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(71) Applicant: **Dainese S.p.A.**
36064 Colceresa (Vicenza) (IT)

(72) Inventor: **PIOVESAN, Alberto**
36064 Colceresa (Vicenza) (IT)

(74) Representative: **Manfrin, Marta et al**
Società Italiana Brevetti S.p.A.
Stradone San Fermo 21 sc. B
37121 Verona (VR) (IT)

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(54) **PROTECTIVE DEVICE**

(57) The present disclosure relates to a protective device (10) for protecting a user, which is designed to assume at least an active inflated configuration and a deflated rest configuration. The inflatable element (12) comprises a first mesh portion (18) and a second mesh portion (19), wherein said first mesh portion (18) and said second mesh portion (19) are situated opposite each other and connected together by means of a plurality of tie elements (5). The tie elements are arranged or organized in a plurality of rows (24) in which the inflatable element has at least one preferential curvature and the rows of tie elements are arranged parallel to each other and are oriented transversely or orthogonally with respect to the preferential curvature or greater curvature.

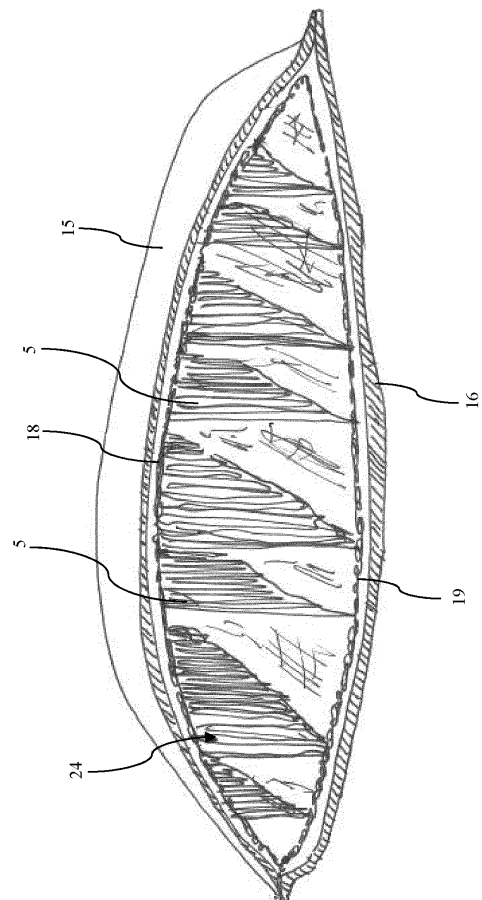


Fig. 2

Description

[0001] The present disclosure relates in general to a protective device for protection of a user. The protective device includes an inflatable element which in the inflated condition, is designed to protect from impacts and/or falls a motorcycle rider, a passenger, a skier or a similar user, during a sporting and/or working activity and/or any other activity.

[0002] A known protective device is for example that described in the European patent EP3291697B1. Such a device includes an inflatable element designed to assume an inflated active condition and a deflated rest condition. The inflatable element includes a 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 inner region or area or chamber. This inner chamber is occupied at least partially by a plurality of joining threads which connect together opposite portions of the knitted body. The fact of providing a single knitted body has the advantage of limiting the manufacturing waste and minimizing the production time; in fact, the joining threads and meshes may be processed using a single knitting machine. The joining threads form part of single thread 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.

[0003] Preferably, 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 of a second sheet, or second wall, which are fixed together along respective perimetral edges. Said first and second sheets cover and line on an outer side or outer surface the knitted body.

[0004] One technical problem underlying the present disclosure is that of providing a protective device for protecting a user, which is able to improve further the prior art for the purposes of wearability of the protection device, and/or achieve further advantages, and provide a garment including said personal protection device.

[0005] This problem is solved by a protective device for protecting a user, by a protective garment and by a production method for manufacturing a protective device according to the respective independent claims.

[0006] Secondary characteristic features forming the subject of the present disclosure are defined in the respective dependent claims.

[0007] A protective device according to the present disclosure for protecting a user comprises an inflatable element, which is designed to assume at least an inflated active condition and a deflated rest condition. The inflatable element comprises a first mesh portion and a second mesh portion, wherein the first mesh portion and the second mesh portion are situated opposite each other and connected together by means of a plurality of tie elements. According to one aspect of the present disclosure,

the inflatable element has at least one preferential curvature and the rows of tie elements are arranged parallel to each other and oriented transversely or orthogonally with respect to the preferential curvature.

[0008] Under a different or additional point of view, because of the geometry reported above, the rows of tie elements are arranged side by side and follow next to each other along said preferential curvature or greater curvature. In other words, the rows of tie elements are parallel to each other and a direction going from a row to a subsequent row is along the curvature or curve.

