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(54) SHOULDER STRAP FOR SUPPORTING BACK LOADS, DEVICE FOR CARRYING BACK LOADS, AND IN PARTICULAR BUOYANCY COMPENSATOR OR THE LIKE

(57) The object of the invention is an improvement to the shoulder straps of devices for carrying loads, particularly on the back of a user, the shoulder straps having a side widening (118, 118') towards the sternal area of the user and an arched shape, the dimensions and shapes being made so that in worn condition the side widening is intended to rest on the thorax area below the cervicothoracic imaginary line and above the breast, while the section extending downward beyond said side widening overlaps the side area of the thorax, the breast being positioned in the area next to a concave side edge (119) that bypasses the breast itself.

In particular, the invention relates to a buoyancy compensator (100) for diving comprising equipped with said shoulder straps.

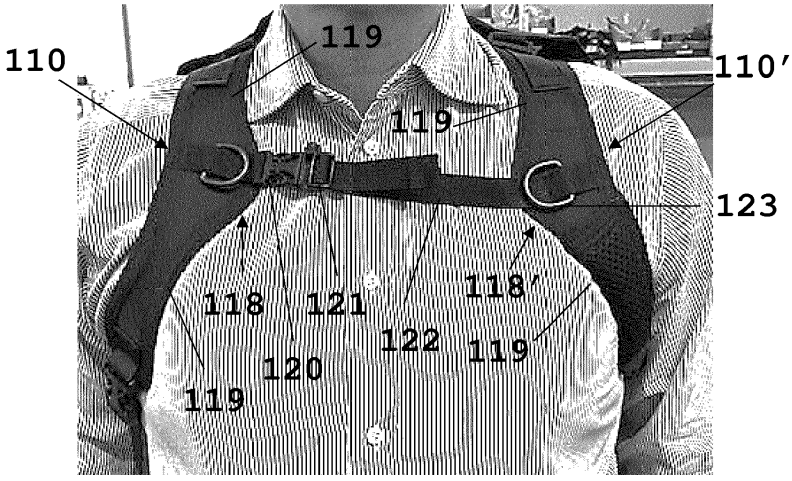

Fig. 2

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Description

TECHNICAL FIELD

[0001] The present invention refers to the field related to devices for carrying back loads, i.e. of the type provided with at least one tie element, so-called shoulder strap, intended to be hooked or to pass around a user's shoulder and thanks to which the weight of the load is distributed on at least one part of the torso and is held against the user's torso.

[0002] In particular the invention refers to carrying devices for sports activities, such as backpacks or the like and, after a further specialization in progress, for equipment for underwater use, such as in particular backpack supports of breathing gas cylinders.

[0003] The invention finds its preferred and advantageous application in the field of buoyancy compensator or stabilizers, commonly known also by the acronym G.A.V. or BCD (Buoyancy Control Device) or by the English term jacket.

STATE OF THE ART

[0004] In general, carrying devices of backpack type or the like are provided with one or two so-called shoulder straps consisting of strip-shaped or elongated elements, such as ties or the like, having two ends which are respectively connected to one of two different points of a load support and so as to pass over and around a corresponding user's shoulder.

[0005] In the shapes of the carrying devices of backpack type or the like, the two points of connection to the load support are provided vertically spaced from each other, referring to the upright position of the user wearing the device and, starting from the point of attachment to the load support provided in the upper position, they pass over the shoulder, on the front side of the torso and are connected by the other end to the point of attachment to the load support provided in the lower position, generally in a position at lower level with respect to the armpit and in the area of the hips or between the armpit and the hips.

[0006] These configurations are also known in diving applications such as in buoyancy compensators or stabilizers, also commonly known by the acronym G.A.V. or BCD (Buoyancy Control Device) or by the English term jacket.

[0007] In these jackets, the shoulder straps can also be integrated with a wearable garment similar to a "waistcoat", which is stuffed at least along part of its extension or carries one or more inflatable and deflatable bags. In this case, the shoulder straps extend from the back portion of the garment, being either integral pieces thereof or directly sewn thereto, continue over the shoulder and the chest portion and, by means of fittings for attaching removably and adjustably as regards the length of the shoulder straps, are connected to a ventral part of the garment or are directly connected, either as integral pieces or by sewing, to the corresponding ventral part of the garment. The load supporting and attaching members are often integrated or attached to the back portion of the garment itself.

[0008] Currently, the shoulder straps used in the above described applications are made straight or curved and are approximately sickle-shaped and, starting from the top end to the bottom end, have a curvature facing laterally outwards with respect to a mid-sagittal plane of the body of the user who wears the shoulder strap, i.e. the carrying device equipped with the latter. In the upper part, the shoulder strap adheres against the front side of the torso and to the supraclavicular and infraclavicular areas as well as to the pectoral area, thereby representing a disturbing element especially for female users as it offloads the weight supported by the device in the form of pressure against the user's chest. If there are careless configurations and heavy loads, this compression not only can be annoying, but it can also cause pain and also have harmful effects on the mammary organs.

[0009] The shoulder strap used in the buoyancy compensator described in US5607258 falls within the example of the state of the art mentioned above. In another scope, but with the same functional problems, there is the shoulder strap described in document US2003121942, wherein the adopted shape solves some problems of interaction with the anatomical parts of the user, but maintains a shape that can create discomfort to the infraclavicular and pectoral areas.

[0010] Therefore, according to a first aspect, the present invention provides a shoulder strap whose shape is improved in order to avoid unwelcome and/or harmful stresses on the user's body.

[0011] According to a further aspect, the present invention provides a carrying device comprising at least one, preferably a pair of shoulder straps configured so as to overcome the drawbacks provided in the current carrying devices, in particular for back loads.

[0012] Still according to an aspect, the present invention aims to a back carrying device for underwater equipment and in particular for one or more respirable-gas cylinder that provides greater comfort and reduces the physiologically potentially harmful stresses on the user's body.

[0013] A further aspect of the present invention provides a jacket of the buoyancy control type or stabilizer type, combined with a support for a back load consisting of at least one respirable-gas cylinder, the jacket improving the comfort and anatomical shape of the parts intended to offload the weight supported on the user's body, particularly of the shoulder straps.

[0014] Referring to a first aspect, object of the present invention is a shoulder strap consisting of a strip-shaped element, comprising a part intended to overlap at least one portion of the shoulder area and one portion of the front side of the torso, the element having an arched profile with a concave edge which is curved in a single direction of curvature and with at least one center and at

least one radius of curvature, and with an opposite convex side which has, in an intermediate area between two opposite ends of said element, a widening transverse with respect to the longitudinal extent of said element, the transverse widening being connected to each of the two ends of said element with a section of concave edge curved in a direction of curvature opposed to that of the concave side of the strip-shaped element, and the curved edge has at least one center of curvature and at least one radius of curvature.

[0015] According to a further characteristic, the intermediate side widening has a curved edge with a direction of curvature corresponding to the direction of curvature of the opposite concave side and with at least one radius of curvature or with more radii of curvature that are shorter than the radius or radii of curvature of said opposite concave edge.

[0016] According to a characteristic, the two opposite ends of the strip-shaped element are provided with removable-attachment extremities which are directly attached to said end and/or to strip-shaped extensions of said end.

[0017] Another characteristic provides that at least one removable-attachment element is also provided at the side widening and/or on said side widening, directly attached to said side widening and/or attached at the end of a strip-shaped extension.

[0018] An advantageous embodiment provides that the strip-shaped element is made in the form of a flat, stuffed pad.

[0019] Referring to an embodiment, both the dimensions of the side widening and the shape of the concave sections connecting the former to the ends of said strip-shaped element as well as the position of said side widening with reference to the ends of the strip-shaped element are all chosen so that the side widening is intended to rest on the thorax area below the cervicothoracic imaginary line and above the breast, while the section between said widening and one end overlaps both the part above the cervicothoracic imaginary line and at least part of the shoulder, and the other section of the strip-shaped element between the side widening and the opposite end thereof overlaps the side area of the thorax, the breast being positioned in the area next to the concave edge connecting said side widening to the corresponding end and said widening being provided at the element side facing the sternal area or the mid-sagittal plane of a user's body.

[0020] According to a further aspect, the present invention refers to a combination of at least one shoulder strap and one supporting structure to support at least one load, said combination constituting a carrying device, the ends of said strip-shaped element being attached at points distant from each other of said supporting structure.

[0021] According to a characteristic, the attachment of at least one end of said strip-shaped element is made in a removable manner.

[0022] According to a further characteristic, attaching means to attach the strip-shaped element can be provided and allow an adjustment of the distance of at least one of the ends of the strip-shaped element from the point of attachment to the load supporting structure.

[0023] Still according to an embodiment, the carrying device comprises a combination of a supporting structure with two shoulder straps, each consisting of a strip-shaped element and in which said strip-shaped elements are made according to one or more of the above-described characteristics which can be provided as an alternative to each other or in any combination with each other, said two strip-shaped elements being made symmetrically with respect to the mid-sagittal plane of the body of a user wearing said carrying device.

