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(54) A WEARABLE SAFETY SYSTEM

(57) A wearable safety system (100; 100') configured to be used in combination with a helmet (200) is provided. The system comprises: a harness (1; 1') comprising two shoulder straps (3a, 3b); at least one inflator (10a, 10b), an ECU (13) and a battery (14). The ECU (13) is arranged in communication with the at least one inflator (10a, 10b). The system further comprises at least one airbag (9a, 9b). The system is configured to generate an activation signal upon detection of an accident. The at least one airbag (9a, 9b) is configured to be inflated upon the generation of the activation signal and to be deployed to form at least one inflated C-shaped body covering a neck portion (301) and a portion of a facial area (302) of the wearer. The invention also relates to a bag arrangement.

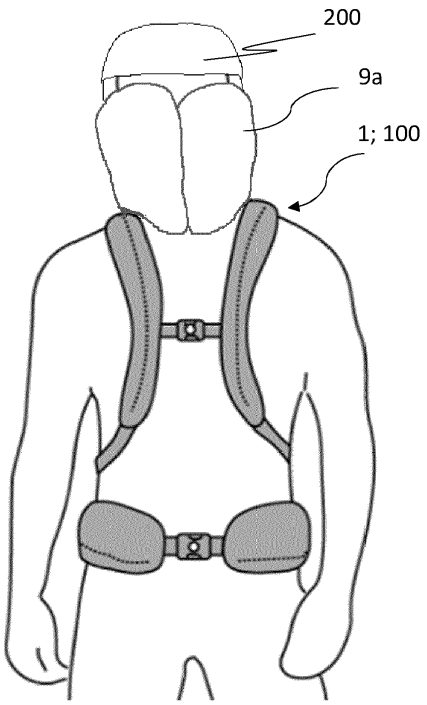

Fig. 3b

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Description

Technical field

[0001] The present invention relates to a wearable safety system and a bag arrangement using such wearable safety system.

Technical background

[0002] There are numerous helmets available on the market for persons having an active life and who primarily wants to protect the head in the event of an accident that does not involve objects falling from above.

[0003] One type of helmet is a so-called integral helmet. Integral helmets are however typically designed for motor cyclists or the like and are too heavy and clumsy for a biker or any person who has an active life or a physical work. The other type of helmet is a helmet that extends like a calotte around the head. Those are typically used by e.g. bikers but also by e.g. workers. While that kind of helmets provide an efficient protection to the scull and back head, they do not provide any substantive protection for the facial area, such as the cheeks, chin and nose.

[0004] There are also alternative, wearable safety systems that are configured to constitute a substitute to a helmet. One example of such systems comprises a collar that is configured to be worn around the neck portion of the wearer. The collar comprises an airbag that is configured to be inflated and deployed in case of an accident and to form an inflated structure that extends around the head and the facial area. However, the collar may be experienced as being heavy, warm and bulky, especially among active persons who require a great freedom of movement of the body.

Summary of the invention

[0005] It is an object of the present invention to overcome the above-described drawbacks, and to provide an improved wearable safety system that is directed to active people that are used to wearing a helmet.

[0006] The system should provide a protection to at least a portion of the facial area.

[0007] The system should be applicable, no matter if it comes to commuting, construction work, outdoor activities or even extreme sports.

[0008] Another object is to provide a wearable safety system that is easy combinable with a bag, such as a backpack.

[0009] These and other objects that will be apparent from the following summary and description are achieved by a wearable safety system according to the appended claims.

[0010] According to an aspect of the present invention, there is provided a wearable safety system configured to be used in combination with a helmet, comprising:

a harness comprising two shoulder straps, said harness being configured to be worn on the torso of a wearer;

at least one inflator, an ECU and a battery, said ECU being arranged in communication with the at least one inflator; and

at least one airbag; wherein

the wearable safety system is configured to generate an activation signal upon detection of an accident, and

wherein the at least one airbag is configured to be inflated upon the generation of the activation signal and to be deployed to form at least one inflated C-shaped body covering a neck portion and a portion of a facial area of the wearer.

[0011] Accordingly, a wearable safety system is provided that is embodied as a harness with two shoulder straps, whereby the wearable safety system is configured to be worn on the torso of a wearer. In the event of an accident, the at least one airbag will be inflated and deployed to form a C-shaped body that not only covers the neck portion and a portion of the facial area of the wearer, but the C-shaped body will also be accommodated in the area that is formed below a lower, circumferential edge portion of the helmet, the wearers collarbone/shoulders and an upper edge of the harness. The at least one airbag will accordingly when deployed serve as an active supplementary protection to the helmet. The at least one airbag protects at least a portion of the facial area and especially the chin, the cheeks and the nose while the helmet protects the skull and back head. Further, the harness will not restrict the wearers ordinary movements or choice of clothes.

[0012] Accordingly, a wearable safety system is provided that is easy to wear and to adapt to the type of clothing and type of activity. Hence one and the same safety system may be used for a number of different types of daily activities, no matter if they are related to work, hobbies or sports. The safety system is especially suitable as a supplement to activities where there is recommended or even required to wear a helmet.

[0013] The C-shaped body may comprise a waist portion and a first and a second arm, the first and second arms extending from the waist portion. The C-shaped body may be formed as one or more portions communicating with one or more inflators. In the event of more than one airbag portion, these may be arranged in fluid communication with each other and be configured to be inflated by one single inflator. Alternatively, two or more airbags may be discrete airbags and each airbag may be configured to be inflated by a respective inflator.

[0014] The free ends of the first and second arms may each have a height exceeding a height of the waist portion. Thereby, the C-shaped body will in its deployed condition efficiently be received in the area between the wearer's collarbone and the lower edge of front end of the helmet.

[0015] The heights of the free ends of the first and second arms may each at least correspond to a distance between the tip of the chin and the nose tip of the wearer, and preferably at least correspond to a distance between a tip of the chin and the zygomatic bone of the wearer.

[0016] The first and the second arms may each have a single-curved extension. By a single-curved extension, the arms will automatically bend in a forward direction when deployed.

[0017] The first and the second arms may each have a free end, said free ends being configured to abut each other in a condition when the at least one airbag is inflated and hence deployed.

[0018] The free ends of the first and second arms may each comprise a friction member or a mechanical connector. The friction member or mechanical connecter serve as a locking or restriction means that prevents the free ends of the first and second arms from separating and opening up in the deployed condition. Non-limiting examples of friction members are rubber, adhesive, or complementary male and female surface patterns. Non-limiting examples of mechanical connectors are Velcro® and magnets.

[0019] The at least one airbag may further be configured to be deployed to form one or more inflated portions having an extension across at least one of the thorax area of the wearer, the shoulders of the wearer, and the hips of the wearer. In the event of more than one portion, these may be arranged in fluid communication with each other and be configured to be inflated by one single inflator. Alternatively, two or more airbags may be formed as discrete airbags and each airbag may be configured to be inflated by a respective inflator.

[0020] The harness may further comprise a back protection panel, and the back protection panel may support the at least one inflator, the ECU and the battery. The back protection panel may have an extension along the longitudinal extension of a back wall of the harness. The back protection panel may be made of a rigid material.

[0021] The at least one inflator may be received in a recess, or in a through-going opening being formed in the back protection panel.

[0022] It is advantageous if the inflator is received in the recess or in the through-going opening to be substantially below or in level with one or both of two opposing major surfaces of the back protection panel. It is preferred that the battery is arranged in a position that makes it easy accessible from the exterior of the back protection panel to allow easy re-charging or replacement. The ECU and the one or more inflators may be arranged in a tamper-proof manner.

[0023] The wearable safety system may further comprise at least one movement sensor from a group consisting of a gyroscopic sensor and an accelerometer, and wherein the ECU is configured to determine, based on an input signal from the at least one movement sensor, existence of an accident and to generate the activation signal. The at least one movement sensor may be configured to communicate with the ECU in a wired or wireless manner.

[0024] The shoulder straps may each comprise a buckle arrangement with a buckle sensor, the buckle sensor being configured to generate a coupling signal indicating if the wearable safety system is coupled or not to the body of the wearer by using the buckle arrangement.

[0025] The buckle sensor may, as non-limiting examples, be in the form of a magnetic coupling that needs to be established by interconnecting components of the buckle arrangement, or in the form of a closed electric circuit that is established by interconnecting the components of the buckle arrangement. No matter configuration, the buckle sensor should be arranged in communication with the ECU, whereby the ECU may determine, based on the coupling signal, if the shoulder straps are correctly fastened or not and hence if the wearable safety system is coupled or not to the body of the wearer by using the buckle arrangement. If determined to be correctly fastened, the wearable safety system may be set to an active mode, thereby allowing the inflator to be activated if necessary.

[0026] The at least one airbag may be integrated in an upper portion of a back wall of the harness and/or in one or both of the two shoulder straps. In the event of the airbag is designed to protect the hips, such airbag or airbag portion may be integrated in the hip belt.

[0027] The airbag may be arranged in a rolled condition, in a folded condition or in a combined rolled and folded condition. The one or more airbags are preferably symmetrically integrated in the harness as seen along a virtual symmetry line extending along a longitudinal centreline of the back protection panel.

[0028] The upper end portion of the back wall of the harness or the one or more shoulder straps, depending on where the at least one airbag is arranged, may comprise one or more split lines configured to rupture during inflation of the at least one airbag. The split lines may be provided by locally weaker or locally thinner material. The one or more spilt lines may by way of example be formed as sewn seams, glued seams or welded seams.

[0029] The at least one airbag may be removably attached to the harness by means of at least one quick-coupling arrangement.

[0030] The at least one airbag may comprise a first flap portion configured to, in a deployed condition, form an inflated body providing a protection to a first part of the wearers body, and a second flap portion configured to, in a deployed condition, form an inflated body providing a protection to a second part of the wearers body;
a connector of the first flap portion is connectable to a connector of the second flap portion, whereby, in a condition when the at least one airbag is deployed, the first and second inflated bodies are forced to jointly deploy and conform to and at least partly encircle the first and second parts of the wearers body.

[0031] The first flap portion may be configured to provide a protection to the shoulders of the wearers body,

and the second flap portion may be configured to provide a protection to the thorax area of the wearers body.

[0032] The connector may be a quick-coupling arrangement. The quick-coupling arrangement may at least partly be supported by the harness.

[0033] The harness may be integral with or be removably connectable to a bag, thereby forming a backpack.

[0034] According to another aspect, the invention refers to a bag arrangement provided with a wearable safety system according to any of claims 1-15, wherein the harness is integral with or is removably connectable to a bag.

[0035] The wearable safety system as such and its advantages have been thoroughly described above. Those arguments are equally applicable to a bag using such wearable safety system. The bag may be configured as a backpack. Thus, in order of avoiding undue repetition, reference is made to the sections above.