[0009] The preferential curvature is understood as meaning the profile of a curved form which the inflatable element has in the inflated condition. This preferential curvature may be obtained by varying the yielding capacity of opposite portions of the inflatable element or in another way so as to obtain a suitable curvature. It should also be pointed out that the tie elements are tensioned when the inflatable element is inflated and in fact limit the inflation of the inflatable element. In the zone of each row of tie elements, the inflatable element has a height or expansion less than in a zone where there are no rows of tie elements. In other words, where the tie element is present, precisely because of the function of the said tie element, the inflatable element expands less. For this reason, each row of tie elements creates a kind of hinge line or further "preferential" folding line of the inflatable element in the inflated condition and allows the inflatable element to be curved or folded better about said hinge line or folding axis, and therefore allows the folding capacity of the inflatable element along the said preferential curvature to be further improved.

[0010] Consequently, advantageously, it is possible to envisage an inflatable element intended to cover a given part to be protected and having a three-dimensional form, already with its preferential curvature. The orientation or direction of each folding axis or hinge line may be chosen depending on the fold which is to be obtained. In other words each row of inflatable elements may be oriented along a corresponding preferred direction so as to create a series of specific folds about the object or body to be protected.

[0011] Preferably, 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 of a second sheet, or second wall, which are fixed together along respective perimetral edges. Said first and second sheets cover and line on an outer side or outer surface the mesh portions.

[0012] Preferably the inflatable element comprises a first protective operating region and a second protective operating region, wherein the first protective operating region is different or separate from said second protective operating region and wherein the first protective operating region includes a first group of tie elements which are arranged in respective rows parallel to each other and the second operating region includes a second group of

tie elements arranged in respective rows parallel to each other, wherein the rows of the first group of tie elements are oriented or arranged with a different orientation or in a different direction with respect to the rows of the second group of tie elements. In other words, the rows of tie elements are arranged spaced from each other respectively in the first protective operating region and in the second protective operating region of the inflatable element so as to form a plurality of hinge lines and allow a broader or more varied curvature of the inflatable element. Even more preferably, the rows of inflatable elements are parallel to each other and even more preferably spaced from each other.

[0013] In this way, when the inflatable element is inflated and each row of tie elements is tensioned, the presence of hinge lines of the first group and the second group which are oriented differently allows more specific folding of the inflatable element.

[0014] For example, it is possible to provide a first inflatable element portion, defining the aforementioned first protective operating region, including a plurality of first rows oriented parallel to each other with a first orientation intended for a preferred curvature, and a second inflatable element portion, defining the second protective operating region, including a plurality of second rows oriented parallel to each other with a second orientation intended for a preferred curvature, wherein the second orientation is different from the first orientation.

[0015] In order to create the hinge line, according to another preferred aspect of the present disclosure, in the condition of at least partial tension, the tie elements belonging to a same row of tie elements are arranged substantially parallel to each other.

[0016] According to a preferred aspect of the present disclosure, in the condition of at least partial tension, the tie elements extend along a direction of development substantially perpendicular to the direction of extension of the rows of tie elements.

[0017] The fact of organizing rows of tie elements oriented differently in different protective zones of the inflatable element therefore allows optimum adjustment of the curvature of the bag and variation of the curvature of the bag with respect to another protective region. In other words, a variation in the orientation of the rows of tie elements allows a different orientation of the hinge lines and therefore adaptation of the curvature of the inflatable element. This advantage is particularly useful when the inflatable element is arranged around the human body and is curved both about a sagittal axis and about a median axis.

[0018] For example in a neck zone, i.e. on the nape between the shoulders, the inflatable element is curved preferably about hinge axes which are orthogonal to a sagittal plane. In fact, the inflatable element has an anatomical curved profile so as to bend around from the neck towards the back. The rows of tie elements are arranged parallel to a coronal or frontal plane and to a transverse plane, and orthogonally with respect to a sagittal

plane.

[0019] Consequently, in the neck zone, the rows of tie elements are arranged in a direction substantially parallel to a transverse axis of the human body, parallel to a coronal or frontal plane and to a transverse plane, and orthogonally with respect to a transverse plane.

[0020] In the shoulder zone, the rows of tie elements are arranged in a direction substantially parallel to a sagittal axis or plane of the human body, transversely or orthogonally with respect to a coronal or frontal plane and to a transverse plane.

[0021] Also in a chest zone, the rows of tie elements are arranged in a direction substantially parallel to a sagittal axis or plane of the human body, transversely or orthogonally with respect to a coronal or frontal plane.

[0022] Obviously, the orientation must be chosen depending on the nature of the body to be protected. Also it should be noted that the rows are preferably symmetrical with respect to a sagittal mid-plane of the user's body so as to obtain an identical curvature in the two parts of the body.

[0023] The tie elements are elements able to be tensioned when the inflatable element is in an inflated condition. In other words, a condition wherein the inflatable element is in an inflated condition corresponds to a condition wherein the tie elements are tensioned. The tie elements can be threads, or other elements such as stitches, tapes or similar tie elements.