[0024] A variation of this carrying device provides an element of back support, i.e. intended to lean against the back of the user wearing said carrying device and to which the ends of the shoulder straps are connected, an upper end at an upper point of said supporting structure while the other lower end at a lower point of said supporting structure, respectively, preferably on the side of said support or of a centerline of said support having the shoulder strap combined therewith.

[0025] A first embodiment variation provides that the connection of each strip-shaped element is made either directly with the corresponding lower point of the load supporting structure or by means of an extension optionally of adjustable length.

[0026] A further variation provides that the lower ends of the two strip-shaped elements forming the two shoulder straps are each connected to a corresponding ventral section of an end of a ventral strap or belt provided on the corresponding side, the two ends of said ventral strap or belt being provided with attachment means removable and adjustable as regards to the length of the ventral strap or belt itself.

[0027] According to an embodiment, said ventral strap or belt is a continuous element that also extends along the entire extent of the load supporting structure.

[0028] On the other hand, an embodiment variation provides that the ventral strap or belt element consists of two segments respectively branching off sideways from a side edge of the load supporting structure.

[0029] Referring to an embodiment, the carrying device is intended to carry at least one respirable-gas cylinder, in particular for underwater activities, the load supporting structure being a backrest element comprising at least one fixing device to removably fix at least one respirable-gas cylinder to said backrest element.

[0030] A further embodiment provides a load supporting structure that in particular supports at least one respirable-gas cylinder in combination with a floating element that is secured to said structure and comprises, along at least part of its extent, one or more sealed chambers alternatively inflatable and deflatable and control means for controlling the inflation and deflation.

[0031] An embodiment provides that said flotation el-

ement consists of a jacket element made in the form of a bodice or waistcoat.

[0032] The jacket element is attached to the load supporting structure and/or the shoulder straps and/or the belt or ventral strap.

[0033] According to an embodiment, the attachment can be fixed.

[0034] According to an embodiment variation, the attachment can be removable, at least for some areas of said jacket element.

[0035] An embodiment provides a buoyancy compensator or stabilizer consisting of

- a watertight envelope or bag provided with a connecting system for the connection to the body;
- an inflating system to inflate the bag and that can be actuated by control and normally supplied by the compressed gas of a cylinder,
- a discharging system to discharge the bag-inflating gas, comprising in turn one or more control-operated outlet valves and optionally one or more automatic gas-release valves;
- a frame for securing one or more cylinders of air or other mixture of respirable gases.

[0036] Briefly, by adjusting the amount of gas contained in the bag, the diver's body can be positioned and stabilized in water at different depths; its operation and any accessories are, however, generally known to the field technician and therefore these aspects should not be extended any further.

[0037] The system for connecting the sealed bag to the diver's body usually comprises a backrest, generally rigid or semi-rigid and/or flexible, and a harness having in turn shoulder strap elements, a waist belt or ventral strap (or tightening strap) with removable fastening elements, such as buckles or the like, the shoulder strap elements being made according to one or more of the embodiments described above.

[0038] The cylinder is in turn connected to the backrest by one or more ties or the like.

[0039] According to another characteristic, a sternum strap removably connecting the shoulder straps to each other and preventing them from progressively spread out can be provided in the sternal area of the user, said sternum strap being equipped with attaching means to be attached to the side extensions of the two shoulder straps.

[0040] According to an embodiment, the sternum strap can be removably attached to the side extension of at least one shoulder strap, while it is permanently attached to the side extension of the other shoulder strap.

[0041] Depending on a possible additional characteristic, the sternum strap is provided with length adjusting members.

[0042] According to an embodiment variation, the same jacket element carries the load supporting structure which is either integrated in one piece to the back portion of said jacket element or attached to said back portion of said jacket element, whereas the shoulder straps consist of an extension integrated into said jacket element, since they consist of an extension of the upper end of the back portion of said jacket element which extends over the shoulder to overlap the pectoral front side of the torso and which are connected to the ventral area on the corresponding side of the said jacket element, at least the upper end of the shoulder straps being either connected to the back portion of the jacket element as integral piece thereof or permanently sewn thereto, and the ends on the ventral side being connected either directly as integral pieces or by sewing to the ventral part of the jacket element on the side corresponding to that of the associated shoulder strap, or said ends are connected at least by buckles adjusting the length of the shoulder straps and/or by removable-attachment fittings.

[0043] As will be evident also from the following description of some exemplary embodiments, the particular configuration of the shoulder straps and the use thereof in a carrying device and in particular in buoyancy compensator or stabilizer for underwater use, allows the pressure of the shoulder strap on the torso to be transferred to areas anatomically less sensitive and more resistant, effectively bypassing areas where there are soft tissues and/or glands and/or organs sensitive to touch or compression.

[0044] The described embodiments not only have the effect of transferring the pressure exerted by the shoulder straps on the body to areas provided with bone and/or muscle tissue more suitable to support the loads, but thanks to the side widenings they widen the contact surface and therefore with the same stress force, substantially caused by the weight of the load, the pressure per surface unit is reduced, i.e. the compression force is distributed over a larger surface of the body.

[0045] Thus, the shape of the side widening and the dimensions can also be defined analytically and/or by means of measurements in order to set the pressure exerted on the contact area of said widenings within preestablished values.

[0046] This operation can also be performed at theoretical mathematical level by using a static model of force transmission or alternatively it can be obtained by simple experimentation.

[0047] The two methods can also be combined by using the theoretical model to determine an order of magnitude of first approximation and by perfecting the setting by experimental empirical measurements.

[0048] Further improvements of the invention are object of the dependent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0049] The invention will be described below with reference to non-limiting examples, provided in the accompanying drawings for illustration purposes only and without limitation. These drawings depict different aspects

and embodiments of the invention and, where appropriate, reference numbers illustrating structures, components, materials and/or similar elements in different figures are denoted by similar reference numbers.

[0050] In the accompanying figures:

Figure 1 shows a schematic front view of a user wearing a back carrying device, of backpack or buoyancy compensator (G.A.V.) type wherein the left shoulder strap with reference to the viewer is of the type according to the known art, while the right shoulder strap is made according to an embodiment of the present invention.

Figure 2 shows a view similar to that of figure 1, wherein the carrying device comprises two shoulder straps according to an embodiment of the present invention.

Figure 3 shows a top plan view on a right shoulder strap made according to known art and on a right shoulder strap made according to an embodiment of the present invention, respectively, the latter being shown on the right of the one made according to known art, with reference to the viewer.

Figure 4 shows a plan view on the inner side of an embodiment of a buoyancy compensator (G.A.V.) made according to an embodiment of the present invention and comprising a supporting structure to support at least one respirable-gas cylinder on the user's back.

Figure 5 shows a detail pertaining to the area where the upper end of a shoulder strap is attached to the backrest of the jacket according to figure 4.

Figure 6 shows a detail pertaining to the attachment of the lower end of a shoulder strap to a flap of the belt element connected to the lower end of the backrest according to the embodiment shown in figure 4.

Figure 7 shows a detail of the removable-attachment means to attach the inflatable bodice-shaped bag to the upper attachment means to attach the shoulder strap to the backrest, in the embodiment of figure 4.

Figure 8 shows the upper end of a shoulder strap, the connecting members to connect the latter to the corresponding upper end of the backrest and the removable hooking means to hook the inflatable bag according to the embodiment shown in figure 4.

Figure 9 shows a side view of an embodiment variation of the buoyancy compensator in which the lower ends of the shoulder straps are directly connected by extensions to a point in the lower area of the backrest, on the corresponding side thereof.

Figure 10 shows a view of the attachment of the upper end of a shoulder strap to the backrest in the embodiment variation according to figure 9.

Figure 11 shows an enlarged view of the detail of the removable-attachment means to attach the inflatable bag to the attachment means to attach the top end of the shoulder strap to the backrest.

Figure 12 schematically shows the definitions of the sectional planes of the human body and the regions of the thoracic segment of torso.

DETAILED DESCRIPTION OF THE INVENTION

[0051] Although the invention is susceptible to various modifications and alternative constructions, two exemplary embodiments are shown in the drawings and described in detail below.

[0052] It must be understood, however, that there is no intention of limiting the invention to the illustrated specific embodiments, but, conversely, the invention intends to cover all modifications, alternative and equivalent constructions that fall within the scope of the invention as defined in the claims.

[0053] The use of "for example", "etc." "or" denotes non-limiting and not-exclusive alternatives, unless differently specified.

[0054] The use of "include" means "include, but not limited to", unless differently specified.

[0055] Indications such as "vertical" and "horizontal", "upper" and "lower", "above" and "below", "right" and "left" -in the absence of different indications-should be read with reference to the operating conditions and referring to the normal terminology used in everyday language, where "vertical" means a direction substantially parallel to that of the gravitational force vector "g" and horizontal a direction perpendicular thereto.

[0056] Although the exemplary embodiments refer to a buoyancy compensator or stabilizer for underwater use, the invention should not be considered limited to this application, but extended to other types of load transport, such as backpacks, or the like.

