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(54) **AN AIRBAG TO BE PART OF A WEARABLE SAFETY SYSTEM AND A WEARABLE SAFETY SYSTEM COMPRISING A HARNESS SUPPORTING SUCH AIRBAG**

(57) An airbag configured to be part of a wearable safety system to allow the provision of a facial protection is provided. The airbag (100) comprises a C-shaped neck portion (4) having a mouth (9) merging with a central opening (10) configured to receive the neck of a user. The neck portion (4) is allowed to partially encircle the neck of the user. The airbag further comprises a first and a second elongated face portion (5) extending from the C-shaped neck portion (4) in an area opposite the mouth (9), each face portion (5) having two opposing long sides. A first attachment portion (20) of one of two opposing long sides of the first face portion (5) is attached to an inner peripheral edge portion (23) of the central opening (10) in an area adjacent a first edge portion (12) of the mouth (9), and a first attachment portion (22) of one of two opposing long sides of the second face portion (5) is attached to an inner peripheral edge portion (23) of the central opening (10) in an area adjacent a second edge portion (12) of the mouth (9). Further, a wearable safety system comprising a harness (200) is provided.

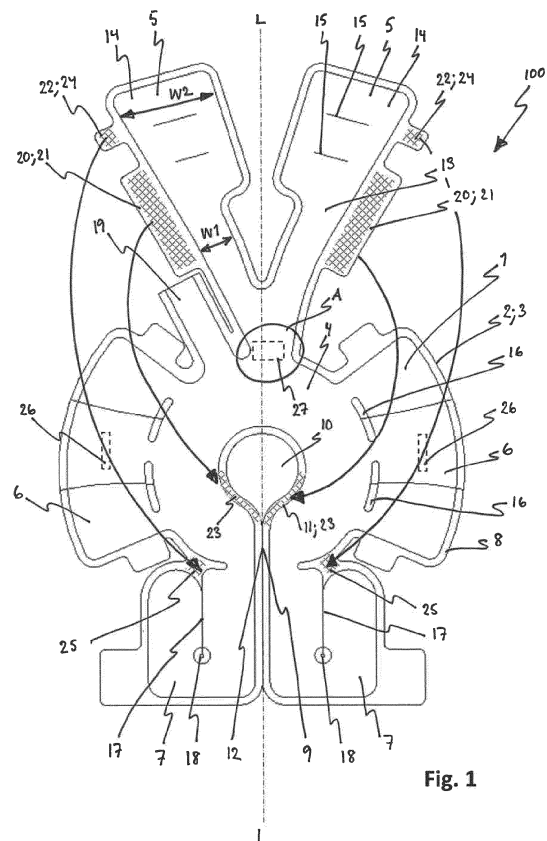


Fig. 1

Description

Technical field

[0001] The present invention relates to an airbag configured to be part of a wearable safety system to allow the provision of a facial protection and a wearable safety system comprising a harness to be worn on the torso of a wearer, said harness supporting such airbag.

Technical background

[0002] It is well known in the art to arrange an airbag as a part of a harness of a backpack where the airbag in the event of an accident is inflated and deployed to form a protection of the head and/or the face. To provide an efficient system it is of importance that the airbag is designed so that it can be inflated and reach its fully deployed condition very quick. It is also of importance that the inflation is not unduly hindered by the wearers clothing or by the harness design, and not at least that the deployed airbag covers the relevant parts of the body.

Summary of the invention

[0003] It is an object of the present invention to overcome the above-described drawbacks, and to provide an airbag to be part of a wearable safety system to allow an effective facial protection, and also to provide a safety system comprising a harness that supports such airbag.

[0004] The airbag should be designed so that it easily conforms to the wearers body during inflation and its deployed condition.

[0005] The airbag should provide a protection to at least a portion of the facial area of the wearer.

[0006] The wearable system should be applicable, no matter if it comes to commuting, construction work, outdoor activities or even extreme sports.

[0007] It is also preferred that the airbag, as seen in an inflated condition does not unduly interfere with a helmet.

[0008] 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.