[0036] According to yet another aspect, the invention refers to a wearable safety system comprising a harness and at least one airbag, the at least one airbag being removably attached to the harness by means of at least one quick-coupling arrangement; wherein: the at least one airbag comprises a first flap portion configured to, in a deployed condition, form an inflated body providing a protection to a first part of the wearers body, and a second flap portion configured to, in a deployed condition, form an inflated body providing a protection to a second part of the wearers body; and wherein a connector of the first flap portion is connectable to a connector of the second flap portion; whereby, in a condition when the at least one airbag is deployed, the first and second inflated bodies are forced to jointly deploy and conform to and at least partly encircle the first and second parts of the wearers body.

Brief description of the drawings

[0037] The invention will be described in more detail with reference to the appended schematic drawings, which show examples of a presently preferred embodiment of the invention.

Fig. 1 is a highly schematic illustration of a wearable safety system according to one embodiment of the invention.

Fig. 2 is a highly schematic illustration of the interior design of one embodiment of the harness forming part of the wearable safety system.

Figs. 3a-3c discloses a first embodiment of the wearable safety system with one airbag.

Fig. 4 is a highly schematic view of an airbag in the form of a C-shaped body.

Figs. 5a and 5b disclose an embodiment of one embodiment of a C-shaped body.

Figs. 6a-6c discloses a second embodiment of the wearable safety system with one airbag.

Fig. 7 is a highly schematic illustration of the interior design of another embodiment of the harness forming part of the wearable safety system.

Figs. 8a and 8b disclose another embodiment of the wearable safety system with two airbags.

Fig. 9 is a highly schematic view of a bag arrangement according to the invention in the form of a backpack.

Figs. 10a and 10b disclose, highly schematically, one example where the at least one airbag is removably attached to the harness by means of a quick-coupling arrangement.

Figs. 11a and 11b disclose one embodiment where connectors are used to control the overall shape of the at least one airbag in its deployed condition.

Detailed description

[0038] The present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which currently preferred embodiments of the invention are shown. The present invention may however be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided for thoroughness and completeness, and to fully convey the scope of the invention to the skilled addressee. Like reference characters refer to like elements throughout.

[0039] Starting with Fig. 1, one schematic illustration of one embodiment of the harness 1 which forms part of the wearable safety system 100 is provided.

[0040] The harness 1 comprises a back wall 2 configured to face the wearer's back, two shoulder straps 3a, 3b which are connected to the back wall 2 at an upper and a lower edge portion thereof, and a hip belt 4 in the form of two flanks 4a, 4b that are connected to the lower edge of back wall 2. The harness 1 is configured to be supported on and coupled to the wearer's torso when in use. The hip belt 4 may be omitted.

[0041] The back wall 2, the two shoulder straps 3a, 3b and the hip belt 4 may be provided with a suitable padding (not illustrated) on surfaces configured to face the body of the wearer. The harness 1 may be provided by any suitable material such as a wear and water-resistant material.

[0042] The two shoulder straps 3a, 3b are provided with a buckle arrangement 5. The buckle arrangement 5 comprises a first and a second buckle member 5a, 5b that are configured to be interlocked across the chest area or the wearer during use of the harness 1. The two flanks 4a, 4b of the hip belt 4 are provided with a buckle arrangement 6 comprising a first and a second buckle member 6a, 6b that are configured to be interlocked across the hips of the wearer during use of the harness 1. By the buckle arrangements 5, 6, the harness 1 may be securely coupled to the wearer's torso when in use.

[0043] The back wall 2 comprises a back protection panel 7. The back protection panel 7 which is best seen in Fig. 2, is preferably encapsulated in a protective cover

8 of the harness 1. The cover may be made tamper-proof. The back protection panel 7 may be a rigid panel. The pack protection panel 7 may have an extension along the longitudinal extension of the back wall 2. The back protection panel 7 may be formed of a plastic material, a composite material or a light-weight metallic material. The back protection panel 7 provides an overall structure to the harness 1. Further, the back protection panel 7 may provide a spinal protection in the event of an accident.

[0044] Now turning to Fig. 2, a highly schematic illustration of the interior design of one embodiment of the harness 1 forming part of the wearable safety system 100 is disclosed. The disclosed harness 1 comprises one airbag 9a and one inflator 10a.

[0045] The airbag 9a is encapsulated in a folded and/or rolled condition in a compartment 11 which has an extension across an upper portion 20 of the back wall 2 and along the two shoulder straps 3a, 3b. The airbag 9a is arranged in communication with the inflator 10a which is supported by the back protection panel 7. The disclosed airbag 9a is in an inflated and deployed condition configured to provide a protection across a portion of the facial area and optionally also across the shoulders and the thorax area of the wearer as will be described below. The airbag 9a is arranged in communication with an opening of the first inflator 10a.

[0046] The airbag 9a is disclosed as one single body. The skilled person does however realize that the airbag 9a may be divided into two or more bodies. These bodies may be configured to communicate with each other and hence be configured to be inflated by one single inflator. Alternatively, the airbags may be stand-alone units and hence be configured to be inflated by one inflator per airbag.

[0047] The at least one airbag 9a may be made of a flexible fabric material. The material may be a textile material such as a woven or non-woven material. The material may be plastic or composite material. The airbag 9a may be provided with tethers (not illustrated) and other types of elements to control the deployment. Such control is well known in the art of airbags and is not further discussed.

[0048] The skilled person realizes that the folding and/or rolling of the airbag 9a may be made in a number of ways with remained function, where the folding pattern is adapted to the overall geometry of the at least one airbag and to intended deployment.

[0049] The at least one airbag 9a is preferably symmetrically integrated in the harness as seen along a virtual symmetry line extending along a longitudinal centreline of the back protection panel 7.

[0050] The back protection panel 7 supports an ECU 13 (Electronic Control Unit) and a battery 14. The ECU 13 which comprises a processor (not illustrated) is arranged in communication with the at least one inflator 10a. The inflator 10a, which as such is well known in the art of airbag systems, may comprise a gas generator (not illustrated). The inflator 10a is configured to be connected to the ECU 13 and to be activated based on an activation signal which is indicating an accident.

[0051] The ECU 13, the at least one inflator 10a and the battery 14 may be received in one or more recesses 15, or through-going openings which are formed in the back protection panel 7. It is advantageous if the ECU 13, the at least one inflator 10a, and the battery 14 are received in the one or more recesses 15 or through-going openings to be substantially below or in level with at least one two opposing major surfaces of the back protection panel 7. Thereby, there are no parts protruding from the back protection panel 7. The one or more recesses 15 or through-going openings 15 may also be configured to receive at least a portion of the at least one airbag 9a.

[0052] It is preferred that the battery 14 is arranged in such position that it is easy accessible from the exterior of the back protection panel 7 to allow easy re-charging or replacement. Access to the battery 14 may be provided for via a non-illustrated reclosable opening in the cover 8. It is preferred that the inflator(s), the ECU and the airbag(s) are arranged in a tamper-proof manner. The skilled person realizes that the ECU 13, the at least one inflator 10a and the battery 14 with remained function may be arranged in other positions in the harness 1.

[0053] Now referring to Figs. 1 and 2. As given above, the shoulder straps 3a, 3b and the hip belt 4 do each comprise a buckle arrangement 5, 6. Each buckle arrangement 5, 6 may comprise a sensor, in the following referred to as a buckle sensor 16, 17. The buckle sensors 16, 17 are configured to generate a coupling signal indicating if the wearable safety system 100 is coupled or not to the torso of the wearer by using the buckle arrangements 5, 6. The buckle sensors 16, 17 may, as non-limiting examples, be in the form of a magnetic coupling that needs to be established by interconnecting the buckle members 5a, 5b; 6a, 6b of the buckle arrangements 16, 17, or in the form of a closed electric circuit that is established by interconnecting the buckle members 5a, 5b; 6a, 6b. No matter configuration, the buckle sensor(s) 16, 17 are arranged in communication with the ECU 13. The buckle sensors 16, 17 may be configured to communicate with the ECU 13 in a wired or wireless manner. The ECU 13 may be configured to determine, based on the coupling signal, if the shoulder straps 3a, 3b and hip belt 4 are correctly fastened or not and hence if the wearable safety system 100 is coupled or not to the body of the wearer by using the buckle arrangements 5, 6. If determined to be correctly fastened, the wearable safety system 100 may be set to an active mode, thereby allowing the at least one inflator 10a to be activated if necessary.

[0054] Further, the wearable safety system 100 comprises at least one movement sensor 18 from a group consisting of a gyroscopic sensor and an accelerometer. The at least one movement sensor 18 is configured to communicate with the ECU 13 in a wired or wireless manner. The at least one movement sensor 18 may be arranged in any suitable position on the harness 1.

[0055] The ECU 13 is configured to determine, based on an input signal from the at least one movement sensor 18, existence of an accident and to generate an activation signal. An accident may be determined to occur in the event the one or more movement sensors 18 indicate a movement or acceleration that alone or in combination exceeds a pre-determined threshold value. The ECU 13 may be configured to determine and control the activation of the at least one inflator 10a to thereby inflate and deploy the at least one airbag 9a. In the event of several airbags, the ECU 13 may be configured to determine which of the one or more airbags should be inflated, or if all airbags in should be inflated simultaneously depending on the determined type of accident.

[0056] In the event a processor of the ECU 13, based on collected and processed signals from the at least one movement sensor 18 should determine that there is an accident, an activation signal will be communicated to the at least one inflator 9a. Based on this activation signal, the gas generator is activated and generates a gas flow which inflates the airbag 9a.

[0057] The disclosed airbag 9a is configured to be deployed to form an inflated C-shaped body that covers a neck portion and a portion of a facial area of the wearer. It may also be designed to be configured to cover the shoulders and the thorax area of the wearer. This will be further described below with reference to Figs. 3a-3c and Figs. 6a-6c.

[0058] In the event of a second airbag 9b being arranged in the hip belt, such second airbag 9b may be configured to form a body that extends across the hips of the wearer. This will be further described below with reference to Fig. 7 and Figs. 8a-8b.

[0059] As is best seen in Fig. 1, the upper portion 20 of the back wall 2 and the two shoulder straps 3a, 3b comprise split lines 19. The skilled person realizes that depending on the design of the at least one airbag in the upper portion 20 of the harness 1, the split lines 19 in the shoulder straps 31, 3b may be omitted. In the event also the hip belt 4 comprises an airbag 9b, split lines 19 may also be formed along the two flanks of the hip belt 4. The split lines 19 are schematically illustrated by dashed lines. The split lines 19 are configured to rupture during inflation of the at least one airbag 9a. The split lines 19 may be provided by locally weaker material or locally thinner material. The one or more spilt lines 19 may be formed as sewn seams, adhesive seams or welded seams.

[0060] The material making up the harness may be configured, upon an activation of the one or more inflators, to rupture along the split lines 19, thereby forming a flap like deflector (not illustrated). The deflector may by way of example be configured to guide the deployment of the first airbag 9a in the forward direction towards the facial area.

