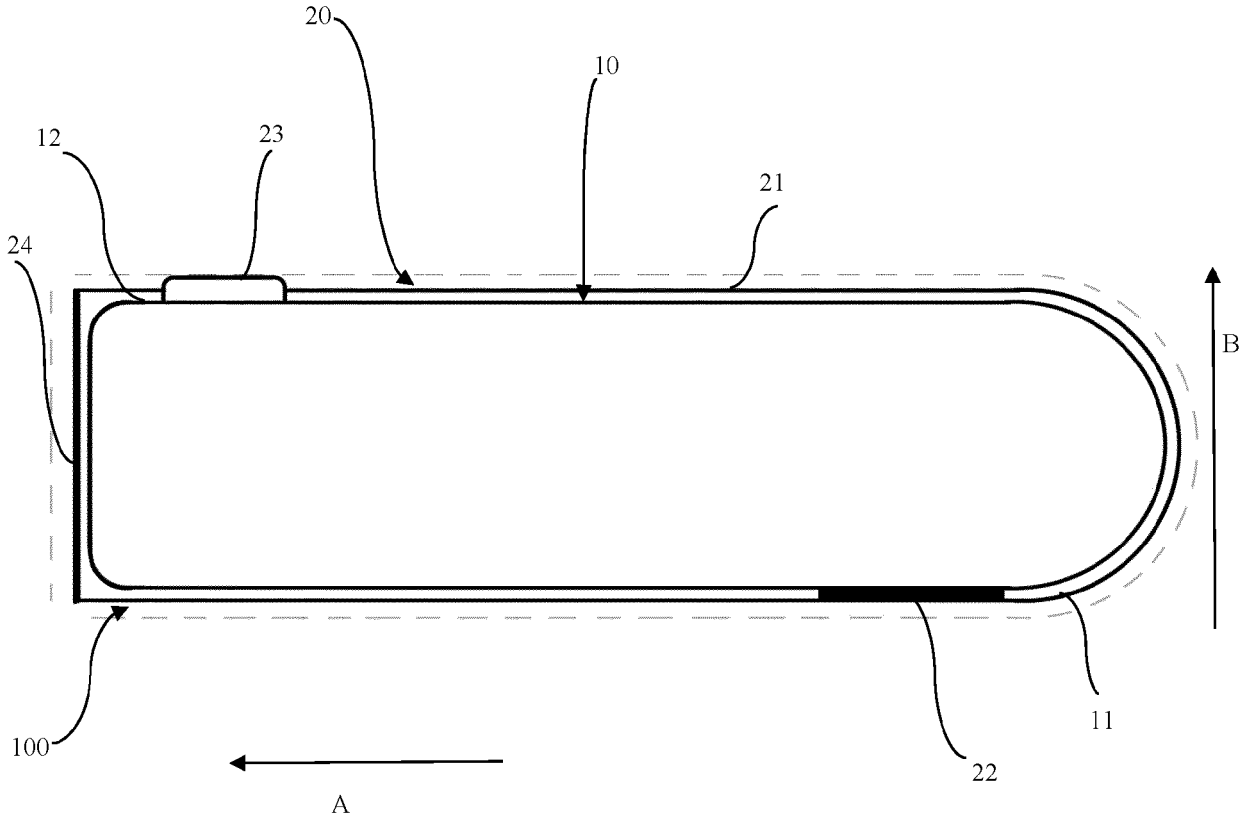

Fig. 5

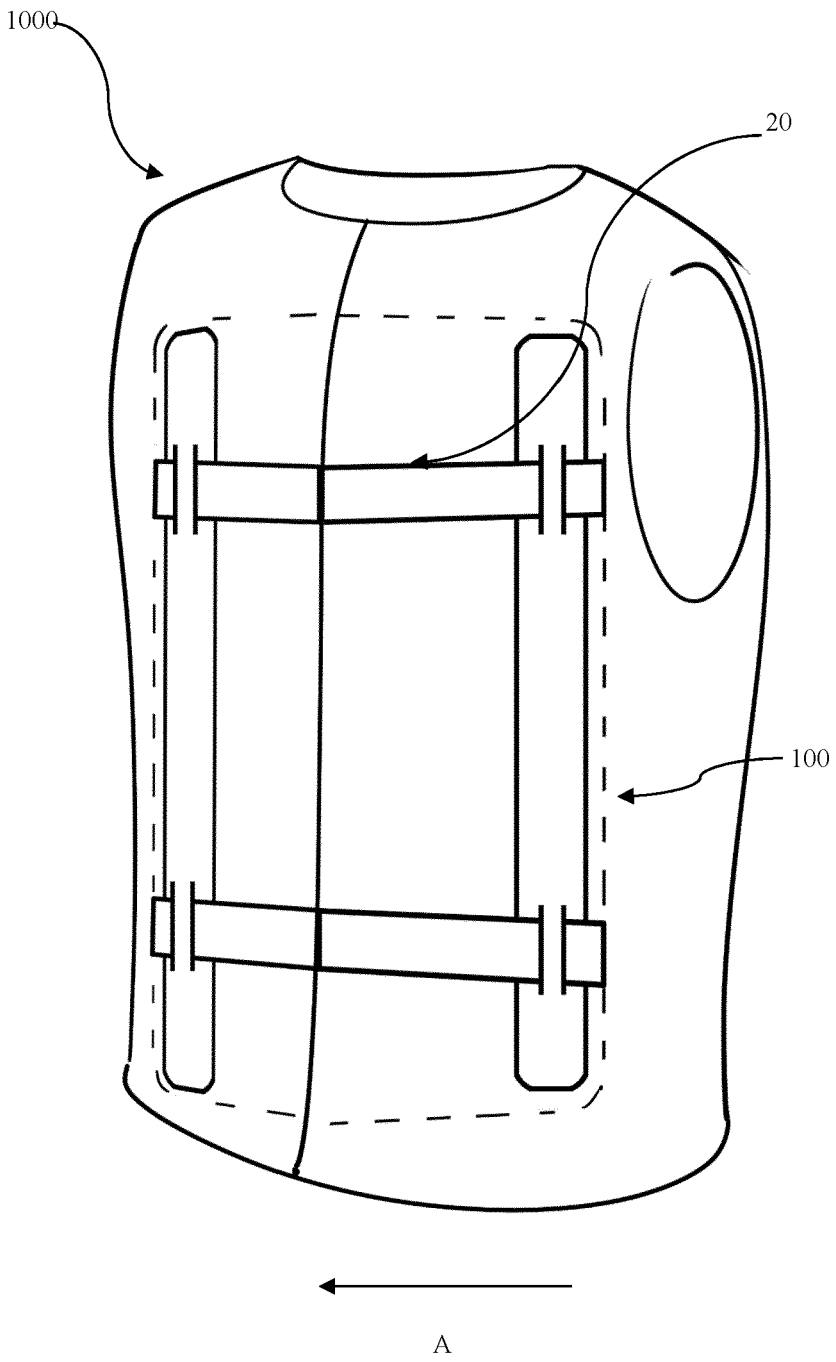

Fig. 6

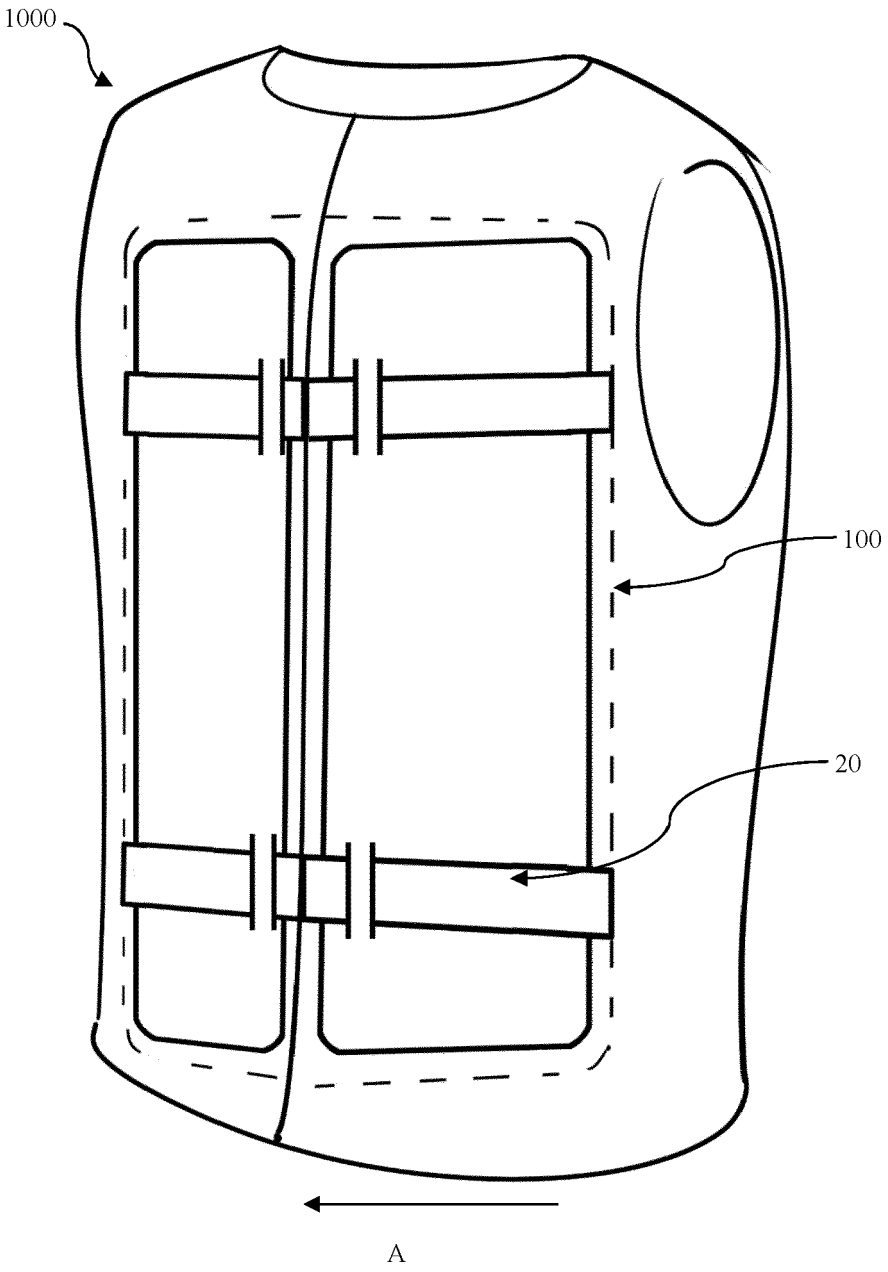

Fig. 7

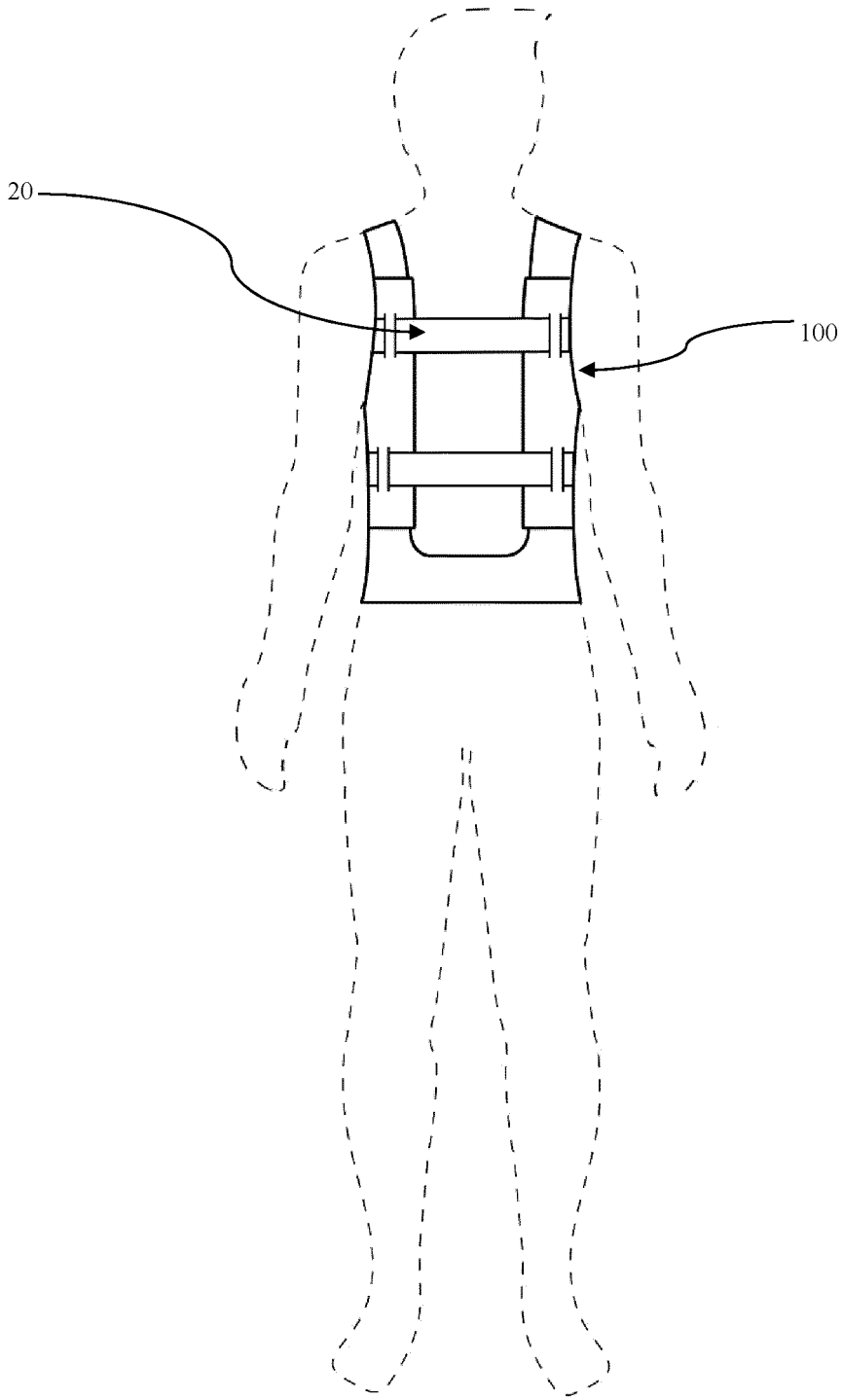

Fig. 8