[0057] In addition, referring to the application specifically illustrated, embodiment variations are possible which provide combinations of the shoulder straps with any of the existing and various forms of construction of these jackets, in which there are different solutions as regards the construction of the supporting frames of the cylinder(s), the attachment of the latter to a wearable element to which at least inflatable and deflatable watertight bags are coupled, possibly with other elements having the function of housing, holding or attaching various kinds of tools.

[0058] The invention is described with reference to a specific and widespread type of construction of the jacket, but it must be understood as extended, with the proper obvious variations, to all the different forms of construction of jackets to which it is applicable.

[0059] The term jacket is to be considered equivalent to the term waistcoat, unless otherwise specified or if it is not different from the context in which the term is used.

[0060] Referring to figures 1 to 3, the difference between a shoulder strap according to the state of the art and a shoulder strap according to the present invention is shown.

[0061] The numeral 100 denotes a shoulder strap according to the state of the art (shown on the left in figure

3 and figure 1, with reference to the figure viewer, but on the other hand provided on the right shoulder with reference to the one who wears the shoulder strap).

[0062] The shoulder strap 100 according to the known art has a stuffed arched area having the form of a strip-shaped element or elongated pad and being made with the two longitudinal side edges 101 on the concave side and on the convex side 102, which have a substantially identical profile and are essentially parallel to each other. The curvature is towards the right side of the user wearing the shoulder strap in order to turn under the armpit.

[0063] A female connector 104 for a corresponding male connector of the type hooking by snap fit is provided at the lower end 103. The male element is not illustrated as it is a known element and is usually used in the field and in any case comprises two fork-like extensions provided with outer side teeth which, once inserted in the female element, engage, from behind, with reference to the direction of removal, two lateral ribs. The fork-like element is inserted by compressing one against the other the two axial appendages forming the fork, while the engagement with the corresponding rib occurs thanks to the fork that elastically spread out once the teeth on the appendages have reached a corresponding side engagement window.

[0064] The opposite end 105 of the shoulder strap 100 also has removable-attachment members to attach to a load supporting structure (not illustrated in the figures), the members being provided at the end (not visible) of a strip-shaped extension 106 which is attached to said end 105.

[0065] The attachment member can be of removable type, female or male, and when it is provided to be removable it may be of the same type as the female part 104 or the corresponding male part of the connector provided on the end 103 of the shoulder strap.

[0066] According to a further characteristic, the strip-shaped extension 106 can be provided with length-adjustment means to adjust the total length of the shoulder strap fitted to a load supporting structure under operating conditions.

[0067] An embodiment variation may provide, alternatively or in combination, length-adjustment means to adjust the length, i.e. the distance of the end of the shoulder strap 100 from the point of attachment not only for the upper end 105 but also for the lower end 104.

[0068] A shoulder strap 110 according to an embodiment of the present invention is shown to the right of the shoulder strap 100 according to the known art.

[0069] The upper end 115 and the lower end 113 have essentially the same attachment members as the shoulder strap 100 according to the known art and are denoted by the numerals 114 and 116, respectively.

[0070] Adjusting means to adjust the distance of the ends 115 and/or 113 from the corresponding point of attachment to a load supporting structure may be provided also in this case.

[0071] In an intermediate position between said two upper and lower ends 115, 113 of the shoulder strap 110, on the side corresponding to the convex side of the shoulder strap according to the known art, the shoulder strap 110 according to the present invention has a side widening 118 that is connected to the ends 113 and 115 with two concave-shaped edges 119 having a direction of curvature opposed to that of the concave side 111.

[0072] As evident, the curvature of the concave side 11 has at least one center of curvature and at least one radius of curvature and the same applies to the curvature of the edge of the side widening 118 which has at least one center of curvature and at least one radius of curvature, the radius(es) of curvature of the side widening 118 being smaller than the radius (es) of curvature of the concave edge 111, while this edge and the edge of the side widening 118 have concurrent direction of curvature.

[0073] The concave edge sections 119 having the side widening 118 connected thereto at the ends 113 and 115 can also have at least one center of curvature and at least one radius of curvature.

[0074] According to a further characteristic of the embodiment illustrated, the side widening 118 carries a female connector of type removably snap-fit hooking and denoted by the numeral 120, in which the corresponding male connector 121 of a sternum strap 122 connecting two shoulder straps 110, 110' of a back carrying device as shown in figure 2 can be engaged by interlocking.

[0075] Also the sternum strap 122 can have length adjusting means to adjust its own length, thus adjusting the distance of the male connector 121 from the area where said sternum strap 122 is attached to the side widening 118' of the corresponding shoulder strap 110'.

[0076] According to a further possible characteristic, on the side widening 118 of one or both shoulder straps 110, 110' at least one ring, for example of the D type or another type, denoted by the numeral 123, can be attached.

[0077] A further possible characteristic provides that the side widening 118 is provided substantially in the area corresponding to the maximum indentation of the concave edge 111. As shown in figures 1 and 2, this way, not only the side widening 118 of the shoulder straps can be positioned at a precise point of the thorax but also the sections of the shoulder straps themselves that extend from the side widening 118 to the lower end can turn around the thorax area having the corresponding breast.

[0078] This condition is evident from figures 1 and 2.

[0079] In particular, figure 1 shows that the shoulder strap 100 according to the known art is positioned above the area of the breast and also the nipple, so that the force generated by the mass of the load, for example a respirable-gas cylinder, is offloaded in the form of compression of the shoulder strap against the breast and the nipple and thus against soft tissues comprising glands and extremely sensitive tactile organs. In the long term, this can cause not only discomfort, but also pain and can also involve a danger of physiological damage.

[0080] On the other hand, the shoulder strap 110' in

figure 1 and both the shoulder straps 110 and 110' in figure 2, which are made according to the embodiment described above and illustrated in greater detail in figure 3, have an offloading zone to offload the force acting on the shoulder and on the part where the pectoral muscles are provided, i.e. in the area below the cervicothoracic imaginary line and above the breast.

[0081] As will be clearer from the description of the following exemplary embodiments, the lower extension section of the two shoulder straps leading from the side widening 118 to the lower end 113, bypasses the area of the corresponding breast and then connects to the structure in different ways and with different patterns.

[0082] As even more evident, in the embodiment of the shoulder straps according to the present invention, thanks to the side widening 118, the surface contacting the thorax and thus the distribution surface of the force generated by the load is greater than that of the shoulder straps according to the state of the art (see figure 1). As a result, the pressure exerted per unit area is lower and therefore not only these pressures are offloaded onto areas anatomically more suitable to bear the stress, but also the intensity thereof is further reduced.

[0083] Figure 4 shows a preferred application of the shoulder straps according to the present invention, according to which they are provided in a buoyancy **compensator 400, so-called G.A.V, which has a bag 401, alternatively inflatable** and **deflatable by control, and additionally has a supporting structure for at least one respirable-gas cylinder (not shown in figure).**

[0084] **Figure 4 shows the view on the inner side of a** fully open and outspread jacket 400.

[0085] In this embodiment, the shoulder straps 110, 110' thanks to extensions 116 are attached, with their upper end 115, to a corresponding upper side point of a backrest 402. The latter can be made either rigid or of semi-rigid or relatively flexible material such as plastic or the like and can be provided with a filling denoted by the numeral 403 on the side contacting the user's back.

[0086] The illustrated backrest 402 has a special shape that is widened sideways in the lower part, that is intended to adhere against the kidney area of the back.

[0087] On the other hand, the lower end 113 of the shoulder straps 110, 110' is attached, so as to be able to adjust their distance, to a corresponding end section 405, 405' of a ventral strap or belt element.

[0088] In the embodiment shown, the attachment of the ends 113 of the shoulder straps 110, 110' is provided at an intermediate point between the free end of the corresponding belt section 405, 405' and the edge of the backrest from which this section extends.

[0089] Preferably, said point of attachment is provided adjacent to or near the side edge of the backrest 402 so as to be positioned in the flank area or in the back area immediately adjacent to the flank area.

[0090] The two end sections 405, 405' are equipped with means for the removable and mutual attachment, i.e. one to the other, which are made like a buckle and which also allow the distance between the two ends to be adjusted in order to adjust the tightening condition of the belt.

[0091] Several embodiments of the extremities 405, 405' and of the belt or central strap can be provided.

[0092] An embodiment provides a continuous belt that extends also behind the backrest, without interruptions.

[0093] Alternatively, the two sections 405 and 405' may be separated from each other and each attached to a side end of the backrest 402, which is the structural continuity element connecting the ventral strap or belt.

[0094] The bag part contains the floating chambers, and to the former the members that allow the latter to be inflated and deflated at user's request are connected, the former being denoted by the numeral 401 and having the form of a bodice or waistcoat.

[0095] In the embodiment illustrated, said part 401 is preferably removably attached to the load supporting structure comprising the backrest 402, the shoulder straps 110, 110' and the belt or the ventral strap with the two end sections 405, 405'. Advantageously, this part 401 can be replaced in the event of damage or loss of tightness of the chambers.