[0061] Now turning to Figs. 3a-3c, the wearable safety system 100 according to a first embodiment is disclosed. The disclosed safety system 100 and the harness 1 comprises an airbag 9a that only is configured to protect the facial area 302 and the neck 301 of the wearer. Starting with Fig. 3a, the wearable safety system 100 is disclosed as worn during its ordinary use. The harness 1 is mounted to the back of the wearer in the same way as an ordinary backpack. Also, the wearer is disclosed as wearing a helmet 200 on her head. The airbag 9a is contained in the upper end of the harness 1.

[0062] Figs. 3b is a schematic front view of the safety system 100 in its inflated and deployed condition, while Fig. 3c is a schematic side view of the wearers head and shoulder. Fig. 4 is a highly schematic top view of the deployed airbag 9a. As is best seen in Figs. 3b and 3c, the airbag 9a has been inflated and deployed into a C-shaped body that extends from the top end of the harness 1 and extends on both sides on the neck 301 towards the facial area 302 of the wearer. Thereby the chin, the cheeks and also the nose are efficiently protected.

[0063] As is best seen in Fig. 4, the C-shaped body comprises a waist portion 91 and a first and a second arm 92a; 92b. The first and second arms 92a; 92b extend from and merge with the waist portion 91. The first and the second arms 92a; 92b are disclosed as having a single-curved extension. By a single-curved extension, the arms 92a; 92b will automatically bend in a forward direction when deployed.

[0064] The first and the second arms 92a; 92b do each have a free end 93a; 93b. The free ends 93a; 93b are configured to abut each other in a condition when the at airbag 9a is deployed. To prevent the free ends 93a; 93b from separating and the first and second arms 92a; 92b from opening up in the deployed condition, the free ends 93a; 93b may each comprise a friction member 94 or a mechanical connector 95. The friction member 94 or the mechanical connecter 95 serve as a locking or restriction means. Non-limiting examples of friction members 94 are rubber, adhesive, or complementary male and female surface patterns such as mating ridges and valleys or mating projections and recesses. Non-limiting examples of mechanical connectors 95 are Velcro® and magnets.

[0065] Now turning to Fig. 3c. The free ends 93a, 93b of the first and second arms 92a; 92b do each preferably have a height H that exceeds a height h of the waist portion 91. Thereby, the C-shaped body of the airbag 9a will efficiently be received in the area between the wearer's collarbone 303 and a lower edge 201 of the helmet 200. The heights H of the free ends 93a; 93b of the first and second arms 92a; 92b may each at least correspond to a distance between the tip of the chin and the nose tip of the wearer, and preferably at least correspond to a distance between a tip of the chin and the zygomatic bone of the wearer.

[0066] Now turning to Fig. 5a and 5b, another schematic embodiment of the C-shaped inflated and deployed body of the airbag 9a is disclosed. Fig. 5a is a schematic top-view of the C-shaped body in its inflated and deployed condition, whereas Fig. 5b is a schematic view of one of the two free ends.

[0067] As is best seen in Fig. 5b, The C-shaped body is formed by three panels. A first panel 81 extends along an upper surface 82 of the C-shaped body, and extends downwardly along the two free ends 93a, 93b and then along the bottom surface 83 of the C-shaped body. A second panel 84 extends along an inner single-curved surface 85 of the C-shaped body. A third panel 86 extends along an outer single-curved surface 87 of the C-shaped body. The three panels 81, 84, 86 are joined along their longitudinal edges 88 by e.g. welding, sewing or adhesive bonding. The length of the second panel 84 is shorter than the third panel 86 to thereby contribute to the C-shaped form of the inflated and deployed body. As a result of the three panels 81, 84, 86, a substantially quadrangular/rectangular cross-section is provided with substantially flat walls. This is of advantage of keeping the desired position during deployment on top of the wearer's shoulders. Especially, the two free ends 93a, 93b will each have a substantially flat extension. This allows the two free ends 93a, 93b of the C-shaped body to better contact each other in the deployed condition, see Fig. 5a. This contributes to an improved face protection.

[0068] As is illustrated in Fig. 5b, the C-shaped body may be provided with one or more tethers 89 (only one showed with dashed lines). The one or more tethers 89 may provide the C-shaped portion with a slight waist portion. The one or more tethers 89 further contribute to flattening the walls of the C-shaped body to thereby allow the C-shaped body to even better conform to the wearer's neck and head shape and also to the shoulders. The skilled person realizes that the number and positions of the tethers 89 may be varied within the scope of the invention.

[0069] Figs. 5a and 5b also schematically illustrate one example of where a friction member 94 or mechanical connector 95 is attached to the free ends 93a, 93b.

[0070] Now turning to Figs. 6a-6c, a second embodiment of the wearable safety system 100 is disclosed. The safety system 100 and the harness 1 differ from the system that was described with reference to Fig. 2 and 3a-3c and Fig. 4 in that the safety system comprises an airbag 9a that is configured to not only protect a portion of the facial area 302 but also the shoulders 304 and the thorax area 305 of the wearer.

[0071] Starting with Fig. 6a, the safety system 100 is disclosed as being worn during its ordinary use. The harness 1 is mounted to the back of the wearer in the same way as an ordinary backpack. Also, the wearer is disclosed as wearing a helmet 200 on her head. Fig. 6b is a schematic side view of the wearer and Fig. 6c is a schematic front view of the safety system 100 when the airbag 9a is in its inflated and deployed condition.

[0072] The deployed airbag 9a comprises a first portion 96 that extends across the neck 301 and a portion of the facial area 302 of the wearer. Thereby the chin, the cheeks and also the nose are efficiently protected. Further, a second portion 97 of the airbag 9a extends across the shoulders 304 of the wearer and also a third portion 98 extends across the thorax area 305 of the wearer. The first, second and third portions 96; 97; 98 may be part of one single airbag 9a. The different portions may be arranged in fluid communication with each other and be configured to be inflated by one single inflator. Also, the different portions may be provided with fold lines that allow the inflated airbag to better conform to the wearers body. The skilled person realizes that the three airbag portions 96; 97; 98 with remained function may be divided into separate airbags.

[0073] Now turning to Fig. 7, another embodiment a wearable safety system 100' is disclosed. The safety system 100' differs from the safety system 100 that was disclosed with reference to Fig. 2 in that the harness 1' further comprises a second airbag 9b that is encapsulated in a folded and/or rolled condition in a compartment 12 which has an extension along the two flanks 4a, 4b of the hip belt 4. The second airbag 9b is arranged in communication with a second inflator 10b which is supported by the back protection panel 7. The second airbag 9b is in an inflated and deployed condition configured to provide a protection across the hips. The second airbag 9b is arranged in communication with an opening of the second inflator 10b. This is one example where the two inflators 10a, 10b are controlled by one and the same ECU 13. The overall design of the harness 1 and the first and second airbags 9a, 9b is the same as previously described with reference to Figs. 1 and 2.

[0074] Turning to Figs. 8a and 8b, the harness 1' and the wearable safety system 100' according to Fig. 7 is schematically disclosed in its ordinary use and in its deployed condition respectively. The two airbags 9a, 9b are contained in the harness in its ordinary use. The first airbag 9a is of the very same type that was described above with reference to Figs. 6a-6c and is not further described. The second airbag 9b is deployed along the hip belt 4 to thereby form a protection of the hips 306 of the wearer.

[0075] Now turning to Fig. 9, the wearable safety system 100; 100' may in one embodiment be provided as a backpack 102. The harness 1; 1' may be integral with or be removably connectable to one or more bags 101. The backpack 102 is disclosed with two bags 101 having different sizes, volumes and intended use. By making the bag(s) 101 removably connectable, the harness 1; 1' may easily be converted from a stand-alone harness 1; 1' to a backpack 102 at the wearer's discretion. The bags 101 may be removably connectable by using e.g, one or more (non-illustrated) straps or buckles.

[0076] Now turning to Figs. 10a and 10b. The at least one airbag 9a, 9b has been exemplified above as being fixedly arranged to the harness 1; 1'. However, in the event of an accident causing a deployment, it is difficult to replace the used airbag with a new airbag and thereby allow a re-use of the harness 1; 1'.

[0077] Figs. 10a and 10b disclose, highly schematically, one example where the at least one airbag 9a, 9b is removably attached to the harness 1; 1 by means of a

quick-coupling arrangement 400. In the disclosed embodiment, the at least one airbag 9a, 9b is provided with eyelets forming female connectors 401, and the harness 1; 1 is provided with T-shaped projections forming male connectors 402. The reversed positions of the male and female connectors 401, 402 may be equally applied. To attach the airbag 9a, 9b to the harness 1; 1', the T-shaped projections are inserted into a respective eyelet. To remove the airbag 9a, 9b, if necessary, the reversed order is performed. The skilled person realizes that the number of quick-coupling arrangements 400 in the harness 1; 1' and the airbag 9a, 9b, and their positions depend on the overall shape of the airbag to be connected and the harness. The positions and number of quick-coupling arrangements 400 attaching the airbag 9a, 9b to the harness 1; 1' can be used to control the overall shape of the at least one airbag in its deployed condition. The skilled person realizes that the quick-coupling arrangement 400 can have another configuration than a T-shaped projection in combination with an eyelet. Non-limiting examples are one or more snap fasteners, also known as poppers, straps or strips of Velcro®.

[0078] The very same principle may be used to connect the at least one airbag to other portions of the harness, such as to the shoulder straps or the hip belt.

[0079] Now turning to Figs. 11a and 11b, one embodiment is disclosed where connectors are used to control the overall shape of the at least one airbag 9a, 9b in its deployed condition.

[0080] Starting with Fig. 11a, one example of an airbag 9a, 9b in its flat, unrolled condition is disclosed. The disclosed airbag 9a, 9b is specifically configured to provide a support for the shoulders and the thorax area. The airbag 9a, 9b comprises a first flap portion 90 and a second flap portion 91. The first flap portion 90 is configured to, in a deployed condition, form an inflated body that provides a protection to a first part of the wearers body, namely the shoulders. The second flap portion 91 is configured to, in a deployed condition, form an inflated body that provides a protection to a second part of the wearers body, namely the thorax area. It goes without saying that yet another flap portion can be added to also provide the C-shaped facial and neck protection discussed above. No matter design, the airbag 9a, 9b has a design that as such is well known in the art by being divided into different bodies by seams or weld lines.

[0081] The first flap portion 90 comprises, on opposite sides of a longitudinal centreline, two female-type connectors. The female-type connectors 92 are arranged in a respective tab 93 that is arranged along the outer edge of the airbag 9a, 9b. Correspondingly, the second flap portion 91 comprises, on opposite sides of the longitudinal centreline, two male-type connectors 94. The connectors 92, 94 are disclosed as being arranged in an area that as such is not to be inflated. Thus, in the event the second flap portion 91 is divided into two bodies 95 to be inflated, the male-type connectors 94 are arranged in an area between two such bodies 95. This allows a stronger attachment of the connectors.

[0082] Now turning to Fig. 11b which highly schematically discloses the airbag 9a, 9b in an inflated and deployed condition and removably attached to a rear wall of a harness 1; 1. The disclosed arrangement is mirror symmetric about the longitudinal centreline and only one side is illustrated.