[0009] According to an aspect of the present invention, there is provided an airbag configured to be part of a wearable safety system to allow the provision of a facial protection, the airbag comprising, as seen in a flat, non-inflated condition:

a C-shaped neck portion defining a mouth merging with a central opening configured to receive the neck of a user, whereby the neck portion is allowed to partially encircle the neck of the user;
a first and a second elongated face portion extending from the C-shaped neck portion in an area opposite the mouth, each face portion having two opposing

long sides; wherein

a first attachment portion of one of the two opposing long sides of the first face portion is attached to an inner peripheral edge portion of the central opening in an area adjacent a first edge portion of the mouth, and a first attachment portion of one of the two opposing long sides of the second face portion is attached to an inner peripheral edge portion of the central opening in an area adjacent a second edge portion of the mouth.

[0010] Accordingly, an airbag is provided that is configured to be part of a wearable safety system to allow a facial protection. To obtain a good coverage of both the face and the thorax area, the airbag needs to be tightly closed around the users face and body when inflated and deployed. The C-shaped neck portion, defining a mouth merging with a central opening creates a robust closing function around the user's neck, where the mouth is configured to be arranged adjacent the users' cheek. As the thus formed, substantially round neck portion is inflated, it will contribute to the guiding of the other portions of the airbag, such as the first and second face portions, into a position across the face of the user. This guidance is facilitated not only by the C-shaped body as such, but also by the first and the second first-type attachment portions of the first and second elongated face portions. These attachment portions are attached to a respective inner peripheral edge portion of the central opening of the neck portion in an area adjacent, and on opposite sides of the mouth of the neck portion. Thus, the first and second elongated face portions merge and extend from a rear end of the C-shaped neck portion in an area opposite the mouth to a front end of the C-shaped neck portion adjacent its mouth. Thereby, the airbag will, in an inflated and deployed condition form one portion that primarily extends around the user's neck and one portion that primarily extends above the neck portion and from the user's rear neck towards the user's facial area. Thus, not only does such inflated and deployed airbag protect the user's facial area, but it also encircles and protects the neck.

[0011] The respective first attachment portions do preferably have an elongated shape that allows an elongated connection to the inner peripheral connection portion of the central opening. It is advantageous if each attachment portion has a length that allows a connection along at least 5-25 % of the full length of the inner peripheral connection portion of the central opening.

[0012] The first and the second elongated face portions may extend from the C-shaped neck portion in an area along an outer peripheral edge portion of the C-shaped body, or from the inner peripheral edge portion of the central opening of the C-shaped body. No matter position, it is preferred that the first and the second elongated face portions extend symmetrically from the C-shaped neck portion in a position opposite the mouth.

[0013] In the event the first and the second elongated

face portions extend from the C-shaped neck portion in an area along an outer peripheral edge portion of the C-shaped body, the two elongated face portions will fold over substantially 180 degrees. This since their attachment portions are attached to a respective inner peripheral edge portion of the central opening in an area adjacent a respective edge portion of the mouth.

[0014] The airbag may further comprise a first and a second elongated chest portion extending from the C-shaped neck portion in an area adjacent the mouth, and on opposite sides of the mouth. The chest portions are configured to provide a protection to the thorax area of the user in the event of the airbag being inflated and deployed.

[0015] A second attachment portion of one of the two opposing long sides of the first elongated face portion may be attached to the first chest portion, and a second attachment portion of one of the two opposing long sides of the second elongated face portion may be attached to the second chest portion. The attachment may be made by e.g., sewing, welding or adhesive bonding. Other connections means may be used, such as mechanical connecting means in the form of buttons or rivets. This kind of connection between the two face portions and the two chest portions have shown to contribute to an improved conformation to the user's body and hence to a better protection during inflation and deployment. The first attachment portion of each face portion may be arranged closer to the neck portion than the second attachment portion.

[0016] The first and/or the second attachment portions of the first and second elongated face portions may be provided as tabs projecting away from an outer peripheral edge of the airbag. By arranging the tabs to project away from the peripheral edge instead of towards the interior of the airbag, there is no undue flow-restriction during inflation. Also, the impact force on the intended fixation area between the attachment portion and its respective mating attachment area on the inner peripheral connection portion of the central opening of the neck portion and on the connection portion on the chest portion will be lower.

[0017] The first and the second elongated face portions may extend from the C-shaped neck portion at a common location or at different locations along the outer peripheral edge portion of the airbag.