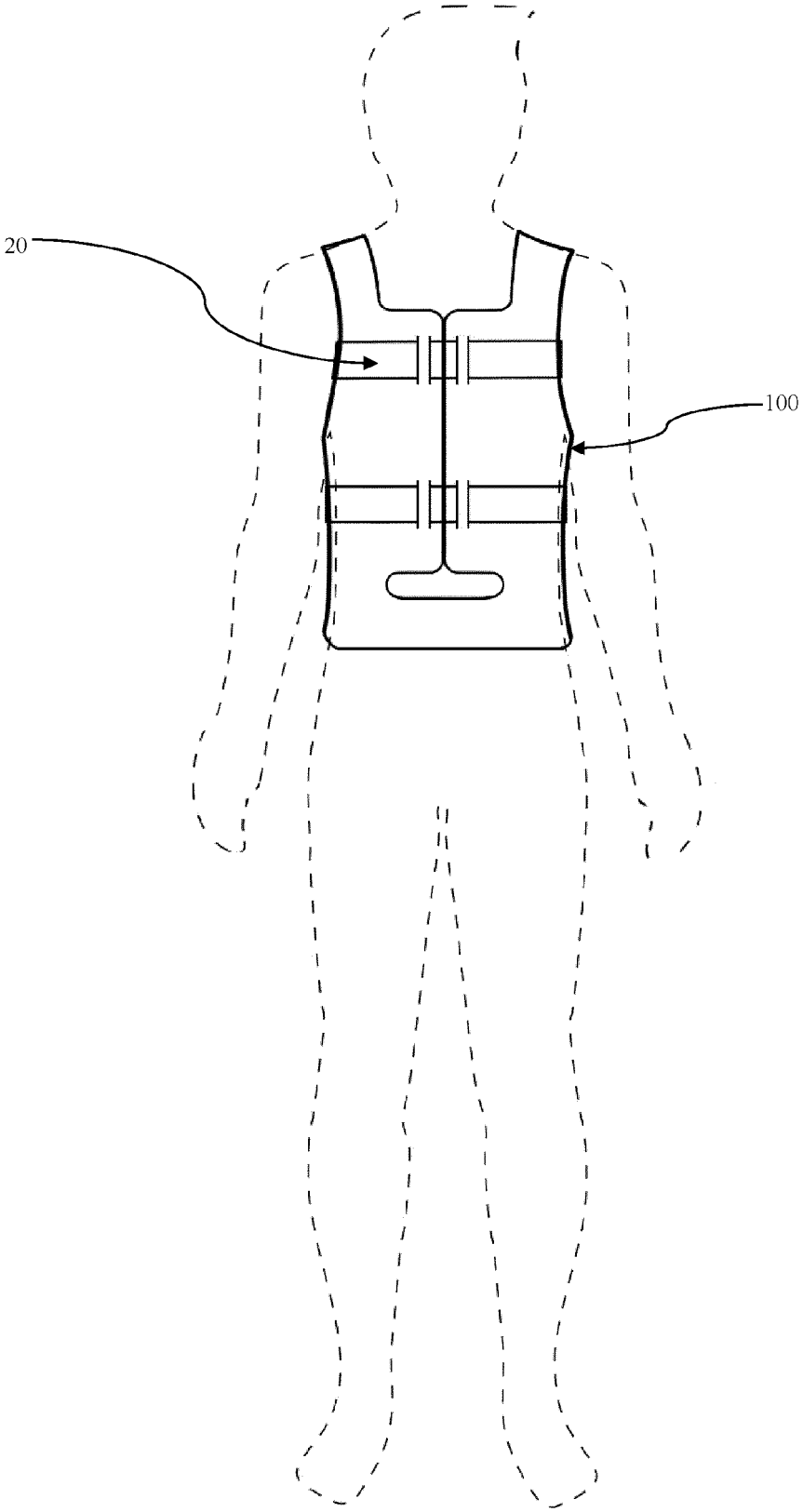

Fig. 9

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EUROPEAN SEARCH REPORT

Application Number
EP 23 20 7495

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	IT 2020 0003 1358 A1 (ALPINESTARS RES S P A [IT]) 18 June 2022 (2022-06-18) * figure 18 *	1-21	INV. A41D13/018
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TECHNICAL FIELDS SEARCHED (IPC)

A41D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	20 February 2024	van Voorst, Frank

CATEGORY OF CITED DOCUMENTS

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