[0083] The harness 1; 1' is very schematically disclosed by dashed lines. The shoulder straps have been omitted. The airbag 9a, 9b as such is removably attached to the harness 1; 1' by a quick-coupling arrangement 400 of the same type that was discussed above with reference to Figs. 9a and 9b. Thus, the airbag 9a, 9b is provided with eyelets forming female-type connectors 401, and the harness 1; 1 is provided with T-shaped projections forming male-type connectors 402. To attach the airbag 9a, 9b to the harness 1; 1', the T-shaped projections are inserted into their respective eyelets. To remove the airbag, if necessary, the reversed order is performed.

[0084] Further, the first flap portion 90 that in its deployed condition is configured to provide a shoulder protection is folded over and connected to the second flap portion 91 that in its deployed condition is configured to provide a protection to the thorax area. The connection is provided for by the female-type connector 92 of the first flap portion 90 engaging the male-type connector 94 of the second flap portion 91. In the event of an accident which causes the airbag 9a, 9b to inflate and deploy, the interconnection between the two flap portions 90, 91 results in that the resulting two inflated bodies 95, 96 are forced to jointly deploy and conform to and at least partly encircle the first and second parts of the wearers body. Thus, the shoulders and the thorax area will be efficiently protected.

[0085] Accordingly, the invention may according to one aspect be seen as referring to a wearable safety system comprising a harness 1; 1' and at least one airbag 9a; 9b , the at least one airbag being removably attached to the harness by means of at least one quick-coupling arrangement 400; wherein: the at least one airbag comprises a first flap portion 90 configured to, in a deployed condition, form an inflated body 96 providing a protection to a first part of the wearers body, and a second flap portion 91 configured to, in a deployed condition, form an inflated body 95 providing a protection to a second part of the wearers body; and wherein a connector 92 of the first flap portion 90 is connectable to a connector 94 of the second flap portion 91; whereby, in a condition when the at least one airbag is deployed, the first and second inflated bodies 96; 95 are forced to jointly deploy and conform to and at least partly encircle the first and second parts of the wearers body.

[0086] The very same principle of using connectors to force different inflated bodies to conform jointly is applicable to also other body parts of the wearer.

[0087] The skilled person realises that a number of modifications of the embodiments described herein are possible without departing from the scope of the inven-

tion, which is defined in the appended claims.

[0088] By way of example, the material of the one or more airbags, may be configured to be stretched during the deployment. The stretching will add an overall stiffness to the inflated airbag. This may be provided for by using different material types/properties in the airbag as a whole or in local surface areas of the airbag.

[0089] No matter embodiment and number of airbags, the spatial extension of the at least one airbag(s) 9a, 9b as seen in its/their inflated and deployed condition may be divided into different virtual zones having different thicknesses to thereby provide different types of cushioning effects across different areas of the wearers body. This effect may be provided for by using seams and tethers.

[0090] Although the airbag has been exemplified as being arranged in the harness in a rolled condition or folded condition, the skilled person realizes that other patterns or combinations of different patterns may be used. No matter how the airbag is packed in the harness, it is preferred that the airbag(s) is/are symmetrically arranged in the harness.

Claims

1. A wearable safety system (100; 100') configured to be used in combination with a helmet (200), comprising:

   a harness (1; 1') comprising two shoulder straps (3a, 3b), said harness (1; 1') being configured to be worn on the torso of a wearer;
   at least one inflator (10a, 10b), an ECU (13) and a battery (14), said ECU (13) being arranged in communication with the at least one inflator (10a, 10b); and
   at least one airbag (9a, 9b); wherein
   the wearable safety system (100; 100') is configured to generate an activation signal upon detection of an accident, and
   wherein the at least one airbag (9a, 9b) is configured to be inflated upon the generation of the activation signal and to be deployed to form at least one inflated C-shaped body covering a neck portion and a portion of a facial area of the wearer.

2. The wearable safety system according to claim 1, wherein the C-shaped Inflated body comprises a waist portion (91) and a first and a second arm (92a, 92b), the first and second arms extending from the waist portion (91).

3. The wearable safety system according to claim 2, wherein free ends (93a, 93b) of the first and second arms (92a, 92b) each have a height H exceeding a height h of the waist portion (91).

4. The wearable safety system according to claim 3, wherein the heights H of the free ends (93a, 93b) of the first and second arms (92a, 92b) each at least corresponds to a distance between the tip of the chin and the nose tip of the wearer, and preferably at least corresponds to a distance between a tip of the chin and the zygomatic bone of the wearer.

5. The wearable safety system according to any of claims 2-4, wherein the first and the second arms (92a, 92b) each have a single-curved extension.

6. The wearable safety system according to any of claims 2-5, wherein the first and the second arms (92a, 92b) each has a free end (93a, 93b), said free ends being configured to abut each other in a condition when the at least one airbag (9a, 9b) is inflated.

7. The wearable safety system according to claim 6, wherein the free ends (93a, 93b) of the first and second arms (92a, 92b) each comprises a friction member (94) or a mechanical connector (95).

8. The wearable safety system according to any of the preceding claims, wherein the at least one airbag (9a, 9b) further is configured to be deployed to form one or more inflated bodies having an extension across at least one of the thorax area (305) of the wearer, the shoulders (304) of the wearer, and the hips (306) of the wearer.

9. The wearable safety system according to any of the preceding claims, wherein the harness (1; 1') further comprises a back protection panel (7) and wherein the back protection panel (7) supports the at least one inflator (10a, 10b), the ECU (13) and the battery (14).

10. The wearable safety system according to claim 9, wherein the at least one inflator (10a, 10b) is received in a recess (15), or in a through-going opening being formed in the back protection panel (7).

11. The wearable safety system according to any of the preceding claims, further comprising at least one movement sensor (18) from a group consisting of a gyroscopic sensor and an accelerometer, and wherein the ECU (13) is configured to determine, based on an input signal from the at least one movement sensor (18), existence of an accident and to generate the activation signal.

12. The wearable safety system according to any of the preceding claims, wherein the shoulder straps (3a, 3b) each comprises a buckle arrangement (5, 6) with a buckle sensor (16, 17), the buckle sensor being configured to generate a coupling signal indicating if the wearable safety system (100; 100') is coupled

or not to the body of the wearer by using the buckle arrangement (5, 6).

13. The wearable safety system according to any of the preceding claims, wherein the at least one airbag (9a, 9b) is integrated in an upper portion (20) of a back wall of the harness and/or in one or both of the two shoulder straps (3a, 3b).

14. The wearable safety system according to any of the preceding claims, wherein the at least one airbag (9a, 9b) is removably attached to the harness (1; 1') by means of at least one quick-coupling arrangement (400).

15. The wearable safety system according to any of the preceding claims, wherein:

the at least one airbag (9a, 9b) comprises a first flap portion (90) configured to, in a deployed condition, form an inflated body (96) providing a protection to a first part of the wearers body, and a second flap portion (91) configured to, in a deployed condition, form an inflated body (95) providing a protection to a second part of the wearers body;
a connector (92) of the first flap portion (90) is connectable to a connector (94) of the second flap portion (91); whereby, in a condition when the at least one airbag (9a, 9b) is deployed, the first and second inflated bodies (95, 96) are forced to jointly deploy and conform to and at least partly encircle the first and second parts of the wearers body.

16. A bag arrangement provided with a wearable safety system (100; 100') according to any of claims 1-15, wherein the harness (1; 1') is integral with or is removably connectable to a bag (101).