[0018] The airbag may further comprise a first and a second shoulder portion, and each shoulder portion may comprise at least one, and preferably at least two elongated connection portions in which a first wall and a second wall of the airbag are connected. The provision of elongated connection portions has shown to be very efficient to facilitate the conformation of the shoulder portions to the wearers body. The elongated portions have an extension from the rear side towards the front side of the wearers body. Especially, the elongated shape has shown to provide a surprisingly better conformation capability than a circular shape.

[0019] The airbag may further comprise a gas inlet portion configured to be connected to an inflator, said gas inlet portion being arranged in a position between the first and second elongated face portions; in a position between an elongated face portion and a shoulder portion; or in an inner peripheral edge portion of the central opening of the C-shaped neck portion.

[0020] The airbag may be woven in one piece to define a unitary inflatable cavity. Alternatively, the airbag may be formed by two panels being joined by sewing, welding or adhesive bonding to define a unitary inflatable cavity.

[0021] The first and the second elongated face portions may be formed separately from the C-shaped neck portion and be joined to the C-shaped neck portion to thereby define a unitary inflatable cavity.

[0022] The airbag may be woven in one piece to define a unitary inflatable cavity, and the first and the second elongated face portions may be detached from a first position of the one-piece woven airbag and then re-attached to the airbag in a different position. This allows a better loom layout and a greater design freedom when weaving the airbag in one piece. The elongated face portions may by way of example be woven by extending from an outer peripheral edge of the C-shaped neck portion. After weaving, the elongated face portions may be detached and then re-attached to the inner peripheral edge portion of the central opening of the C-shaped neck portion.

[0023] The first and the second elongated face portions may be detached from an outer peripheral edge portion of the C-shaped neck portion and re-attached to an inner peripheral edge portion of the central opening.

[0024] The airbag may comprise one or more tethers. The tethers may be integrated into the airbag during weaving the airbag in one piece. This is known in the field as woven-in-tethers, WIT. The tethers may also be provided as straps, springs or seams that are arranged when manufacturing the airbag. The tethers, no matter type, may be used to control and/or facilitate the deployment of the airbag as it is inflated.

[0025] One of two opposing wall portions in an interface between the C-shaped neck portion and the first and second elongated face portions may be provided with a biasing member configured to facilitate a separation of the two opposing wall portions during an inflation of the airbag. The biasing means may be a tether or a seam. The biasing means may even be a combination of a tether and a seam. The seam may form a fold. By separating the two wall portions, a faster and more uniform inflation may be provided for.

[0026] According to another aspect, the invention refers to a wearable safety system comprising a harness to be worn on the torso of a wearer, said harness supporting an airbag according to any of claims 1-14, and wherein the C-shaped neck portion, the first and second elongated face portions and the first and second shoulder portions of the airbag are received in an upper portion of a back panel of the harness, and wherein the first and

second chest portions are received in a respective shoulder strap of the harness.

Brief description of the drawings

[0027] 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 discloses one embodiment of an airbag forming part of the invention.

Fig. 2 highly schematically discloses one way of manufacturing an airbag.

Fig. 3 discloses a second embodiment of an airbag forming part of the invention.

Fig. 4 discloses a third embodiment of an airbag forming part of the invention.

Fig. 5A is a schematic front view of the airbag in the inflated and deployed condition when worn on the body of a user.

Fig. 5B is a side view of the airbag in the inflated and deployed condition when worn on the body of a user.

Fig. 5C is a rear view of the airbag in the inflated and deployed condition when worn on the body of a user.

Fig. 6 discloses one embodiment of a harness forming part of the wearable system according to the invention.

Detailed description

[0028] 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.

[0029] Starting with Fig. 1, one schematic illustration of one embodiment of the airbag 100 is disclosed in its flat condition. The airbag 100 is configured to be folded and/or rolled into a compact body before being arranged in a harness.

[0030] The airbag 100 is formed as one unitary inflatable cavity 1. The cavity 1 is defined by a first and a second wall 2, 3 which are arranged flat, one on top of the other. Thus, only one of the two walls 2, 3 is shown.

[0031] The airbag 100 may be woven in one piece to define the unitary inflatable cavity 1. This is known in the art as one-piece-weaving, OPW. Alternatively, the airbag 100 may be formed by two panels that are joined by sewing, welding or adhesive bonding to define the unitary inflatable cavity 1. The first and second walls 2, 3 are substantially identical.