[0096] Figure 5 shows a detail of an embodiment of the attachment of the upper extension 116 of the shoulder strap 110 to the corresponding upper side point of the backrest 402 and the adjusting means to adjust the length of the extension 116, i.e. the distance of the upper end 115 of the shoulder strap 110 from the point of attachment to the back strap 402. In figure a tightening strap 407 to tighten a cylinder on the rear side of the jacket 400 is also depicted.

[0097] Figure 6 shows a detail of an embodiment of a jacket similar to the one according to figure 4, the detail pertaining to one of the end sections 405 of the ventral strap or belt and with a view on the front side of the jacket.

[0098] The lower end 113 of the shoulder strap 110 connects by the female connector 114 to a male connector 409 which is attached to the end of a strip-shaped extension 410 connected to the belt section 405. The male connector 409 is attached to the band 410 so that its position along the band can be changed, thanks to a buckle of known type and widely used, for example in backpacks or the like and which allows the end coupling said connector 409 to the band to be slid along the band and to be fixed in the desired position while allowing the tensioning of the band by exerting a tensile force on the free end of the band itself. The band is fixedly connected to the end section of the belt 405.

[0099] The example shows the embodiment in which the two end sections 405, 405' of belt not only are connected to each other by a length-adjustable band denoted by the numeral 411, but are also removably attached to the rear face of the backrest 402 thanks to the use of attaching means of the loop/hook type, such as velcro or the like.

[0100] Figure 7 shows an openable hooking loop 412 which is provided at the upper end of the inflatable and

deflatable bodice-like part 401 at each area where the band that attaches the upper end 115 of the shoulder straps passes, the hooking loop being intended to be hooked to said band section 116 so as to also attach the upper part of said bag 401 to the backrest, as shown in figure 8.

[0101] The hook 412 delimits a loop for the engagement of said strip-shaped extension 116 for attaching the upper end of the corresponding shoulder strap 110 and has a closing branch which delimits outward said loop and which can be locked and unlocked by means of an elastic snap-fit hooking at one end with a transverse rib of the two ribs which delimit said loop sideways.

[0102] Figure 9 shows a side view of a buoyancy compensator, according to a further embodiment variation of the present invention.

[0103] In this embodiment as shown in the figure, the lower end 113 of the shoulder straps is not connected to the corresponding end section 405, 405' of belt, as shown in the example of the preceding figures. Unlike these embodiments, the band 410 attaching the lower end 113 of each shoulder strap 110 extends from a point 500 of the corresponding lower side area of the backrest 401. In particular, in the illustrated figure, this point is provided at a certain distance from the side end of the lower side extension of the backrest to which the end section 405 of the ventral strap or belt is connected. Also in this case, on the band 410 there is the male connector 409 that in the figure is engaged in the female connector 114 attached in turn to the lower end 113 of the corresponding shoulder strap 110 and also in this example the position of the male connector 409 along the band 410 is adjustable, in order to correctly tighten the shoulder strap to the body and therefore the load supporting structure to the body itself.

[0104] Figures 10 and 11 show, as figures 7 and 8, the upper point where a strip-shaped extension 116 of the upper end 115 of a shoulder strap 110 is attached to the backrest 402.

[0105] In the example shown, this is achieved by passing the free end of the strip-shaped extension 116 through a loop in a tightening buckle 501 which is attached to the backrest 402 and by locking the free end of the strip-shaped extension 116 into said tightening buckle. This is made in a manner known in the state of the art and to the field technician so as to allow an adjustment of the position on the strip-shaped extension and therefore an adjustment of the distance of the upper end 115 of the shoulder strap 110 with respect to said buckle, i.e. with respect to the upper point of attachment to the backrest 402.

[0106] This configuration is similarly provided also in the embodiment of figure 8 referred to the embodiment of figure 4.

[0107] In both embodiments, the ends of the shoulder straps can also be attached in another way by using state-of-the-art solutions which are within the scope of the options the person skilled in the art can choose from.

[0108] Figure 11 shows, as figures 7 and 8, the openable anchoring hook to anchor an upper end on one of the two sides of the inflatable bag 401 to the upper extension 116 of the upper end of a shoulder strap 110.

[0109] According to an embodiment variation of the embodiments related to figures 4 to 11, the shoulder straps according to the present invention can be combined and integrated in a buoyancy compensator or stabilizer, commonly known also by the acronym G.A.V. or BCD (Buoyancy Control Device) or by the English term jacket, wherein a garment element made in a "waistcoat"-like shape is the part to which it is attached, or which is shaped so as to generate the load supporting structure that supports the load, in this case at least one respirable-gas cylinder. In this example, therefore, the flotation element shaped as a wearable element or waistcoat is not hooked to this load supporting structure but it is the float element itself that takes the function of both float elements and harness that couples the load supporting structure to the user's body.

[0110] In contrast to the previous embodiments, the waistcoat-shaped wearable element comprises one or more inflatable and deflatable floating bags spread over at least one or more areas and, in the back area, it is shaped so as to generate a load supporting structure or else a load supporting structure is attached to said back part of the waistcoat-shaped garment.

[0111] In this variation, the shoulder straps are extensions of the back part of the waistcoat-shaped garment that extend towards the front or pectoral part of the torso and pass over the shoulder on the corresponding side of the back part of the waistcoat-shaped wearable element.

[0112] The shoulder straps can be integral extensions of said back dorsal part of the garment or can be permanently sewn to said back part or else can be removably attached thereto.

[0113] Similarly, the end of each shoulder strap on the front side of the torso may be either connected, as an integral piece, to a ventral part of the waistcoat-shaped garment provided on the same side as the associated shoulder strap, or it may be permanently or removably connected by sewing or the like.

[0114] In all cases, each shoulder strap may comprise a maximum length and a system of adjustable buckles for managing the abundance of the length and that allow the adjustment of the shoulder straps themselves.

[0115] As regards the shape of the shoulder straps as well as other additional characteristics described with reference to the previous examples shown in the figures, even in this embodiment all or part of these characteristics can be provided in any combination or sub-combination, obviously when they can be applied.

Claims

1. Shoulder strap consisting of a strip-shaped element, comprising a part intended to overlap at least one

portion of the shoulder area and one portion of the front side of the torso,
characterized by having an arched profile with a concave edge (111) which is curved in a single direction of curvature and with at least one center and at least one radius of curvature, and with an opposite convex side which has, in an intermediate area between two opposite ends of said element, a side widening (118, 118') transverse with respect to the longitudinal extent of said element, the transverse widening being connected to each of the two ends (113, 115) of said element with a section of concave edge (119) curved in a direction of curvature opposite to that of the concave side of the strip-shaped element, and the curved edge has at least one center of curvature and at least one radius of curvature, and **characterized in that** both the dimensions of the side widening (118, 118'), the shape of the concave sections (119) connecting the former to the ends (113, 115) of said strip-shaped element as well as the position of said side widening (118, 118') with reference to the ends (113, 115) of the strip-shaped element are all chosen so that the side widening (118, 118') is intended to rest on the thorax area below the cervicothoracic imaginary line and above the breast, while the section between said widening and one end (115) overlaps both the part above the cervicothoracic imaginary line and at least part of the shoulder, and the other section of the strip-shaped element between the side widening (118, 118') and the opposite end (113) thereof overlaps the side area of the thorax, the breast being positioned in the area next to the concave edge (119) connecting said side widening (118, 118') to the corresponding end and said widening being provided at the element side facing the sternal area or the mid-sagittal plane of a user's body.

2. Shoulder strap according to claim 1, **characterized in that** the side widening (118, 118') has a curved edge with a direction of curvature corresponding to the direction of curvature of the opposite concave side and with at least one radius of curvature or with more radii of curvature that are shorter than the radius or radii of curvature of said opposite concave edge.

3. Shoulder strap according to claim 1 or 2, **characterized in that** at least one of the two opposite ends (113, 115) of the strip-shaped element (110) is provided with removable-attachment extremities (114) which are directly attached to said end and/or to strip-shaped extensions (116) of said end.

4. Shoulder strap according to one or more of the preceding claims, **characterized in that** at least one removable-attachment element (120, 122) also provided at the side widening and/or on said side widening, directly attached to said side widening (118, 118') and/or attached at the end of a strip-shaped extension (121).

5. Carrying device comprising a combination of at least one shoulder strap, one supporting structure and at least one load, **characterized in that** said at least one shoulder strap is made according to one or more of claims 1 to 4, the ends of said strip-shaped element being attached at points distant from each other of said supporting structure.

6. Device according to claim 5, wherein the attachment of at least one end of said strip-shaped element is made in a removable or fixed manner.

7. Device according to claims 5 or 6, wherein attaching means to attach the strip-shaped element (110) are provided and allow an adjustment of the distance of at least one of the ends (113, 115) of the strip-shaped element (110) from the point of attachment to the load supporting structure.

8. Device according to one or more of claims 5 to 8, **characterized by** comprising a combination of a supporting structure with two shoulder straps (110), each consisting of a strip-shaped element and in which said strip-shaped elements are made symmetrically with respect to the mid-sagittal plane of the body of a user wearing said carrying device.