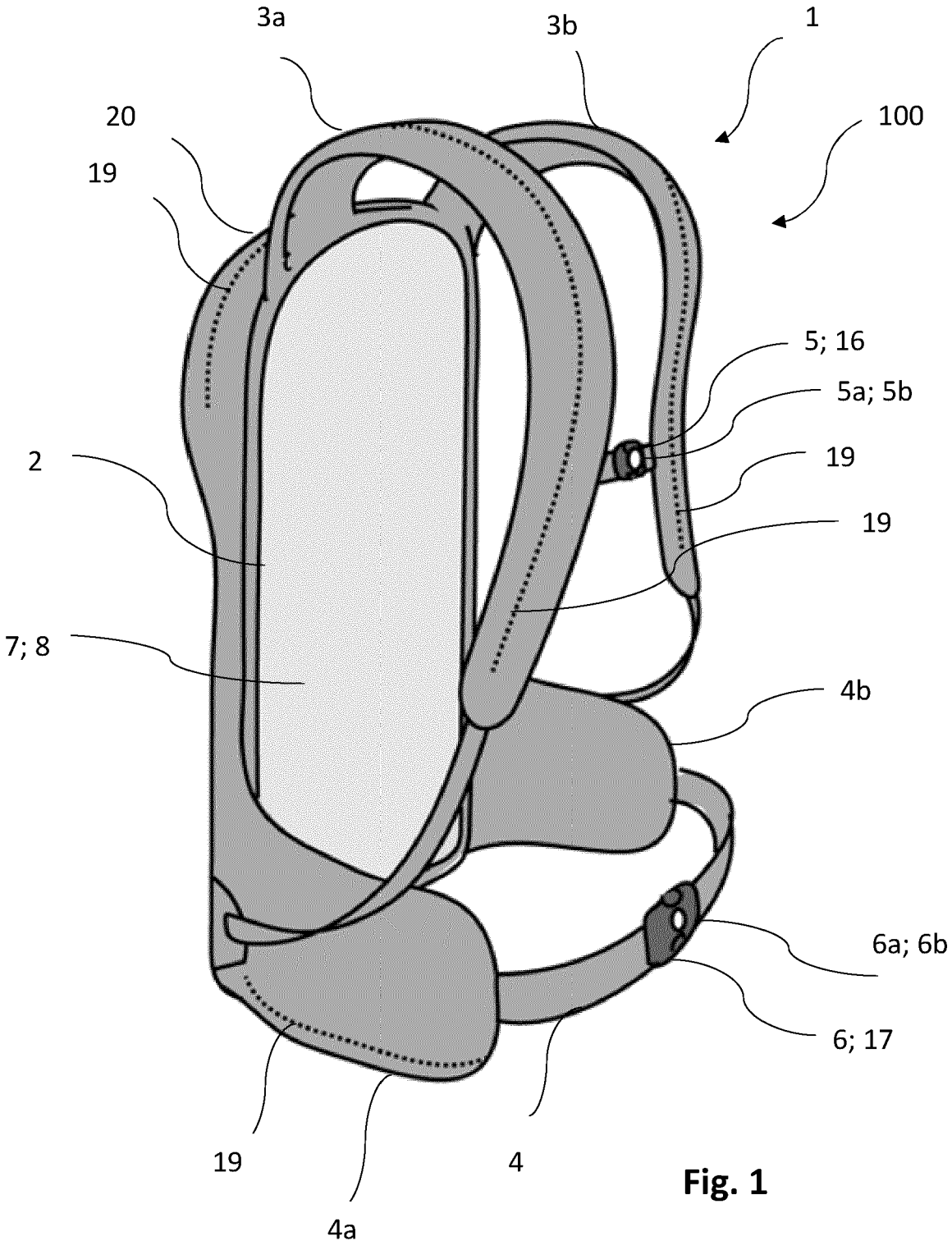

Fig. 1

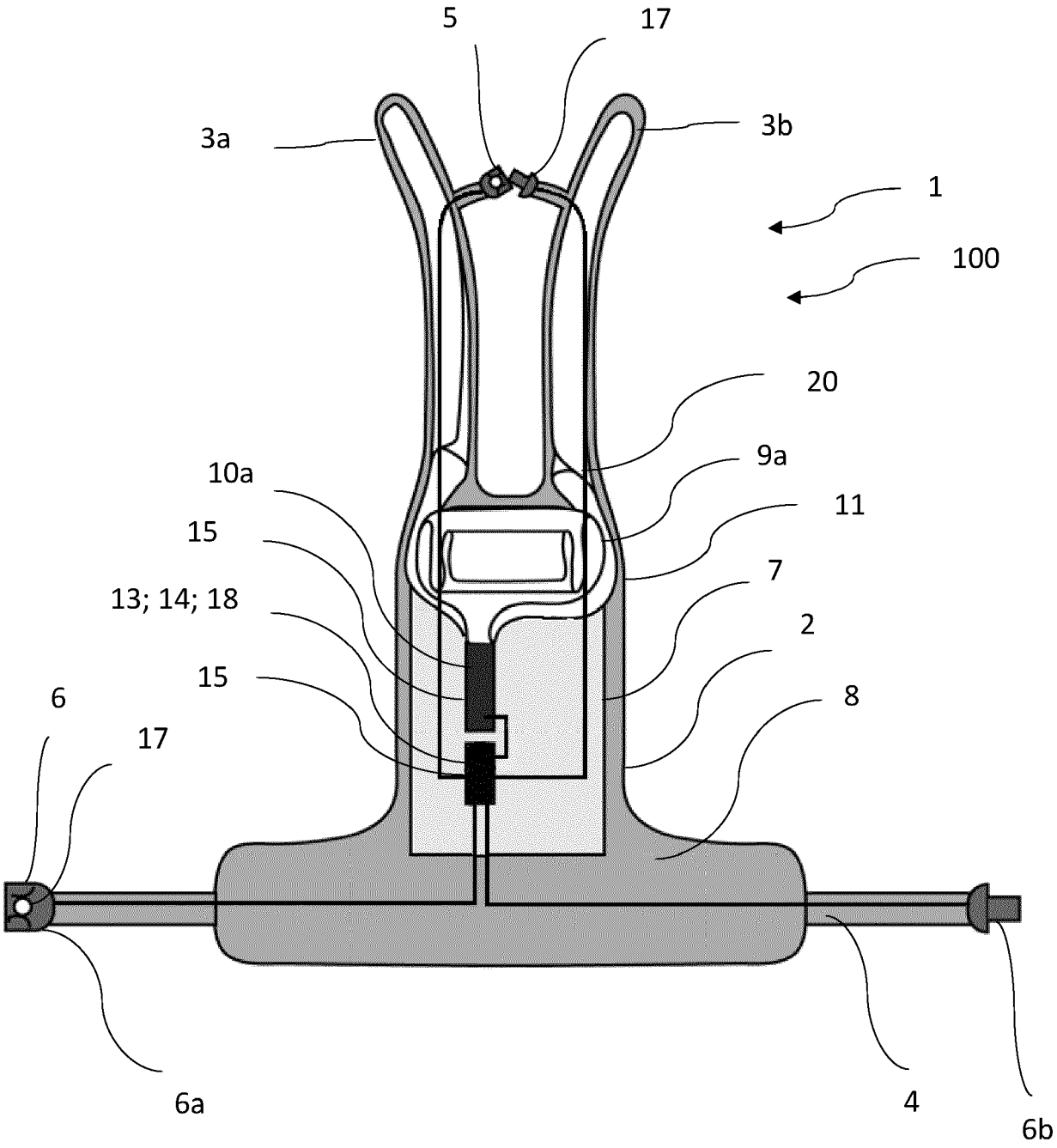

Fig. 2

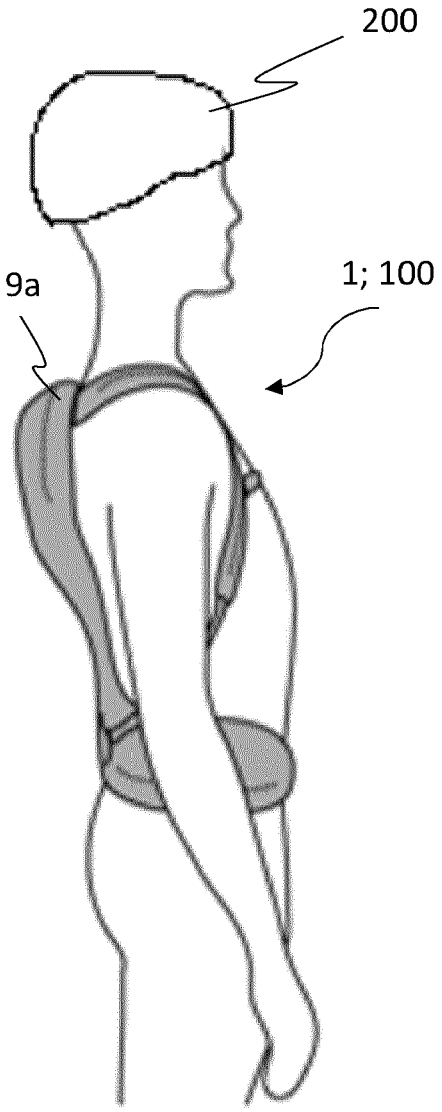

Fig. 3a

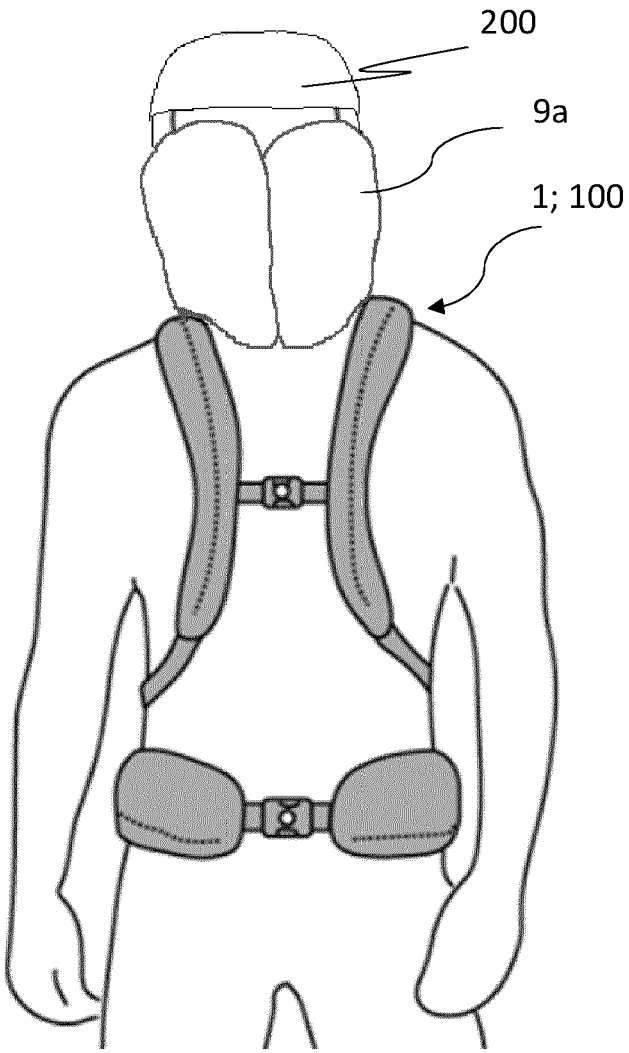

Fig. 3b

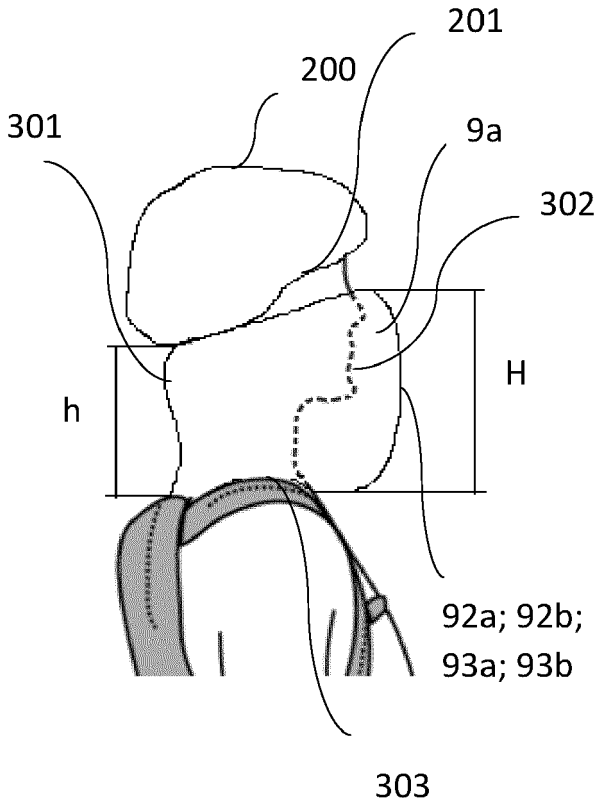
201
200
301
9a
302
H
h
92a; 92b;
93a; 93b
303