[0024] In one embodiment of the present disclosure, the inflatable element is made using the technology described in the patent application WO2017163196A1. Namely it consists preferably of an inflatable element with threads, which is formed by mesh portions and walls as described in this patent application, and even more preferably with a curved configuration due to a varying expansion capacity of an inner side facing the user and an outer side. In particular the outer side of the inflatable elements gives way or extends more than the inner side facing the user. As a result of this feature, it is possible to obtain a general curvature of the bag in every direction, namely an unvaried curvature. In other words, on the outer side the inflatable element inflates in a non-varying manner. The inflatable element therefore has opposite portions with a different yielding capacity.

[0025] Preferably, the different yielding capacity of the two opposite portions of the inflatable element may be obtained in two different ways.

[0026] In a first way, the different yielding capacity is obtained by varying the yielding capacity or elasticity of the first mesh portion with respect to the second mesh portion. In a second way, the different yielding capacity is obtained by varying the yielding capacity or elasticity of the first wall with respect to the second wall. In fact, the opposite portions of the inflatable element include, respectively, the first mesh portion and the first wall, the second mesh portion and the second wall. Again alternatively, it is possible to vary in a specific manner the yielding capacity both of the mesh portion and the walls,

namely the overall yielding capacity of the first mesh portion and the first wall, with respect to the overall yielding capacity of the second mesh portion and the second wall.

[0027] In this way, if the inflatable element has a preferential curvature or a greater curvature along a given arc of curvature, the row of tie elements is arranged transversely with respect to said arc of curvature, preferably orthogonally with respect to the arc of curvature. In other words, the inflatable element has a preferential curvature such that, viewed laterally, it defines an arc of curvature contained in a plane. Each row of threads is arranged or oriented orthogonally with respect to said arc of curvature and this plane so as to allow in an even better manner the curvature of the inflatable element about each row of threads. For example, if the inflatable element portion has a preferential curvature from the neck towards the back, the rows of tie elements are arranged parallel to each other and are oriented orthogonally with respect to the preferential curvature, and therefore extend in a parallel manner from the neck towards the back. For example, if in addition to or in combination with the preceding embodiment, the inflatable element portion has a preferential curvature from one side of the user's body to the other, the rows of tie elements are arranged parallel to each other and oriented orthogonally with respect to the preferential curvature, and therefore extend parallel from one side to the other side of the user's body.

[0028] This aspect also facilitates, therefore, the curvature of the inflatable element.

[0029] Further characteristic features and modes of use forming the subject of the present disclosure will become clear from the following detailed description of a number of preferred examples of embodiment thereof, provided by way of a nonlimiting example. It is nevertheless evident that each embodiment may have one or more of the advantages listed above; in any case it is nevertheless not necessary that each embodiment should have simultaneously all the advantages listed.

[0030] Reference will now be made to the figures in the attached drawings in which:

Figure 1 shows a plan view of a protective device according to an embodiment of the present disclosure;

Figure 2 shows a schematic cross-sectional view along the line II-II of the protective device according to Figure 1 with the inflation element inflated;

Figure 3 shows a schematic view, from the front, of a protective device in the inflated condition when worn;

Figure 4 shows a schematic view, from the rear, of a protective device in the inflated condition when worn;

Figure 5 shows a schematic view of a garment including a personal protection device.

[0031] With reference to the accompanying figures, the reference number 10 indicates a personal protection de-

vice according to the present disclosure in accordance with an embodiment of the present disclosure.

[0032] The personal protection device 10 comprises an inflatable element 12 which is adapted to assume substantially a first rest condition or deflated condition, and a second active condition or inflated condition. The modes of inflating the inflatable element 12 will be described in the description below.

[0033] In one embodiment of the present disclosure the inflatable element 12 has a vest-like form and is designed to surround a top zone or chest of the user's body. More particularly, the inflatable element includes a first protective operating region 20 for the back of the neck and nape region between the shoulders, a second protective operating region 21 on the shoulders and a third protective operating region 22 on the chest. More particularly, because of the anatomy of the human body, each second protective operating region 21 and the third protective operating region 22 are each doubled into two parts on the right and left of the human body in a symmetrical manner with respect to a sagittal plane.

[0034] The inflatable element 12 may be made using the technology described in patent application PCT/IB2009/055512 and in patent application PCT/IT2009/000547, which are incorporated here by reference in their entirety in the present disclosure, or more preferably using the technology described in patent application WO2016178143A1, or even more preferably in patent application WO2017163196A1. Namely it consists preferably of an inflatable element with threads, which is formed by meshes and walls as described in these patent applications, and even more preferably with a curved configuration due to a varying expansion capacity of an inner side facing the user and an outer side.

[0035] The inflatable element 12 comprises a first mesh portion 18 and a second mesh portion 19. The first mesh portion 18 and the second mesh portion 19 are situated opposite each other and are connected together by a plurality of tie elements 5. The mesh portions 18, 19 are in turn covered by respective covering walls 15, 16. The tie elements 5 are organized in rows 24, namely are arranged aligned and in sequence.

[0036] The inflatable element 12 further comprises, as mentioned, the first protective operating region 20, for example at the back on the nape and around the neck, towards the back, the second protective operating region 21 in the shoulder region and a third protective operating region 22 on the chest. The various operating portions have a preferential curvature C or greater curvature.