9. Device according to claim 8, **characterized in that** said supporting structure comprises a back support element (402), i.e. intended to lean against the back of the user wearing said carrying device and to which the ends of the shoulder straps (110, 110') are connected, an upper end (116) at an upper point of said supporting structure (402) and the other lower end (113) at a lower point of said supporting structure, respectively, preferably on the side of said support or of a centerline of said support having the shoulder strap combined therewith.

10. Device according to claim 9, wherein the connection of each strip-shaped element (110) is made either directly with the corresponding lower point of the load supporting structure (402) or by means of an extension (410) optionally of adjustable length.

11. Device according to claim 9, wherein the lower ends (113) of the two strip-shaped elements (110) forming the two shoulder straps are connected to a ventral section (405, 405') of an end of a ventral strap or belt provided on the corresponding side, the two ends of said sections (405, 405') of said ventral strap or belt are provided with attachment means removable and adjustable as regards to the length of the ventral strap or belt itself.

12. Device according to claim 11, wherein said ventral strap or belt is either a continuous element extending also over the whole extent of the load supporting structure, or said ventral strap or belt consists of two segments (405, 405') respectively branching off sideways from a side edge of the load supporting structure (402).

13. Device according to one or more of preceding claims 5 to 12, **characterized in that** said load comprises at least one respirable-gas cylinder, in particular for underwater activities, the load supporting structure being a backrest element (402) comprising at least one fixing device to removably fix at least one respirable-gas cylinder to said backrest element.

14. Device according to claim 13, wherein a flotation element (401) is provided in combination and is attached to said load supporting structure (402) and comprises, along at least part of its extent, one or more sealed chambers alternatively inflatable and deflatable and control means for controlling the inflation and deflation.

15. Device according to claim 14, wherein said flotation element (401) consists of a jacket element made in the form of a bodice or waistcoat.

16. Device according to claim 14 or 15, wherein the jacket element is attached to the load supporting structure and/or the shoulder straps and/or the belt or ventral strap, in a stable or removable manner.

17. Device according to any one of preceding claims 14 to 16, wherein the flotation element consists of a waistcoat-shaped garment and at the same time constitutes the wearable harness to whose back portion the load supporting structure is attached, whereas each of the two shoulder straps is made either as an integral extension or as an extension permanently attached to it, at least to the upper side of the back portion of said garment.

18. Device according to claim 17, wherein the end of each shoulder strap on the front or pectoral side of the torso is made in one piece with a corresponding ventral part of said waistcoat-shaped garment or is permanently attached to said ventral part or is removable therefrom, adjusting members to adjust the length of said shoulder straps being optionally provided.

19. Buoyancy compensator or stabilizer constituted by

- a watertight envelope or bag provided with a connecting system for the connection to the body;
- an inflating system to inflate the bag and that can be actuated by control and normally supplied by the compressed gas of a cylinder,
- a discharging system to discharge the bag-inflating gas, comprising in turn one or more control-operated outlet valves and optionally one or more automatic gas-release valves;
- a frame for securing one or more cylinders of air or other mixture of respirable gases,

characterized by comprising a device according to one or more of claims 5 to 18.

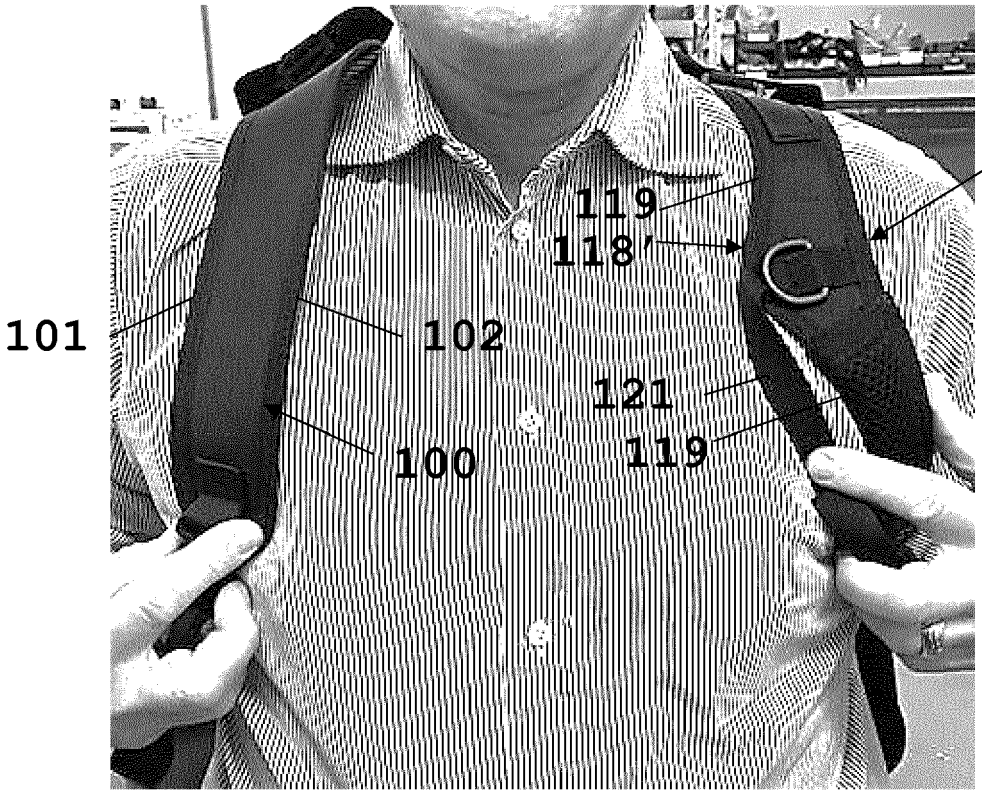
110'
119
118'
101
102
121
100
119

Fig. 1

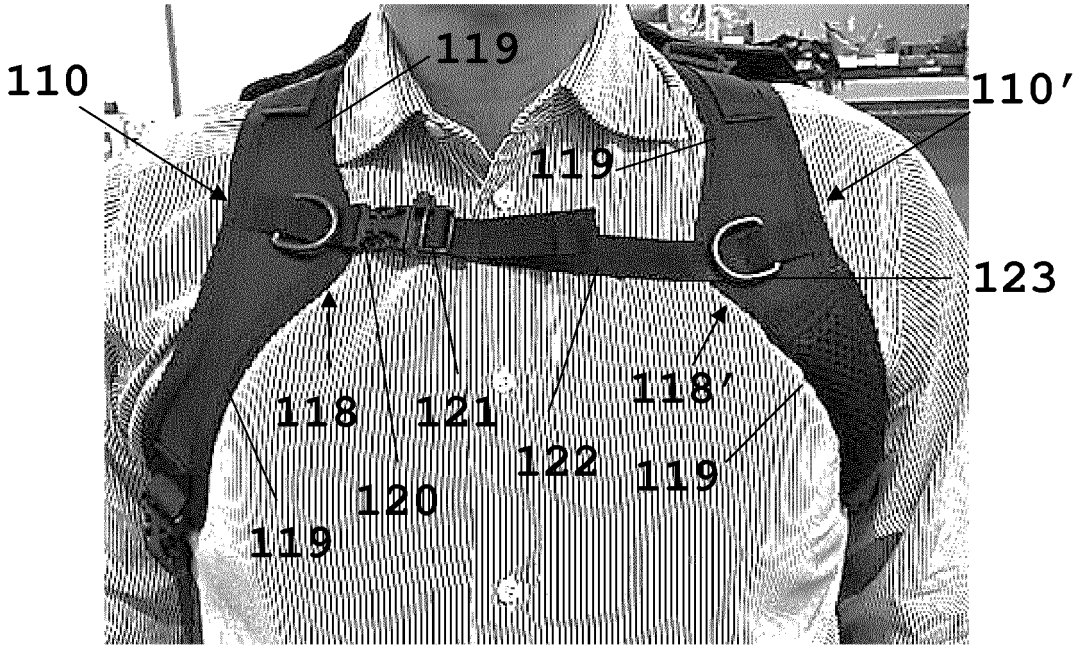
119
110
110'
119
123
118'
118
121
122
119
120
119