Fig. 3c

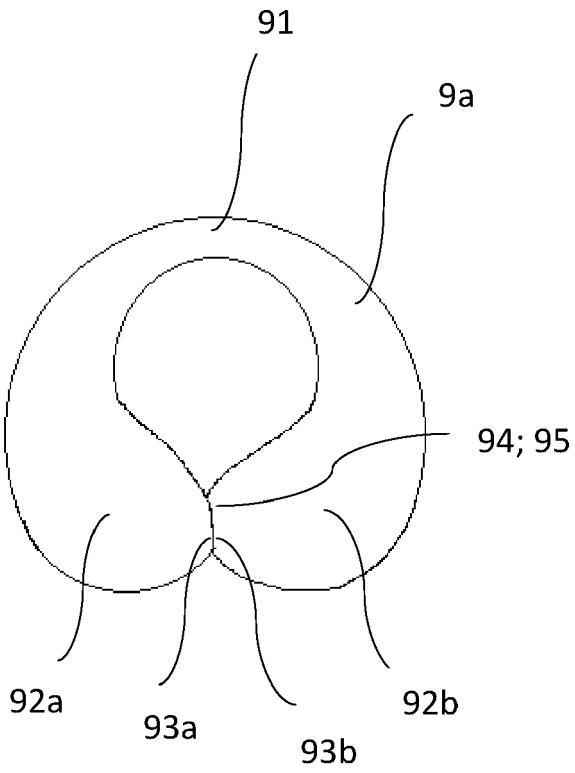
91
9a
94; 95
92a
93a
93b
92b

Fig.4

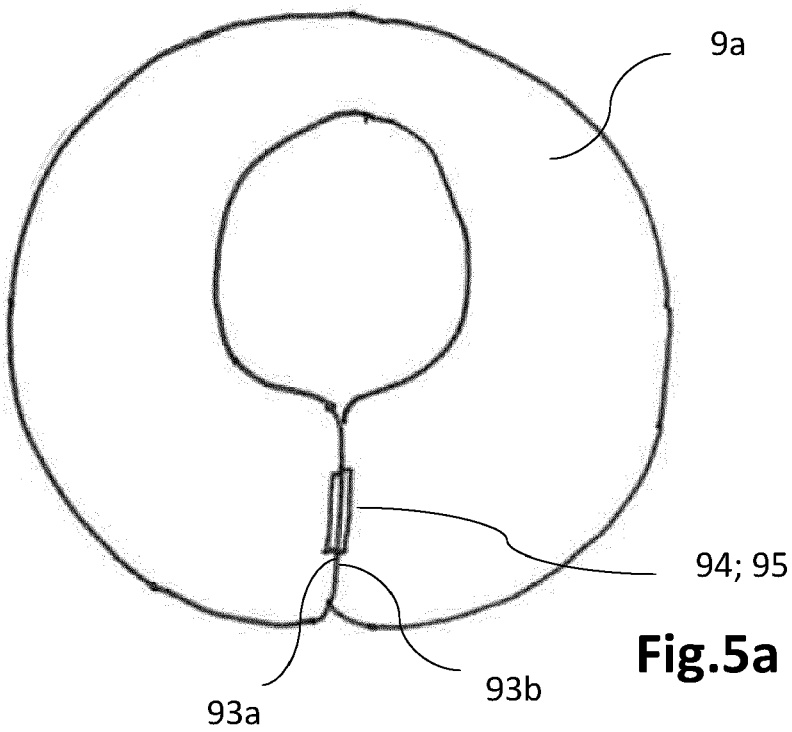

Fig.5a

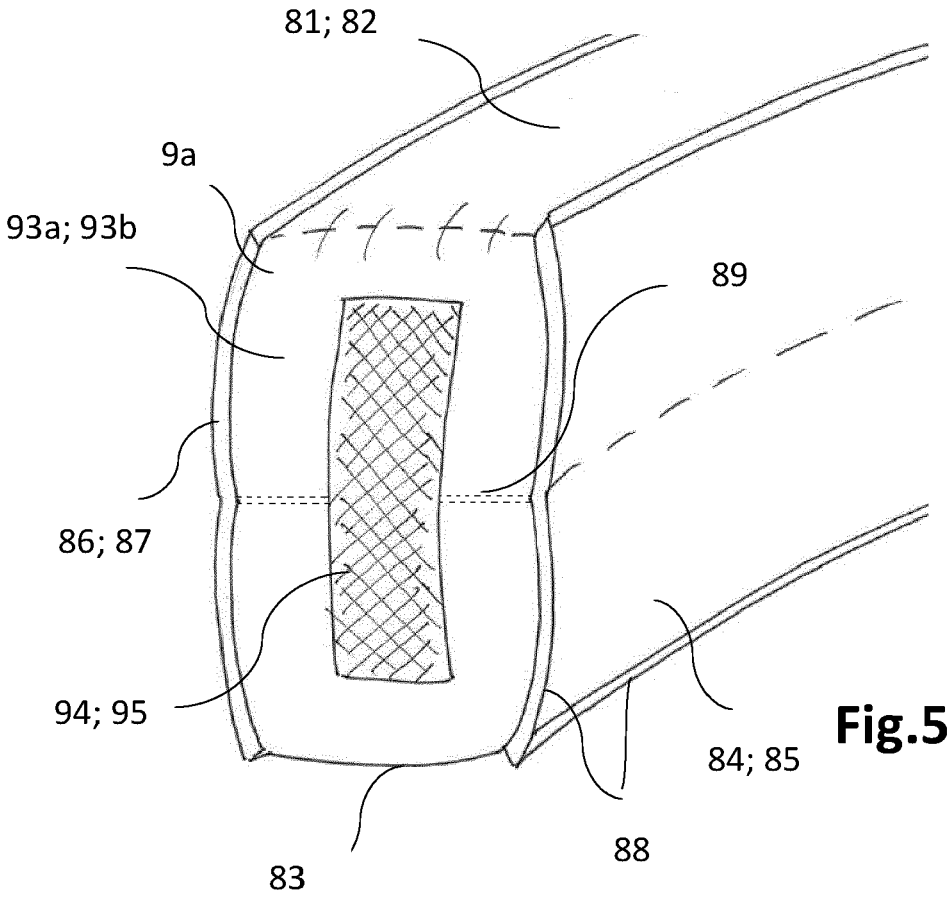

Fig.5b

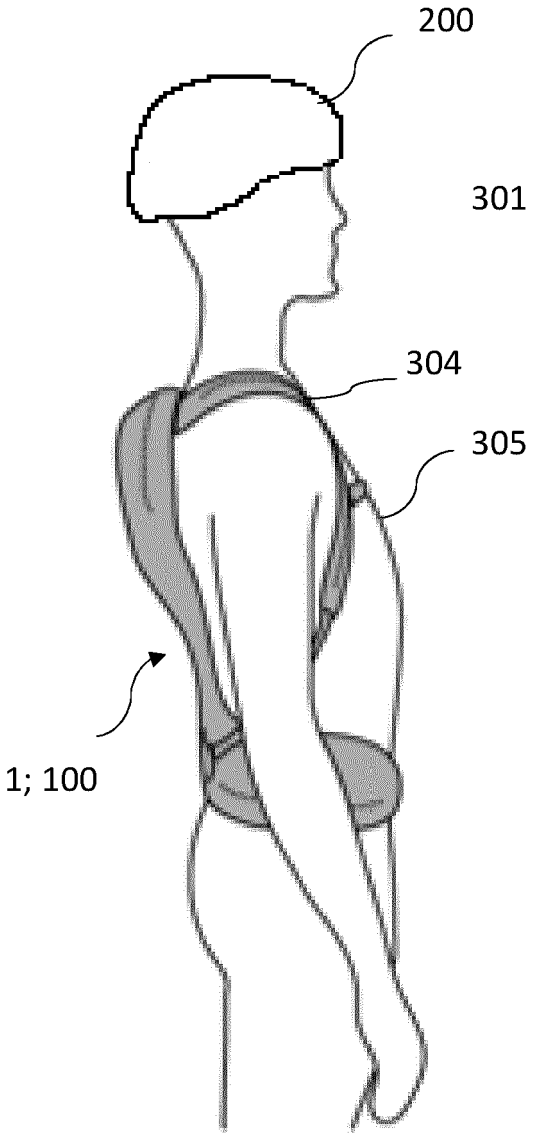

Fig.6a

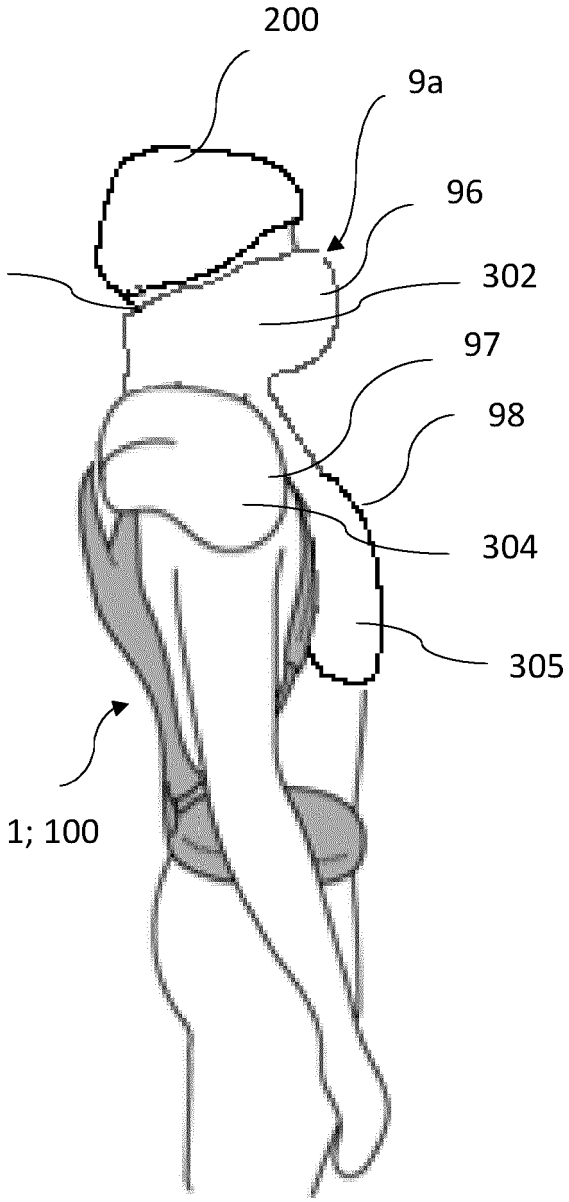

Fig.6b

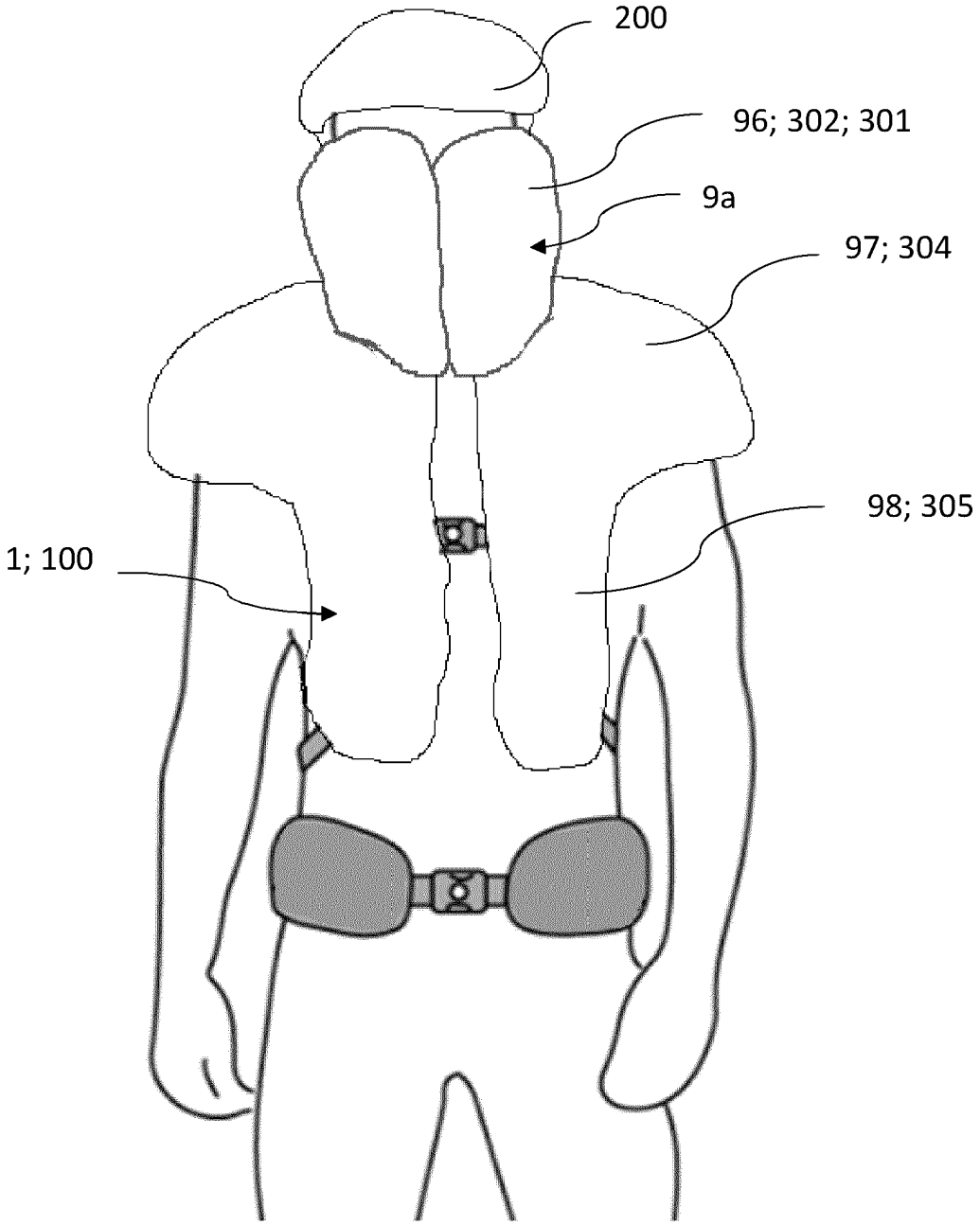

Fig.6c