[0037] Basically, each protective operating portion has a preferential curvature or a greater curvature which may be obtained, as mentioned above, by varying the yielding capacity of opposite portions of the inflatable element. For example, this may be done by varying the relative yielding capacity of the mesh portions, or the walls, or both of them. The rows 24 of tie elements are arranged orthogonally with respect to said preferential curvature C or greater curvature so as to assist the preferential

curvature or greater curvature.

[0038] Even more particularly, In the shoulder zone, the rows 24 of tie elements are arranged in a direction substantially parallel to a sagittal axis or plane of the human body, transversely or orthogonally with respect to a coronal or frontal plane and to a transverse plane. The preferential curvature of the shoulders is indicated by C2 in Figure 3. Also in a chest zone, the rows of tie elements are arranged in a direction substantially parallel to a sagittal axis or plane of the human body, transversely or orthogonally with respect to a coronal or frontal plane. The preferential curvature of the shoulders is indicated by C3 in Figure 3.

[0039] In a zone of the nape, where the bag is curved from the nape towards the back, the rows of elements are arranged parallel to each other and orthogonal to the sagittal plane. The preferential curvature of the nape is indicated by C1 in Figure 4. According to a preferred aspect of the present disclosure, a row 24 of the first operating region 20 is oriented differently from a row 24 of the second protective operating region 21 and from a row 24 of the third operating region 22.

[0040] In Figure 1 the rows 24 of tie elements 5 are shown in schematic form as lines for the purposes of illustration of the invention. Each row 24 defines in fact a hinge line or axis of curvature. In this way, in the inflated condition, the inflatable element may be curved better around each hinge line and so as to follow in an improved manner the preferential curvature.

[0041] Preferably, for each protective operating region 20, 21, 22, the tie elements 5 are arranged between said mesh portion 18 and said second mesh portion 19 which are aligned in a plurality of rows 24 of tie elements 5. The plurality of rows 24 of each group of tie elements 5 are arranged parallel to each other and one row is arranged at a distance from the adjacent row 24. The arrangement in rows 24 allows the folding and curvature of the inflatable element to be better adjusted.

[0042] In order to control even better the curvature of the inflatable element, in the active condition, when the inflatable element 12 is in the inflated condition, the tie elements 5 are parallel to each other in the respective row 24 and substantially orthogonal to the direction of the row. The rows are preferably shorter in the edge zone, namely they gradually decrease in length towards the edge zone.

[0043] A first group of tie elements 5 is therefore obtained in the neck zone, a second group of tie elements 5 is obtained in the shoulder zone, and a third group of tie elements 5 is obtained in the chest zone.

[0044] With regard to the inflatable element 12 it may be made as in the aforementioned cited international patent applications. More particularly, the term "tie element 5" is understood as meaning an element or body having the function of keeping joined together or fastened or fixed, by means of its tensile stress, two or more parts of the inflatable element 12, at least when the latter is in the inflated condition.

[0045] In the example, the tie elements 5 have a thread-like form and are flexible and inextensible elements. Therefore, they are suitably designed in terms of dimensions such that, when the inflatable element 12 is in the rest condition, they are preferably not subject to tensioning and are collapsed inside the inner chamber 3, whereas when the inflatable element 12 is in the inflated condition they are tensioned.

[0046] The inflatable element comprises opposite walls 15, 16 which are perimetally joined together along the edges. More particularly, the inflatable element 12 comprises a textile structure comprising the aforementioned tie elements 5 and the two opposite mesh portions 18, 19, each of which lines internally, namely on the inner chamber 3 side, a respective wall 15, 16. Basically, a textile structure 40 formed by two meshes 18, 19 is arranged inside the zone between the two walls 15, 16 and each mesh is preferably fixed to the respective wall 15, 16.

[0047] Even more particularly, in order to provide the inflatable element with structural stability, each mesh 18, 19 is stably fixed to the surface of the respective wall 15, 16, preferably by means of a film of glue or layer of glue, as described hereinbelow. Considered from another point of view, the inflatable element 2 has a substantially double-shell structure, in which each shell corresponds to a wall 15, 16 and a respective mesh 18, 19. The first mesh 18 and the second mesh 19 have, in the inflated condition, a surface area which differs from each other, for example the second mesh 19 has a surface area or expansion capacity which is smaller than that of the first mesh 18. In order to obtain this different surface area the second mesh may be made of a material which is less elastic or less yielding (more resistant to tensile force) than the first mesh 18. Alternatively or in combination with this embodiment, the first wall 15 or the second wall 16 have, in the inflated condition, surface areas different from each other, for example the second wall 16 has a surface area which is smaller than that of the first wall 15 and is made of a material which is less elastic or less yielding. For example, the first mesh 18 and/or the first wall 15 may be made with a yarn different from that of the second mesh 19 and/or the second wall 16, respectively, for example a more elastic or yielding yarn. The different yarns are not shown in the drawings. Alternatively again, the second mesh 19 and/or the second wall 16 may be made using the same material, but with a denser weft than the first mesh 18 and/or the respective first wall 15 during knitting and therefore have a smaller extension capacity than the first mesh 18. The different mesh affects the different yielding capacity of the two parts.