[0032] The airbag 100 will, in order of facilitating the

explanation and understanding of the invention, be divided into different virtual "portions" - a C-shaped neck portion 4, a first and a second elongated face portion 5, two shoulder portions 6, and two chest portions 7. These portions 4, 5, 6, 7 are all virtual portions and part of the unitary inflatable cavity 1. The two elongated face portions 5, the two shoulder portions 6 and the two chest portions 7 radiate out from the central C-shaped neck portion 4.

[0033] The airbag 100 comprises an outer peripheral edge portion 8. The edge portion 8 is continuous. Depending on how the airbag 100 is formed, the edge portion 8 may have different properties. In the event of a woven airbag, the edge portion 8 may be a woven portion which has a locally increased thickness or a locally higher strength. The edge portion may also be seen as a fold. In the event of a sewn or welded airbag, the edge portion 8 may be a fold, a seam or a weld. The edge portion may have a uniform width. Alternatively, it may have a non-uniform width. The edge portion may be provided with locally formed tabs that may be used when connecting the airbag to a harness.

[0034] The C-shaped neck portion 4 is configured to partially encircle the neck of the user as seen in a condition when the airbag 100 is inflated. The C-shaped neck portion 4 forms a mouth 9 that merges with a central opening 10. The central opening 10 is configured to receive the neck of a user. The peripheral edge portion 8 is continuous, whereby it also extends along two opposing edges 12 along the mouth 9 and along an inner peripheral edge 11 of the central opening 10. The central opening 10 is preferably substantially circular or oval.

[0035] The airbag 100 is preferably substantially mirror symmetric about a longitudinal centreline L that extends along the two opposing edges 12 of the mouth 9. Hence, unless nothing specific is said, only one side of the airbag 100 is discussed in detail below.

[0036] The first and the second elongated face portions 5 extend from the C-shaped neck portion 4 in an area opposite the mouth 9. The elongated face portions 5 are disclosed as extending from the C-shaped neck portion 4 at a common location. The skilled person realises that the two elongated face portions 5 with remained function may extend from different locations along the peripheral edge portion 8.

[0037] Each elongated face portion 5 is disclosed as having a first section 13 arranged closest to the C-shaped neck portion 4 and a second section 14 arranged at its free end. The width W2 of the second section 14 is disclosed as exceeding the width W1 of the first section 13. The second sections 14 are configured to extend across the users' face in the event the airbag 100 should be inflated.

[0038] The second sections 14 are each provided with elongated connection portions 15 where the two walls 2, 3 of the airbag 100 are connected. The connection portions 15 contribute to the shaping of the face portions 5 as seen in the inflated condition. This will be better described below.

[0039] The two shoulder portions 6 are arranged in a position between the two face portions 5 and the two chest portions 7. Each shoulder portion 6 is disclosed as comprising two elongated connection portions 16 in which the two walls 2, 3 of the airbag 100 are connected. The provision of elongated connection portions 16 have shown to be very efficient to facilitate the conformation of the shoulder portions 6 to the user's body. The elongated connection portions 16 have an extension from the rear side towards the front side of the user's body. Especially, the elongated shape has shown to provide a surprisingly better conformation capability than a circular shape.

[0040] The two elongated chest portions 7 extend from the C-shaped neck portion 4 in an area adjacent the mouth 9, and on opposite sides of the mouth 9. Thus, the two chest portions 7 extend from the C-shaped neck portion 4 in an area opposite the two elongated face portions 5. The chest portions 7 are configured to provide a protection to the thorax area of the user in the event of the airbag 100 should be inflated and deployed.

[0041] Each chest portion 7 is disclosed as having an elongated connection portion 17 in which the two walls 2, 3 of the airbag 100 are connected. The connection portions 17 are configured to facilitate the conformation of the chest portions to the user's body.

[0042] Each connection portion 17 is disclosed as being provided with a throughgoing opening 18. The opening 18 is configured to allow the airbag 100 to be removably connected a harness. This may be made by a button or a T-shaped member that is configured to be received in the opening. The skilled person realises that also other types of connectors may be used. The opening may even be omitted.

[0043] The airbag 100 further comprises a gas inlet portion 19. The gas inlet portion 19 is configured to be connected to a non-disclosed inflator in a manner that as such is well known in the art and not further described.