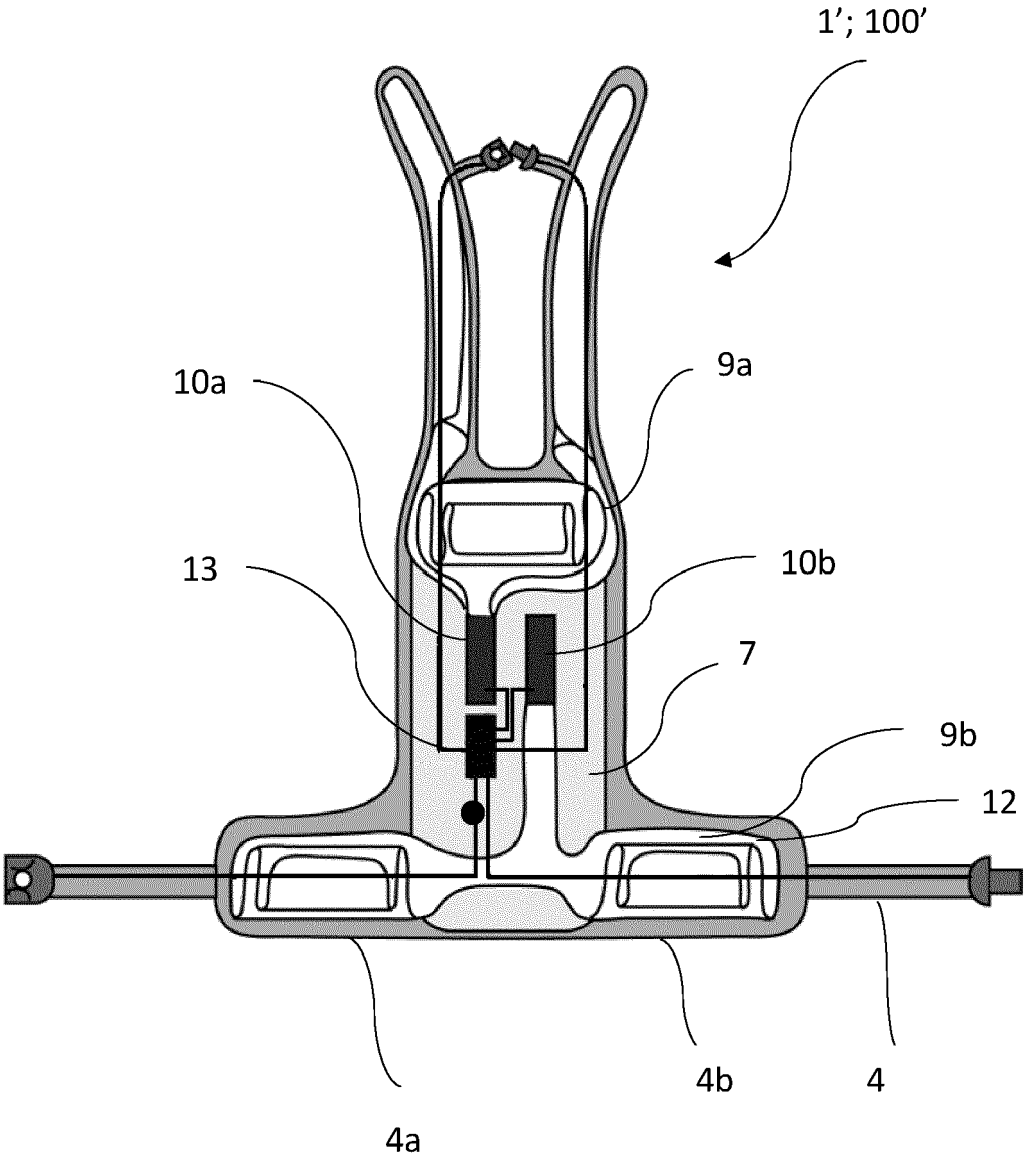

Fig. 7

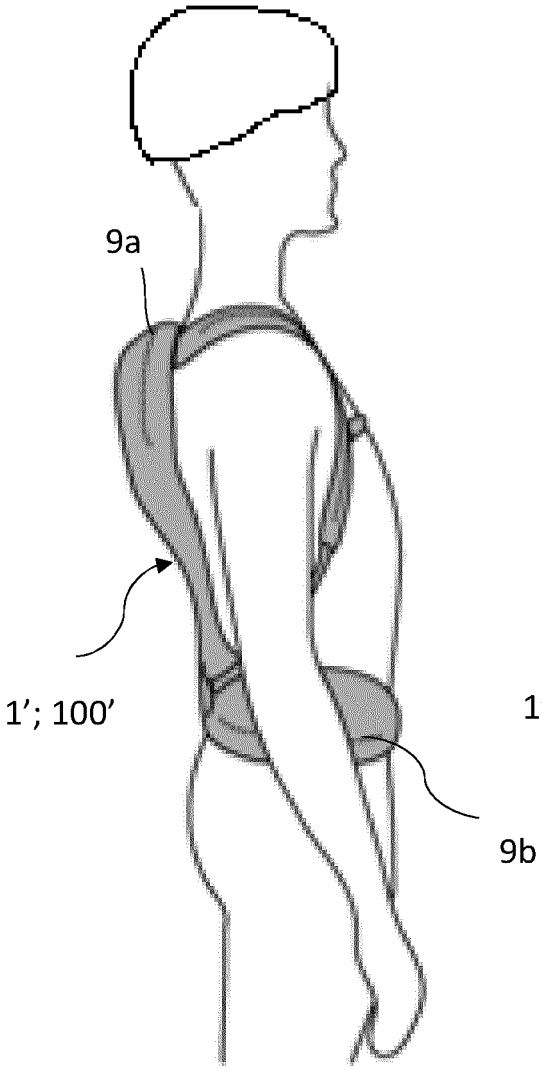

Fig.8a

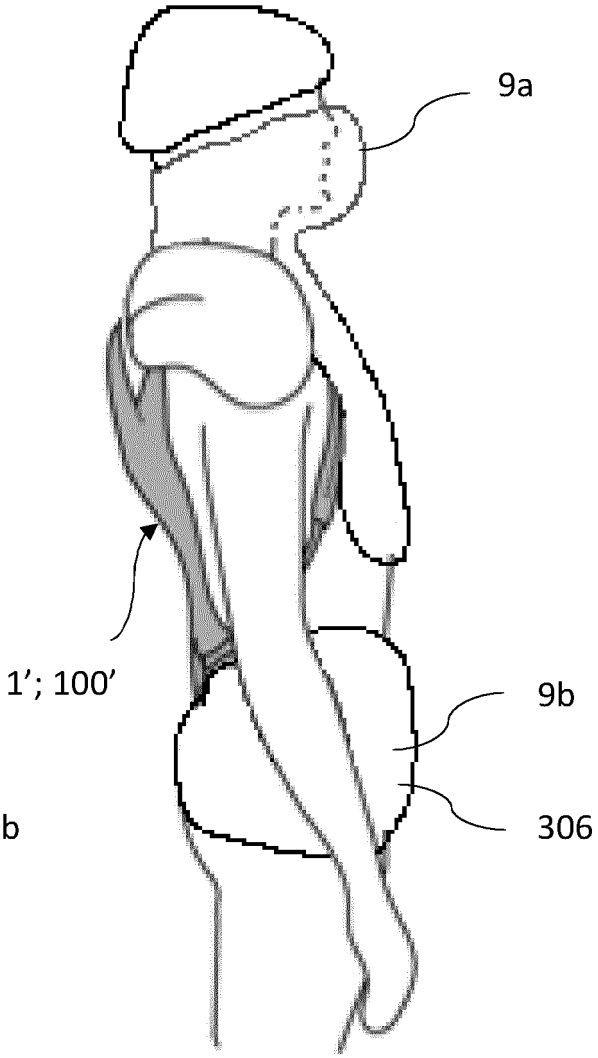

Fig.8b

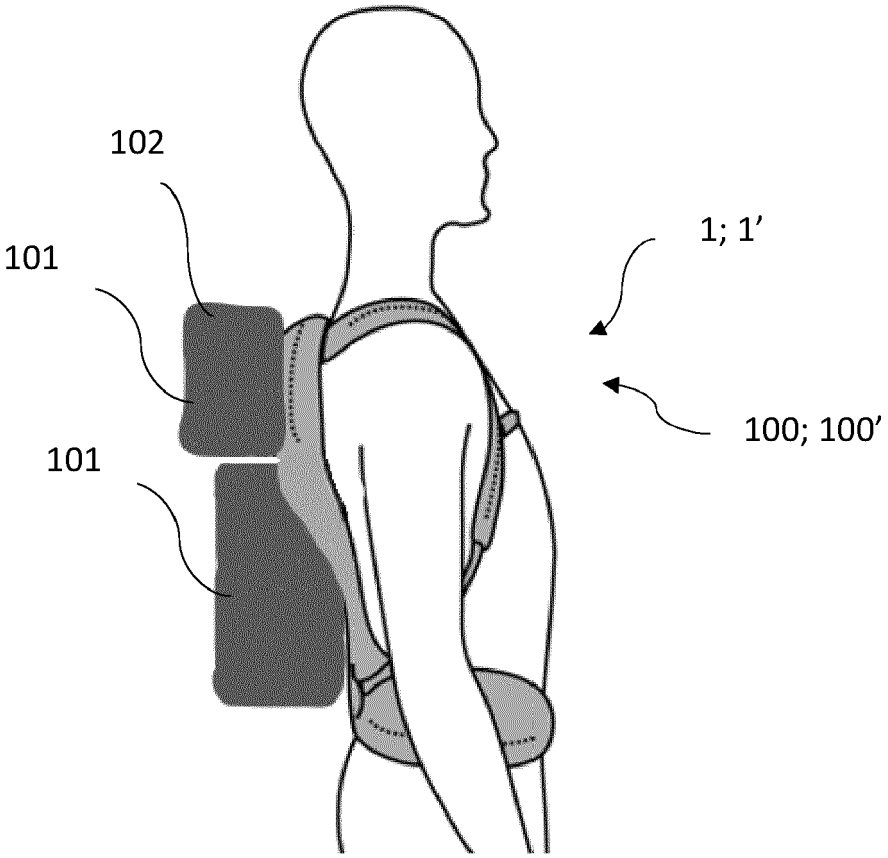

Fig. 9

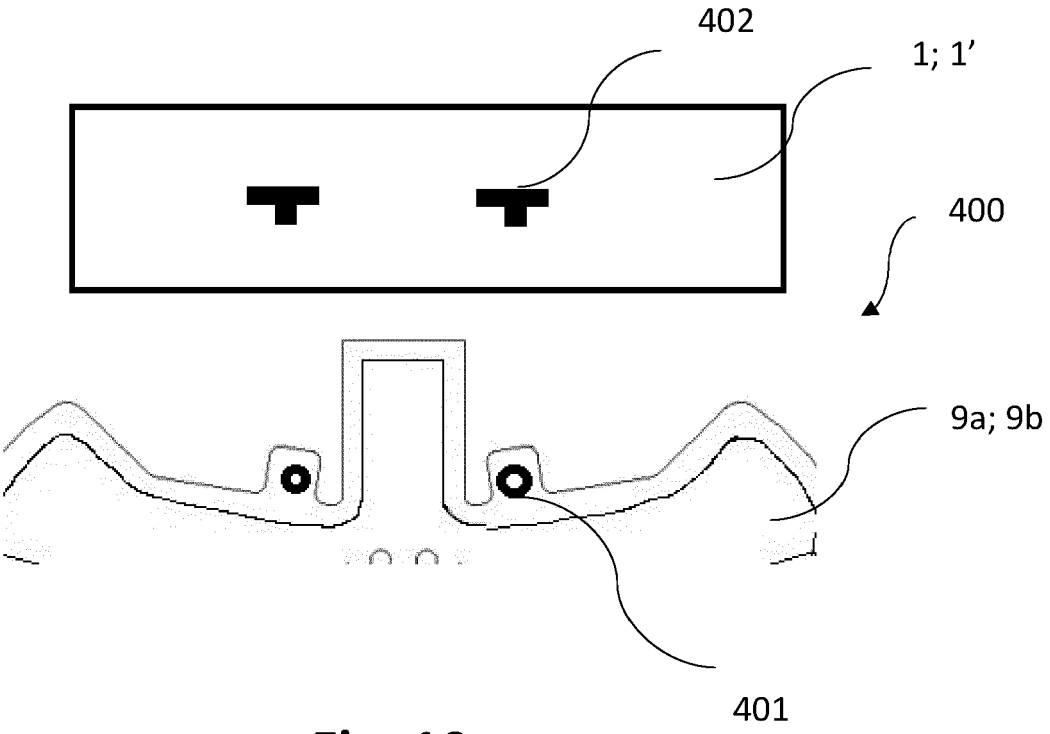

Fig. 10a

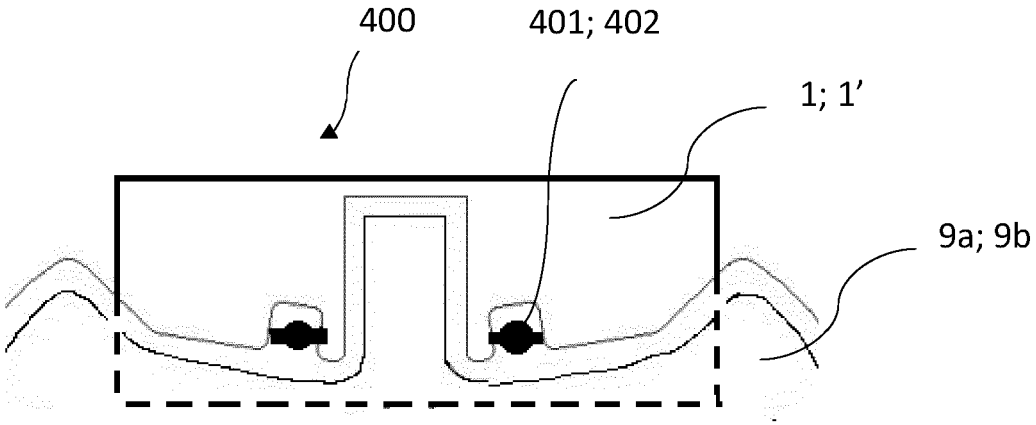

Fig. 10b

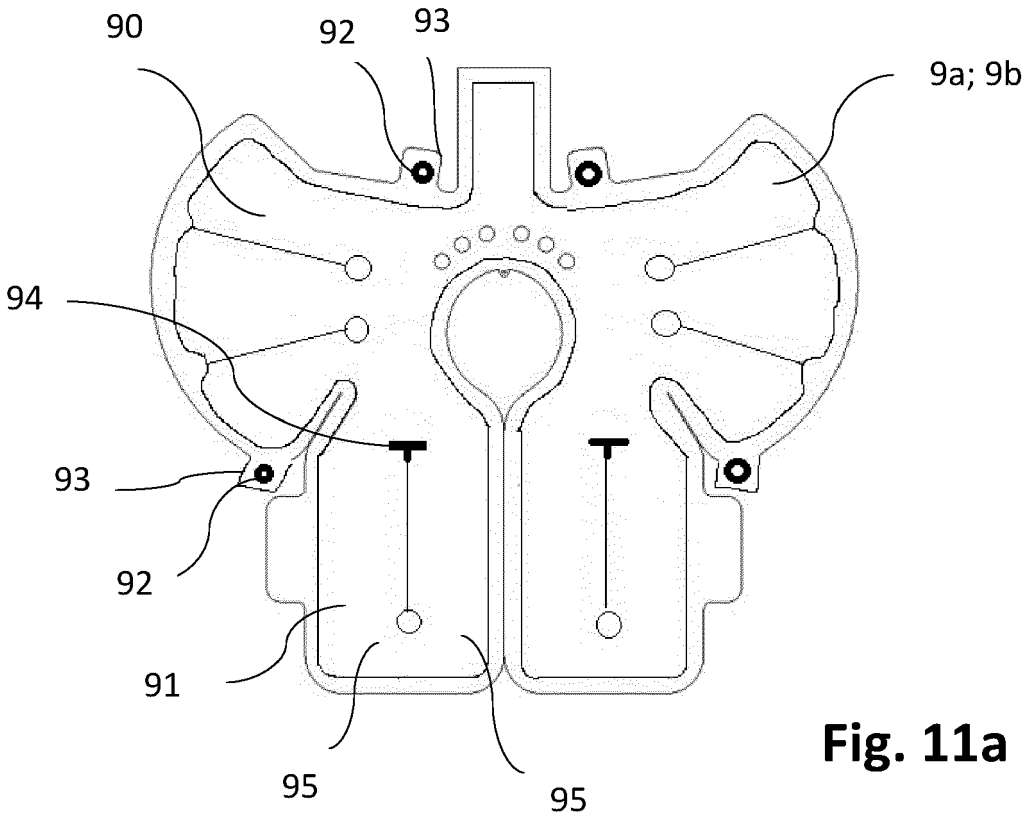