[0048] The two meshes 18, 19 are joined together along the respective perimeter by means of stitching or by means of another connection system, as described in international patent application WO 2010-067288 A1.

[0049] As can be seen in the figures, the walls 15, 16 may be broader than the meshes 18, 19 and may be

further joined together along the perimeter.

[0050] Each of the two walls 15, 16 or sheets may be made of a laminate material, such as that described in WO 2010-067288 A1, or a thermoplastic polyurethane or TPU. For example, in the case of TPU, the walls 15, 16 are made of a TPU layer 15a (which, for example, represents between about 45% and 65% by weight, preferably between 48% and 55% by weight, and even more preferably about 50% by weight of the laminate) and a layer 15b with the function of a glue or adhesive (which represents approximately the remaining part by weight of the laminate), in the example a layer of polyurethane (not thermoplastic) glue distributed over the TPU layer 15a by means of roller spreading or similar distribution technology. In the example shown, it therefore consists of a sheet which, before fixing to the mesh 18, 19, is formed by TPU+PU and overall has a thickness, for example, of 200 microns.

[0051] As mentioned above, in the example, the tie elements 5 are flexible tie elements and have the form of threads and are made for example of polyester or polyamide, with a thickness of between about 500 and about 1000 decitex (units of length of a continuous thread or a yarn) and have ends 5a, 5b which are fixed to the respective wall portions 18, 19 which they connect. Even more particularly, each tie element or thread 5 includes a bundle of continuous untwisted fibres which emerge from a single point of a respective mesh 18, 19.

[0052] The tie elements 5 have opposite ends 5a, 5b which are stably fixed to the mesh 18, 19 of the respective wall 18, 19. Fixing at the opposite ends 5a, 5b of the tie elements 5 is, for example, performed by means of simple insertion of tie elements 5 between the wefts of the mesh 18, 19. Basically, in the example shown in the figures, the tie elements 5 are obtained by a given number of threads which are fixed alternately to one mesh 18 and consecutively to the other mesh 19. In other words, each thread 5 is inserted underneath a weft of the mesh 19 of the wall 16, is curved upwards and extends again towards the opposite wall 15, where it is connected in the same way to the mesh 18. Alternatively, the tie elements 5 are connected to the mesh 18, 19 by means of interweaving or by means of tying or similar fixing systems.

[0053] The set of two meshes 18 and 19 and the tie elements 5 forms a fabric of the so-called three-dimensional 3D or double needle-bed type.

[0054] The meshes 18 and 19 may also be made of polyester or polyamide.

[0055] The present disclosure also relates to a protective garment 30 comprising a protective device 10 as defined above. For example it consists of a skier's suit.

[0056] With regard to inflation, in order to perform inflation of the inflatable element 12, in the event of a sudden fall and/or sliding and/or an impact involving a user or a vehicle being ridden/driven, the protective device 10 is adapted to cooperate with special activation means (not shown) which are operationally connected for example to a cylinder 50 containing compressed cold gas, such

as helium. The cylinder may be provided with a respective shut-off valve (not shown).

[0057] Alternatively, the inflation fluid source may comprise gas generators preferably of the pyrotechnic or other hybrid type or other types known according to the state of the art.

[0058] Opening of the shut-off valve of each inflation cylinder is preferably controlled by a control unit depending on the detection of the state of the vehicle/rider system; for example said control unit may implement a system for predicting the fall which allows early identification of the fall event and a reliable prediction of this event by means of accelerometer sensors fixed to the skis or to the skier and a unit for processing the signals produced by the said sensors.

[0059] Alternatively, the device according to the present disclosure may also be applied using an activation cable connected to a vehicle ridden by a user, which cable activates inflation of the inflatable element following the movement of the user away from the vehicle, for example following a fall or a sudden impact. Use of a cable is employed in particular in the horse-riding sector.

[0060] In any case the aforementioned activation and inflation means may be incorporated in the protection device according to the present invention or located on the outside thereof.

[0061] It should also be noted that the activation modes, although being an aspect of particular importance for effective 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.

[0062] The subject-matter of the present disclosure has been described hitherto with reference to preferred embodiments thereof. 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 illustrated hereinbelow.