[0044] The gas inlet portion 19 is illustrated as being arranged in a position between one of the elongated face portions 5 and a shoulder portion 6. The skilled person realises that other positions are equally possible. The gas inlet portion 19 may by way of example be arranged in a position between the two elongated face portions 5 or in a position along the inner periphery 11 of the central opening 10 of the C-shaped neck portion 4. The skilled person realises that the airbag 100 may comprise more than one gas inlet portion. No matter position, it is preferred that the position is chosen so that the airbag 100 is substantially symmetrically inflated and deployed in the event of an accident.

[0045] Each elongated face portion 5 has two opposing long sides. One of the two opposing long sides of each face portion 5 comprises a first attachment portion 20. The first attachment portion 20 is provided as an elongated tab 21. The tab 21 projects away from the outer peripheral edge 8 of the airbag 100. By arranging the tabs 21 to project away from the peripheral edge 8 instead

of towards the interior of the airbag 100, there is no undue flow-restriction during inflation.

[0046] The first attachment portions 20 are configured to be attached to a respective inner peripheral connection portion 23 of the central opening 10 in an area adjacent the opposing edges 12 of the mouth 9. The first and the second connection portions 20, 22 are arranged on opposite sides of the mouth 9. The attachment may be made by sewing, welding or adhesive bonding. The attachment may alternatively be made by any mechanical connecting means, such as a button or a rivet.

[0047] The respective first attachment portions 20 do preferably have an elongated shape that allows an elongated connection to a respective inner peripheral connection portion 23 of the central opening 10. It is advantageous if each first attachment portion 20 has a length that allows a connection along at least 5-25 % of the full length of the inner peripheral connection portion 23 of the central opening 10.

[0048] Further, one of the two opposing long sides of each face portion 5 comprises an optional second attachment portion 22. The first and second attachment portions 20, 22 are preferably arranged along the same long side. The first attachment portion 20 is arranged closer to the neck portion 4 than the second attachment portion 22. The second attachment portions are provided as tabs 24. The tabs 24 project away from the outer peripheral edge 8 of the airbag 100. Thereby there is no undue flow-restriction during inflation.

[0049] The second attachment portions 22 are configured to be attached to the first and the second chest portions 7, respectively. The second attachment portions 22 are configured to be attached to the respective chest portions 7 in a connection portion 25 where the two walls 2, 3 making up the airbag 100 are connected. The attachment may be made by sewing, welding or adhesive bonding. The attachment may alternatively be made by any mechanical connecting means, such as a button or a rivet.

[0050] To allow the first and the second attachment portions 20, 22 to be attached to the respective connection portions 23, 25, it is required that the two elongated face portions 5 are folded over in a direction towards the respective chest portions. This is schematically disclosed by the arrows in Fig. 1. In the event the first and the second elongated face portions 5 extend from the C-shaped neck portion 4 in an area along an outer peripheral edge 8 of the airbag 100 as is disclosed in Fig. 1, the two elongated face portions 5 will fold over substantially 180 degrees. The folding will be made in the area marked as A in Fig. 1.

[0051] It is to be stressed that the first and the second attachment portions 20, 22 are attached to the respective connection portions 23, 25 along the inner peripheral connection portion 23 of the central opening 10 and to the chest portions 7 before the airbag 100 is folded and/or rolled into a suitable format that allows the airbag 100 to be received in the harness of a wearable item.

[0052] The airbag 100 may comprise one or more tethers 26. The tethers 26 may be integrated with the airbag 100 during weaving the airbag 100 in one piece. This is known in the field as woven-in-tethers, WIT. The tethers 26 may also be provided as straps, springs or seams that are arranged when manufacturing the airbag 100. The tethers 26, no matter type, may be used to control and/or facilitate the deployment of the airbag 100 as it is inflated. One such tether 26 is disclosed, highly schematically in the respective shoulder portions 6. The skilled person realises that the number of tethers and their positions may vary within the scope of the invention.