Fig. 2

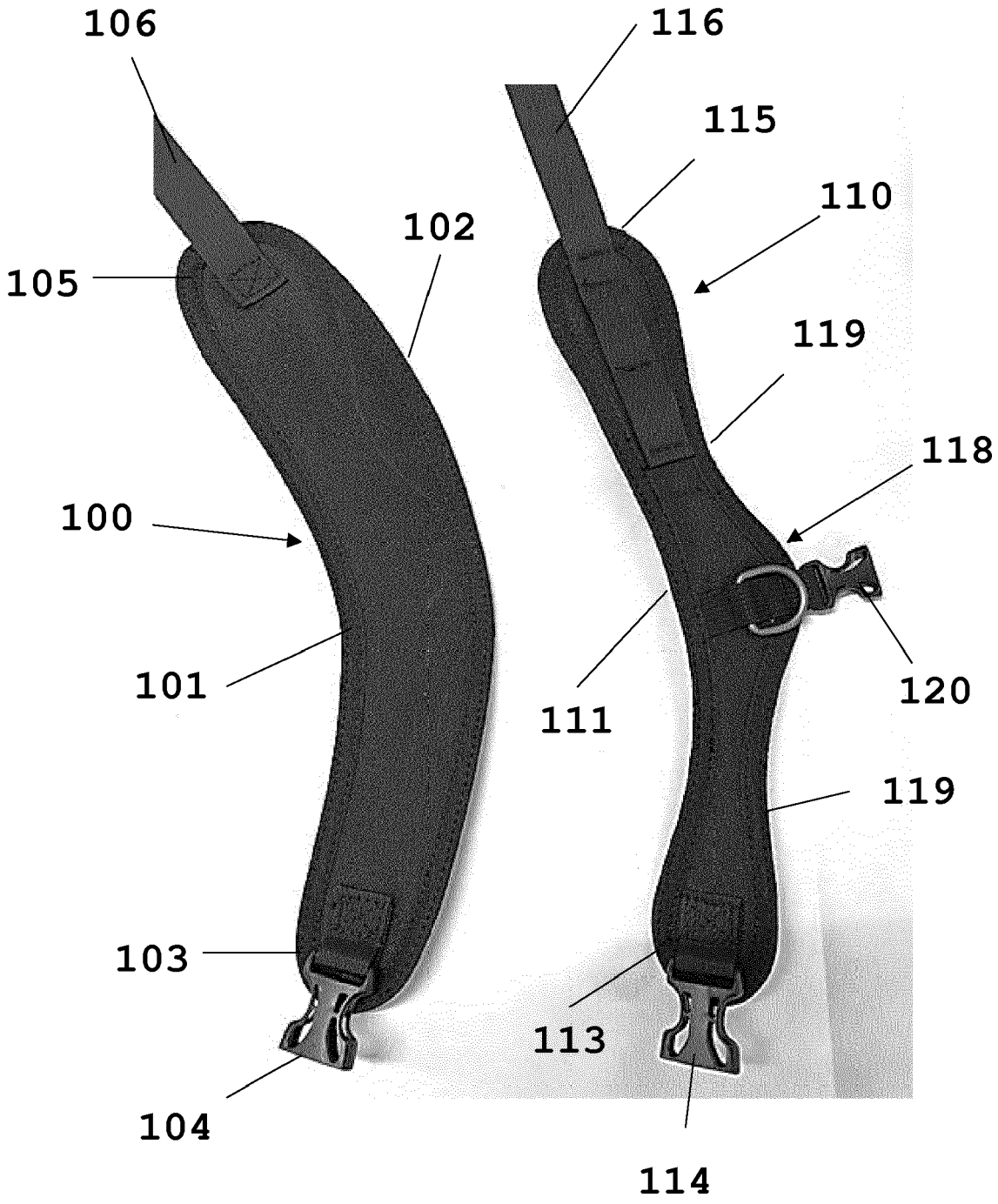
106
116
115
110
102
105
119
118
100
101
111
120
119
103
113
104
114

Fig. 3

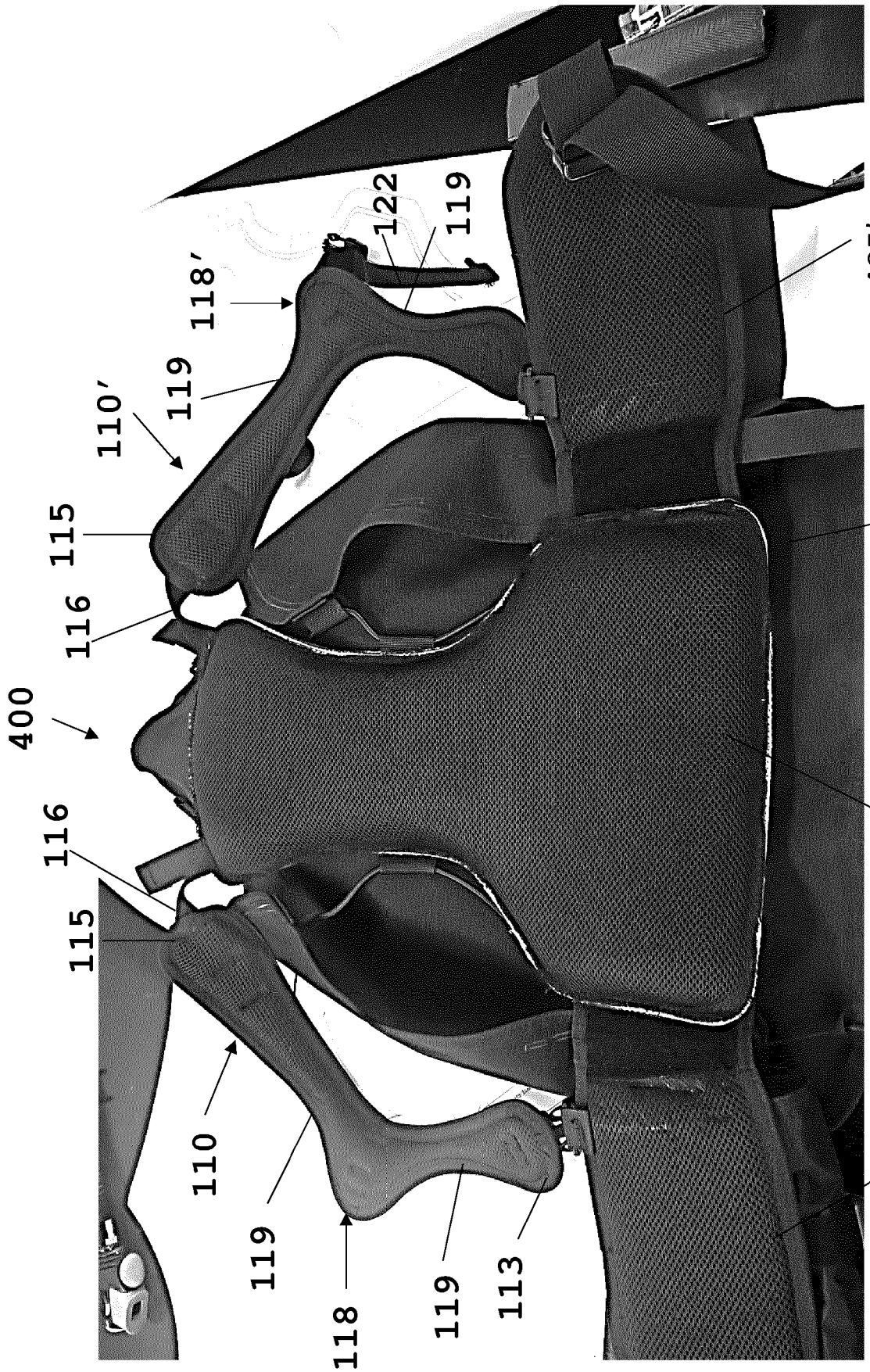
122
119
118'
119
110'
115
116
400
116
115
110
119
118
119
113
405'
401
402
405