Claims

1. Protective device (10) for the protection of a user, said protective device (10) comprising an inflatable element (12) configured to assume at least an inflated active configuration and a deflated rest configuration, said inflatable element (12) comprising a first mesh portion (18) and a second mesh portion (19), wherein said first mesh portion (18) and said second mesh portion (19) are situated opposite each other and are connected to each other by a plurality of tie elements (5); wherein the tie elements are arranged or organized in a plurality of rows (24) and wherein the inflatable element has at least one preferential curvature, or greater curvature, and wherein

- the rows of tie elements are arranged parallel to each other and oriented transversely or or-

- thogonally with respect to the preferential curvature (C) or greater curvature and/or
 - the rows of tie elements are parallel to each other and a direction going from a row to a subsequent row is along said preferential curvature (C) or greater curvature. 5
2. Protective device according to claim 1, the inflatable element (12) comprises a first protective operating region (20) and a second protective operating region (21), wherein the first protective operating region (20) is different or separate from said second protective operating region (21), and wherein the first protective operating region includes a first group of tie elements (5) arranged in respective rows parallel to each other and the second operating region includes a second group of tie elements (5) arranged in respective parallel rows, wherein the rows of the first group of tie elements are oriented or arranged with a different orientation or in a different direction with respect to the rows of the second group of tie elements. 10
 3. Protective device according to any one of the preceding claims, wherein the tie elements belonging to the same row of tie elements are arranged substantially parallel to each other and wherein the tie elements, in a condition of at least partial tension, extend along a direction of development substantially perpendicular to the direction of extension of the rows of tie elements. 15
 4. Protective device according to any one of the preceding claims, wherein the device is an inflatable device, and wherein the inflatable element is arranged around the human body and said preferential curvature or greater curvature is a curvature around a user body preferably both around a sagittal axis and around a median axis and/or a transverse axis. 20
 5. Protective device according to claim 4, wherein the inflatable element, or a portion thereof, is preferably curved about hinge axes orthogonal to a sagittal plane and the rows of tie elements are oriented along an axis orthogonal to a sagittal plane, parallel to a coronal or frontal plane and to a transverse plane, for example in a nape area. 25
 6. Protective device according to claim 4 or 5, wherein the inflatable element or a portion thereof, is preferably curved about hinge axes parallel to a sagittal axis or plane of the human body, transversely or orthogonally with respect to a coronal or frontal plane and to a transverse plane, for example in a shoulder area. 30
 7. Protective device according to claim 4 or 5, wherein the inflatable element (12) or a portion thereof (20, 21, 22) is preferably curved about hinge axes parallel to a sagittal axis or plane of the human body, transversely or orthogonally with respect to a coronal or frontal plane, for example in an area of the chest. 35
 8. Protective device according to any one of the preceding claims, including an external protective covering comprising at least a first wall (15) and a second wall (16), wherein said first mesh portion (18) internally lines said first wall (15) and said second mesh portion (19) internally lines said second wall (16). 40
 9. Protective device according to claim 8, wherein, in order to obtain said preferential curvature, said first mesh portion (18) has a yielding capacity different from that of said second mesh portion (19). 45
 10. Protective device according to claims 8 or 9, for obtaining said preferential curvature, wherein said first wall (15) has a yielding capacity different from that of said second wall (16). 50
 11. Protective device (10) according to any one of the preceding claims, wherein the protective device (10) is a wearable device. 55
 12. Garment including a protective device (10) according to any one of the preceding claims.