[0053] One of two opposing wall portions 2, 3 in an interface between the C-shaped neck portion 4 and the first and second elongated face portions 5 may be provided with a biasing member 27 configured to facilitate a local separation of the two opposing walls 2, 3 during inflation of the airbag 100. The biasing means 27 may be a tether or a seam. The biasing means may even be a combination of a tether and a seam. A seam may be arranged to form a fold in one of the two walls. The biasing means 27 is preferably arranged in the area A where a fold is formed when the two elongated face portions 5 are folded over in a direction towards the respective chest portions 7 to allow the first and the second attachment portions 20, 22 to be attached to the respective connection portions 23, 25.

[0054] Now turning to Fig. 2, an alternative way of manufacturing the airbag 100 is disclosed. As given above, the airbag 100 may be woven in one piece to define a unitary inflatable cavity. The so called one-piece-weaving technique (OPW) does however have some limitations when it comes the positioning of the two elongated face portions. From an inflation and deployment aspect, it may sometimes be more favourable to let the elongated face portions 5 extend from the peripheral edge portion of the central opening 10 of the C-shaped neck portion 4. This position is however difficult to accomplish from a weaving standpoint. The advantage of arranging the elongated face portions 5 to extend from the inner peripheral edge of the central opening 10 is that a faster inflation is allowed and hence a faster deployment of the airbag 100 in the event of an accident. There is no need for the 180 degrees folding over. To overcome this, the technique to be described below may be used.

[0055] The airbag 100 is woven in one piece to define a unitary inflatable cavity 1. The elongated face portions 5 are woven to extend from the outer peripheral edge 8 of the airbag 100.

[0056] After weaving, the elongated face portion/s 5 is detached by cutting. The thus-cut-off face portion 50 is re-attached in a different position, such as along the peripheral edge 11 of the central opening 10 of the C-shaped neck portion 4. The peripheral edge 11 of the central opening 10 is provided with an elongated tube 28 to facilitate the re-attachment. Any remaining portion 29 after detaching the elongated face portions 5 may be used as a gas inlet portion. The skilled person realises

that the joint between the two pieces to be attached may be formed in a number of ways, not further discussed.

[0057] This methodology of one-piece-weaving a unitary inflatable cavity 1, and then detaching and re-attaching a portion 5, 50 allows a better loom layout and a greater design freedom when weaving the airbag 100 in one piece.

[0058] The skilled person realises that the first and the second elongated face portions 5 in yet another embodiment may be formed separately from the C-shaped neck portion 4 and be joined to the C-shaped neck portion 4 to thereby define a unitary inflatable cavity 1.

[0059] Now turning to Fig. 3, a second embodiment of an airbag 100' is disclosed. The embodiment of Fig. 3 has the overall same design as that discussed above with reference to Fig. 1. The two elongated face portions 5 differ slightly in the design of the second sections 14 by being mirrored in view of the embodiment of Fig. 1. The first elongated attachment portions 20 are arranged along the two opposing long sides of the first and second elongated face portions 5. The two elongated attachment portions 20 are configured, just as in the first embodiment of Fig. 1, to be connected to a respective inner peripheral connection portion 23 of the central opening 10 in an area adjacent the opposing edge portions 12 of the mouth 9. The attachment may be made by sewing, welding or adhesive bonding, or by using mechanical connecting means such as a buttons or rivets. It is advantageous if each attachment portion 20 has a length that allows a connection along at least 5-25 % of the full length of the inner peripheral connection portion 23 of the central opening 10.

[0060] The embodiment of Fig. 3 does not have any attachment portions that are configured to connect to the two chest portions 7. Further, as yet another difference to the embodiment of Fig. 1, the edge portion of the central opening 10 in the C-shaped neck portion 4 is provided with a gas inlet 19 that is configured to be connected to a non-disclosed gas injector.

[0061] Turning to Fig. 4, a third embodiment of an airbag 100" is disclosed highly schematically. The gas inlet 19 is arranged in a position between the two elongated face portions 5.

[0062] Now turning to Figs 5A-5C, three different views of an airbag 100 according to the invention is disclosed in its inflated and fully deployed condition and as worn on a wearers body. The airbag 100 is of the same type that is disclosed in Fig. 1.

[0063] Fig. 5A discloses a front view, from which it can be seen how the chest and shoulder portions 6, 7 extend across the thorax area and the shoulders of the wearer and also how the second sections 14 of the first and second elongated face portions 5 extend across the facial area. The tabs 24 of the two second attachment portions 22 are shown as connecting to a respective connecting portion 25 of the two chest portions 7. It should be stressed that the two first attachment portions connecting to the respective connecting portions of the central open-

ing of the C-shaped neck portion will be hidden when the airbag 100 is inflated and are hence not illustrated in Figs. 5A-5C.