Fig. 4

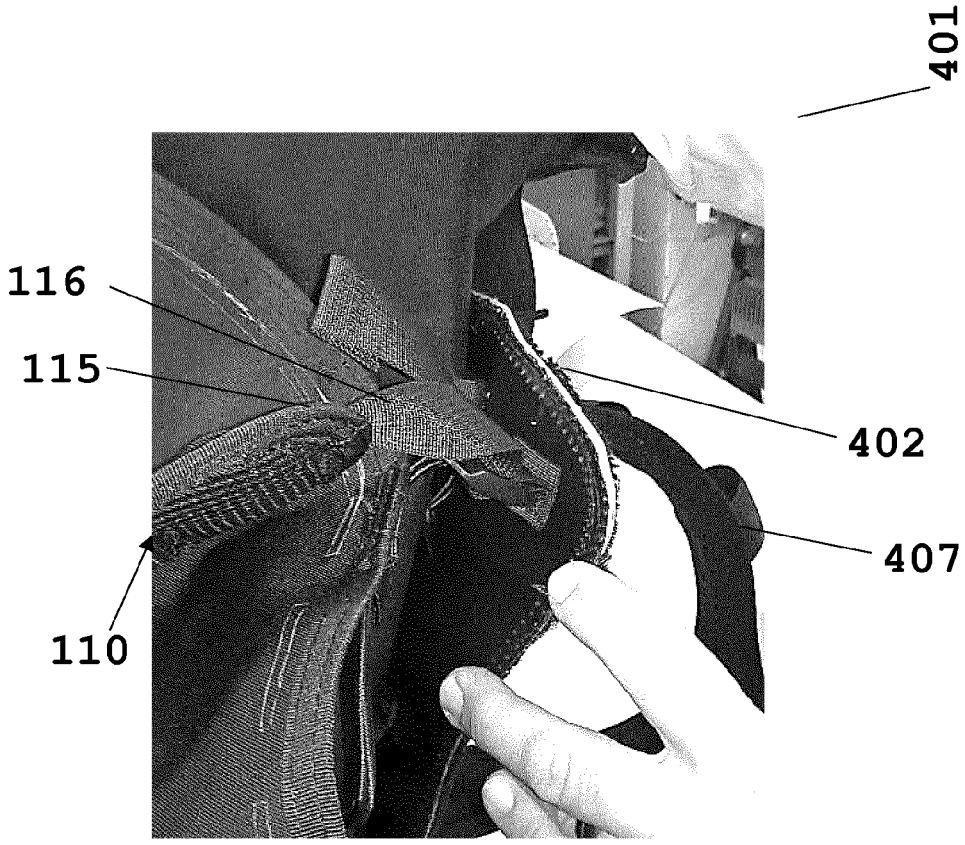
401
116
115
402
407
110

Fig. 5

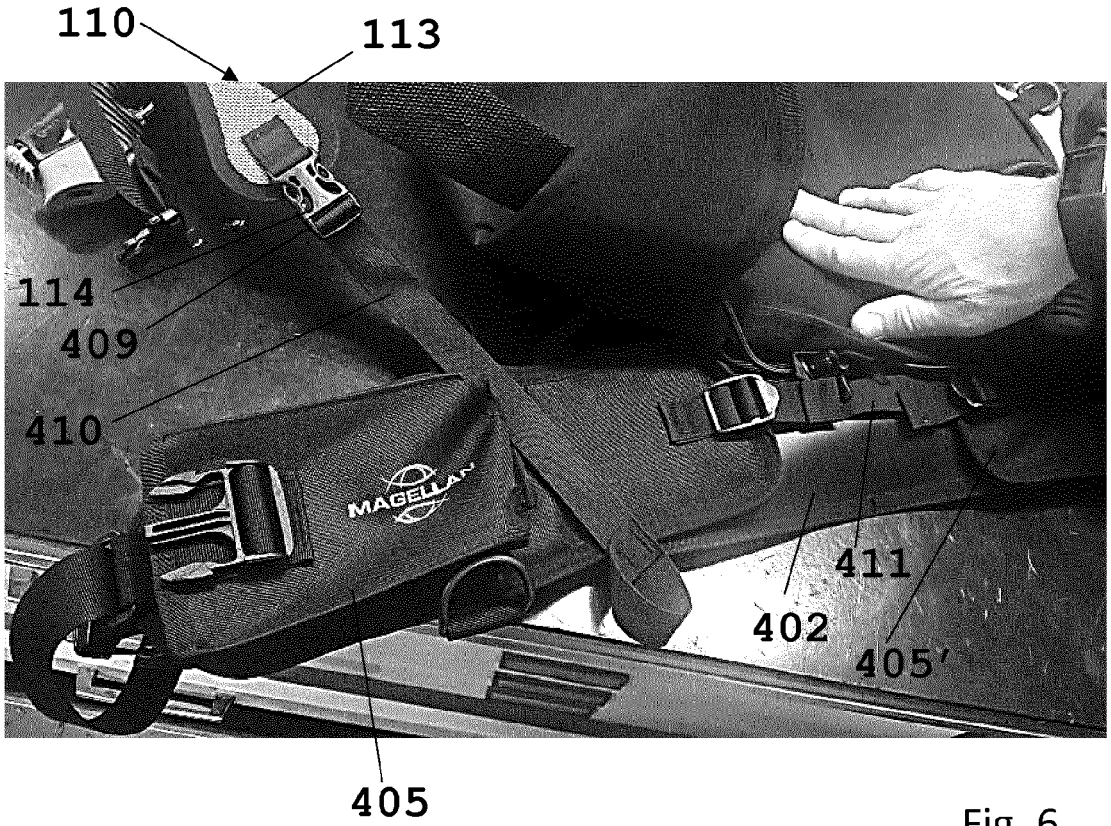
110
113
114
409
410
MAGELLAN
411
402
405'
405