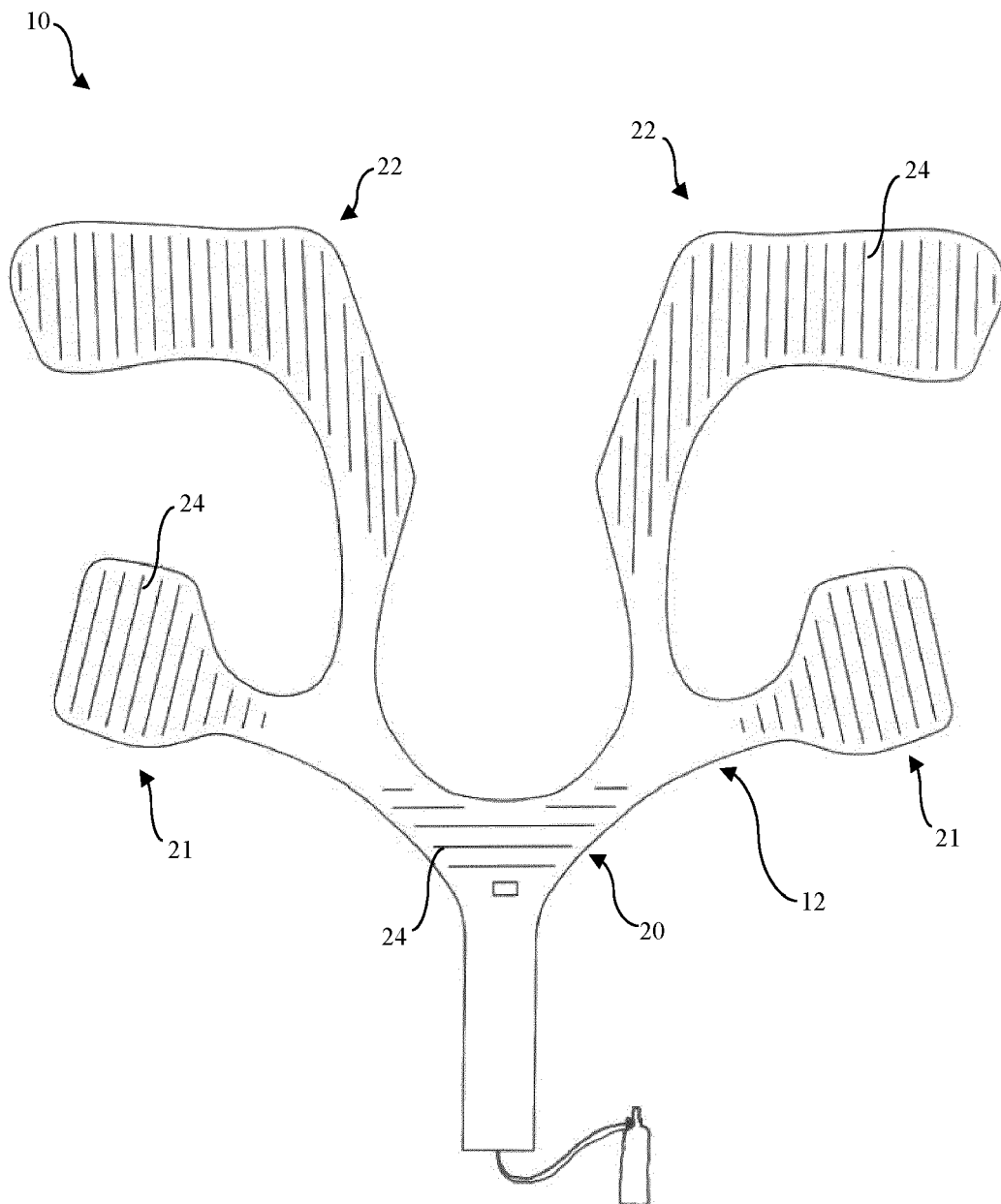


Fig. 1

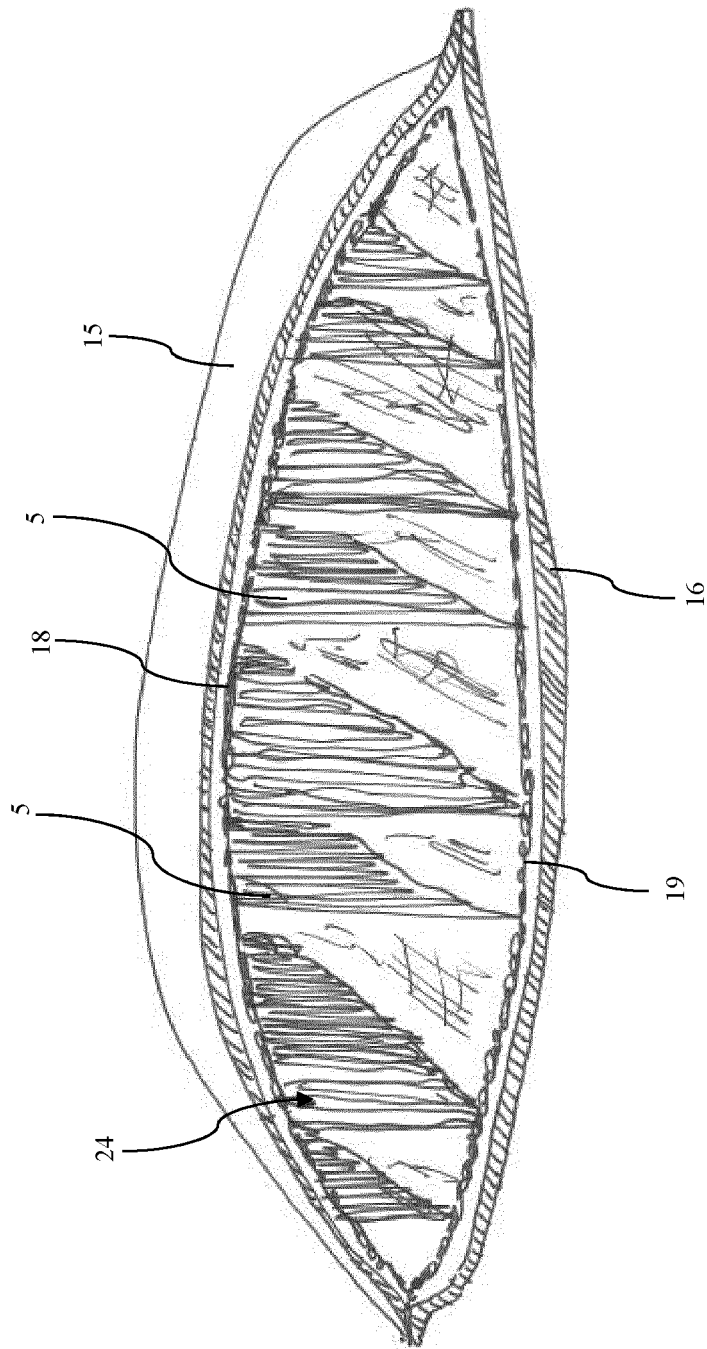


Fig. 2

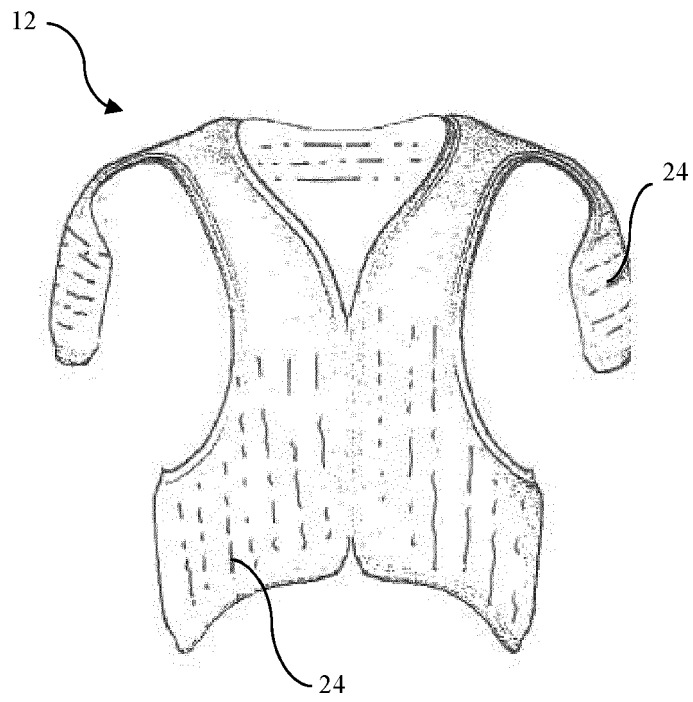


Fig. 3

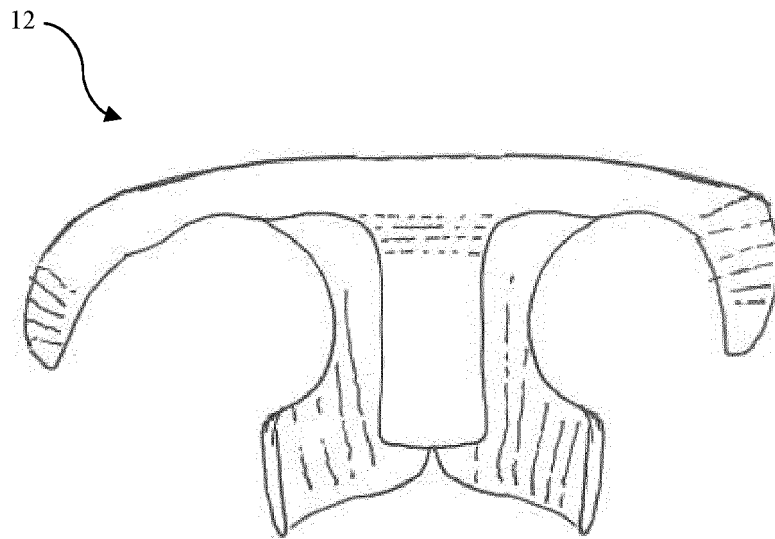


Fig. 4



Fig. 5



EUROPEAN SEARCH REPORT

Application Number
EP 20 21 6088

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X,D	WO 2017/163196 A1 (DAINESE SPA [IT]) 28 September 2017 (2017-09-28) * page 6, line 5 - page 8, line 16; figure 2 * * page 3, lines 2-20 *	1-12	INV. A41D13/018
A,D	WO 2010/067288 A1 (DAINESE SPA [IT]; DAINESE LINO [IT]; RONCO LUIGI [IT]) 17 June 2010 (2010-06-17) * claim 1; figure 8 *	1-12	
			TECHNICAL FIELDS SEARCHED (IPC)
			A41D
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 17 May 2021	Examiner D'Souza, Jennifer
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 20 21 6088

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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17-05-2021

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2017163196 A1	28-09-2017	EP 3432744 A1	30-01-2019
		WO 2017163196 A1	28-09-2017

WO 2010067288 A1	17-06-2010	EP 2373189 A1	12-10-2011
		EP 2373190 A1	12-10-2011
		EP 2373524 A1	12-10-2011
		ES 2388411 T3	15-10-2012
		ES 2390011 T3	05-11-2012
		ES 2390647 T3	15-11-2012
		JP 5486607 B2	07-05-2014
		JP 5671472 B2	18-02-2015
		JP 5841843 B2	13-01-2016
		JP 2012511457 A	24-05-2012
		JP 2012511458 A	24-05-2012
		JP 2012511637 A	24-05-2012
		US 2012007344 A1	12-01-2012
		US 2012011642 A1	19-01-2012
		US 2012032422 A1	09-02-2012
		WO 2010067285 A1	17-06-2010
		WO 2010067288 A1	17-06-2010
		WO 2010067393 A1	17-06-2010

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 3291697 B1 [0002]
- WO 2017163196 A1 [0024] [0034]
- WO 2009055512 W [0034]
- IT 2009000547 W [0034]
- WO 2016178143 A1 [0034]
- WO 2010067288 A1 [0048] [0050]