Fig. 11a

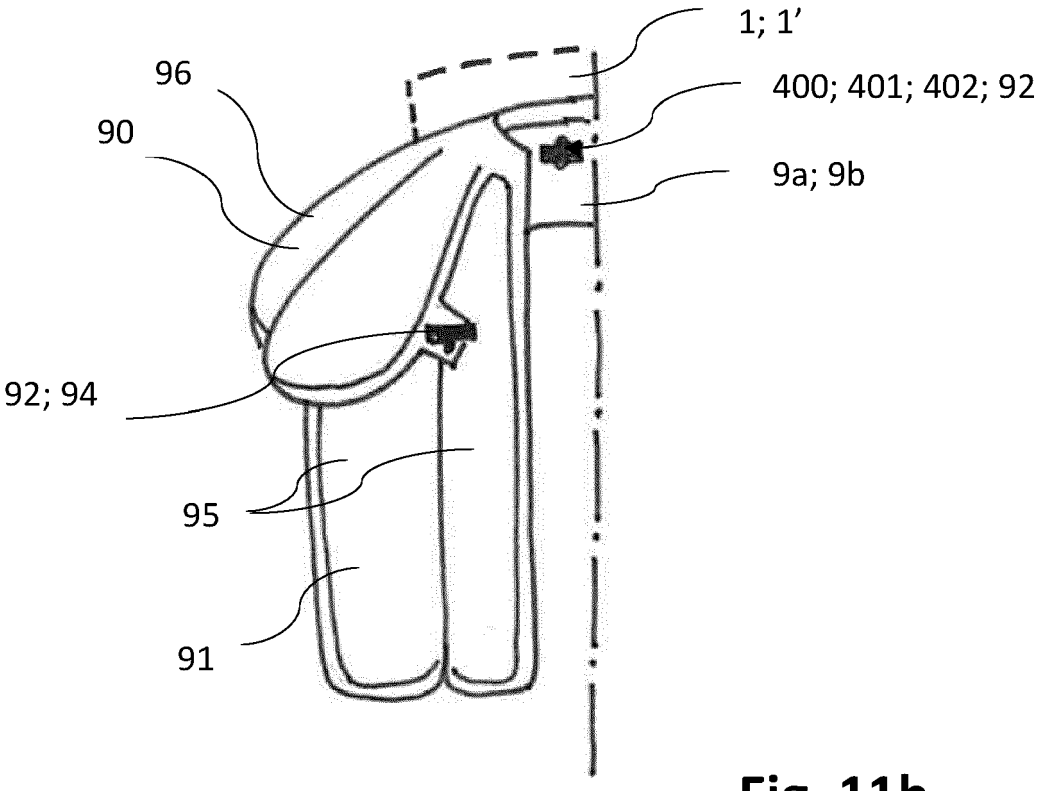

Fig. 11b

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EUROPEAN SEARCH REPORT

Application Number
EP 22 19 5667

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	14 February 2023	D'Souza, Jennifer

CATEGORY OF CITED DOCUMENTS

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