Fig. 6

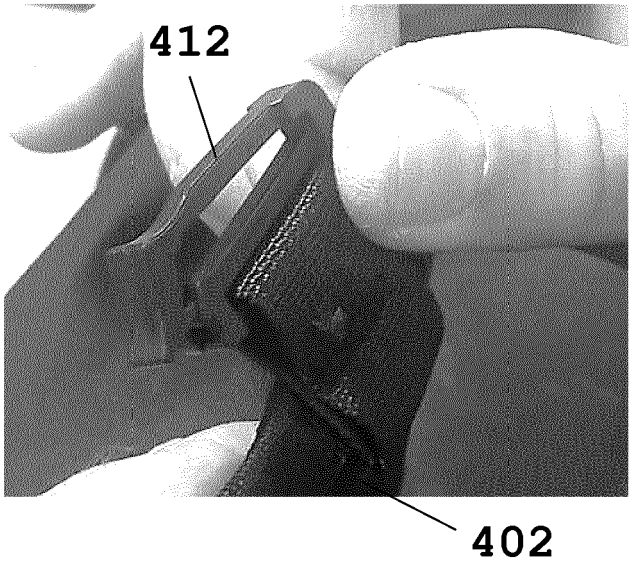

Fig. 7

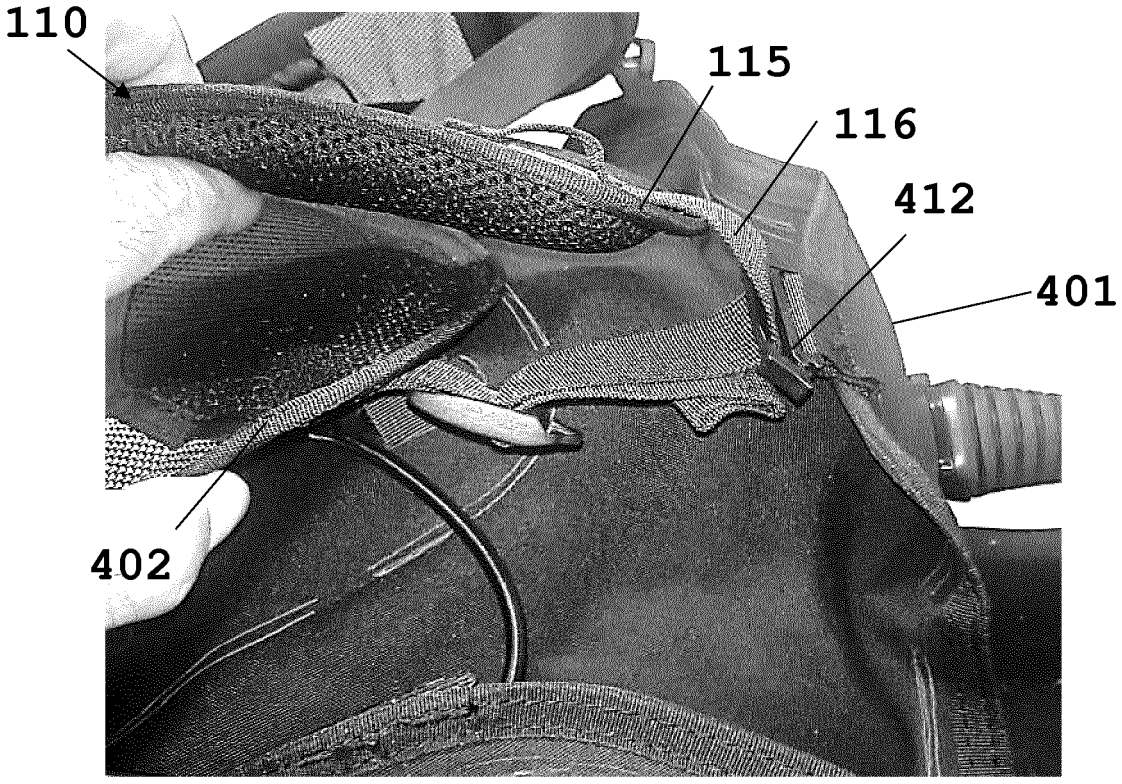

Fig. 8

Fig. 9

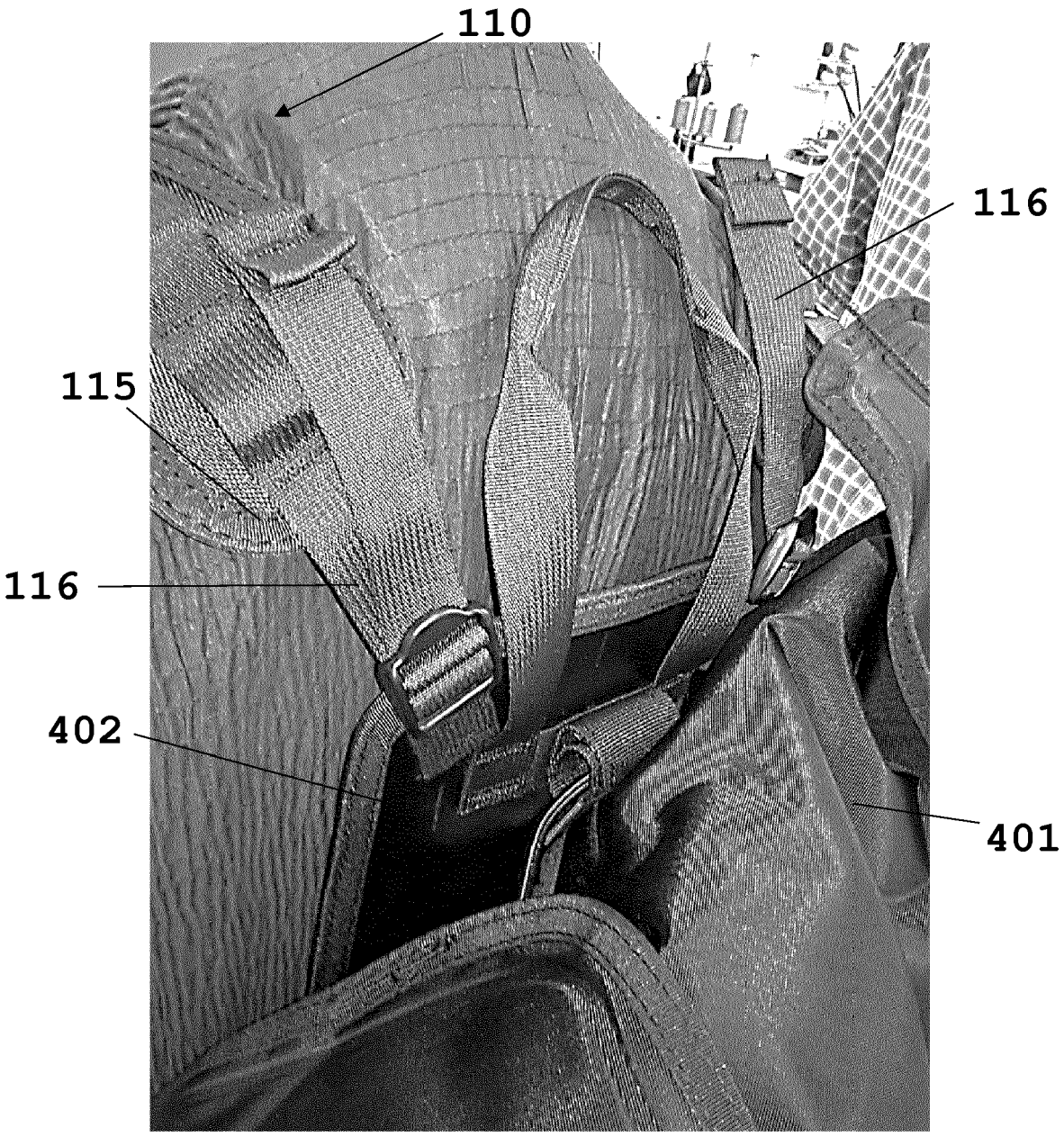

Fig. 10

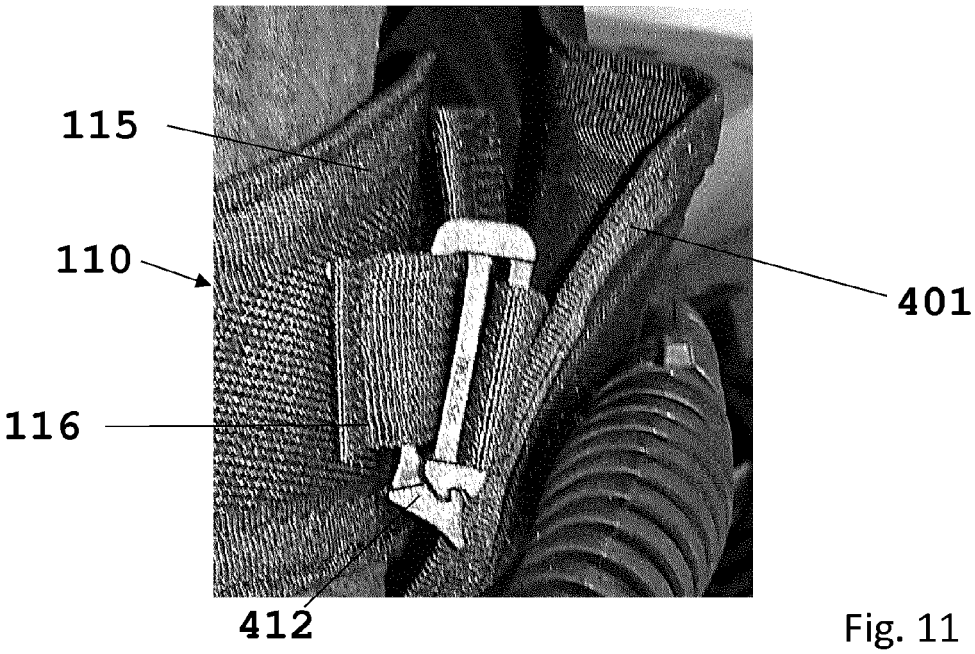
115
110
116
401
412

Fig. 11

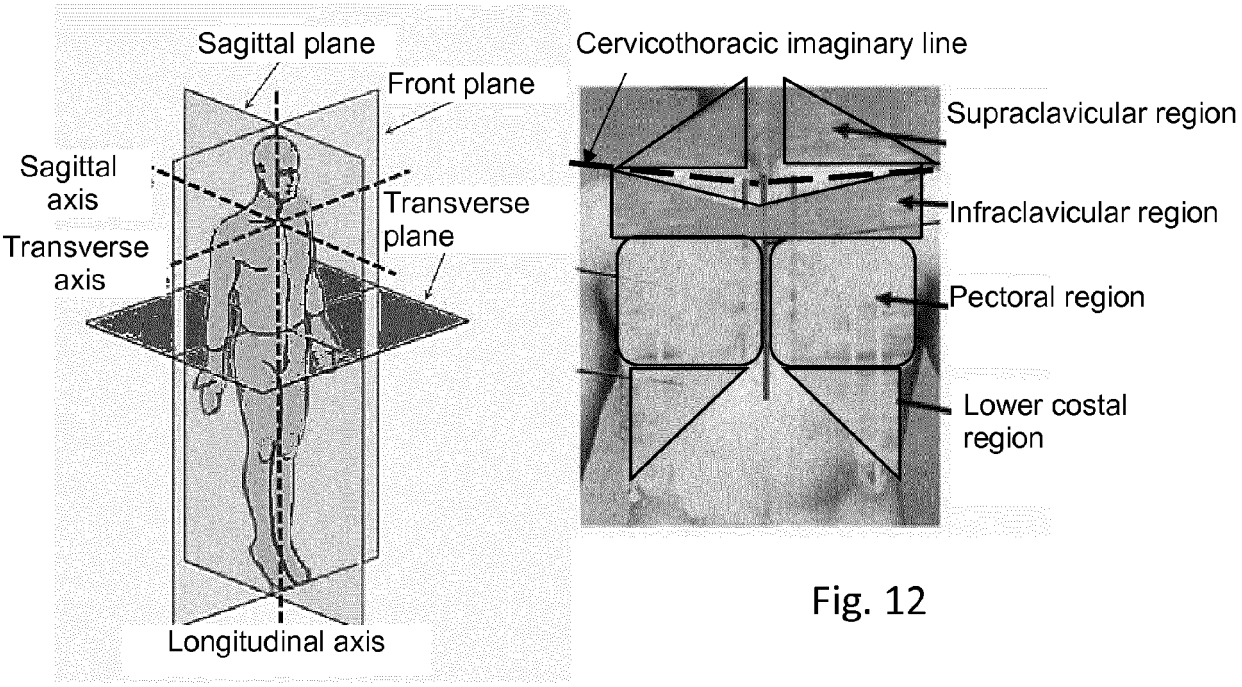
Sagittal plane
Front plane
Sagittal axis
Transverse plane
Transverse axis
Longitudinal axis
Cervicothoracic imaginary line
Supraclavicular region
Infraclavicular region
Pectoral region
Lower costal region

Fig. 12

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EUROPEAN SEARCH REPORT

Application Number
EP 19 17 5523

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	US 5 607 258 A (EUNGARD WILLIAM C [US]) 4 March 1997 (1997-03-04) * abstract; claims 1-21; figures 1-11 * * column 2, line 17 - line 21 * * column 4, line 22 - line 27 * -----	1-19	INV. A45F3/14 A45F4/10 B63C11/22
X	US 2003/121942 A1 (CHANG I-TEH [CN]) 3 July 2003 (2003-07-03) * abstract; claims 1-20; figures 1-12 * -----	1-3,5-10	

TECHNICAL FIELDS SEARCHED (IPC)

A45F
B63J
B63C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	4 October 2019	Oliveras, Mariana

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 19 17 5523

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04-10-2019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5607258 A	04-03-1997	NONE	
US 2003121942 A1	03-07-2003	NONE	

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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