[0064] Fig. 5B discloses a side view, from which it can be seen how the chest and shoulder portions 6, 7 of the airbag 100 extend across the thorax area and the shoulders and also how the first and second sections 14 of the first and second elongated face portions 5 extend across the facial area. Especially, it can be seen how the different widths W1 and W2 of the first and second sections 13, 14 of the elongated face portions 5 allow the user to wear a helmet if wanted. It can also be seen how the airbag 100, via a gas inlet 19 communicates with a gas generator 201 that is supported by a back panel 202 forming part of a harness 200.

[0065] Fig. 5C discloses a rear view, from which it may be seen how the two elongated face portions 5 extend from the C-shaped neck portion 4 and are folded substantially 180 degrees, see arrow, to allow a protection of the facial area of the user. The gas injector 201 that is supported by the back panel 202 of the harness 200 is connected to the gas inlet 19. The gas inlet 19 is in this embodiment arranged in a position between one of the two shoulder portions 6 and the elongated face portions 5.

[0066] Now turning to Fig. 6, one embodiment of a harness 200 to be worn on the torso of a wearer is disclosed. The harness is thus part of a wearable safety system. The harness 200 is disclosed as being part of a backpack. The airbag (not shown), which as such has a design as described above, is folded and/or rolled before being arranged in the harness. The C-shaped neck portion, the first and second elongated face portions and the first and second shoulder portions of the airbag are received in an upper portion of a back panel of the harness. The first and the second chest portions are received in a respective shoulder strap of the harness.

[0067] The back panel and the two shoulder straps are each provided with a split line to allow a controlled rupturing as the airbag is inflated.

[0068] Accordingly, the invention refers to an airbag that is configured to be part of a wearable safety system to allow a facial protection. To obtain a good coverage of both the face and the thorax area, the airbag needs to be tightly closed around the users face and body when inflated and deployed. The C-shaped neck portion, having a mouth merging with a central opening creates a robust closing function around the user's neck. As the thus formed, substantially round neck portion is inflated, it will contribute to the guiding of the other portions of the airbag, such as the first and second face to a position across the face of the user. This guidance is facilitated not only by the C-shaped body as such, but also by the first and the second first-type attachment portions of the first and second elongated face portions. These attachment portions are attached to a respective inner peripheral edge portion of the central opening of the neck portion in an area adjacent, and on opposite sides of the

mouth of the neck portion. Thus, the first and second elongated face portions merge and extend from a rear end of the C-shaped neck portion in an area opposite the mouth to a front end of the C-shaped neck portion adjacent its mouth. Thereby, the airbag will, in an inflated and deployed condition, form a portion that primarily extends around the user's neck and a portion that primarily extends above the neck portion and from the user's rear neck towards the user's facial area. Thus, not only does a thus inflated and deployed airbag protect the user's facial area, but it also encircles the neck.

[0069] The skilled person realises that a number of modifications of the embodiments described herein are possible without departing from the scope of the invention, which is defined in the appended claims.

Claims

1. An airbag configured to be part of a wearable safety system to allow the provision of a facial protection, the airbag (100) comprising, as seen in a flat, non-inflated condition:
 - a C-shaped neck portion (4) defining a mouth (9) merging with a central opening (10) configured to receive the neck of a user, whereby the neck portion (4) is allowed to partially encircle the neck of the user;
 - a first and a second elongated face portion (5) extending from the C-shaped neck portion (4) in an area opposite the mouth (9), each face portion (5) having two opposing long sides; wherein a first attachment portion (20) of one of the two opposing long sides of the first face portion (5) is attached to an inner peripheral edge portion (23) of the central opening (10) in an area adjacent a first edge portion (12) of the mouth (9), and a first attachment portion (22) of one of the two opposing long sides of the second face portion (5) is attached to an inner peripheral edge portion (23) of the central opening (10) in an area adjacent a second edge portion (12) of the mouth (9).
2. The airbag according to claim 1, wherein the first and the second elongated face portions (5) extend from the C-shaped neck portion (4) in an area along an outer peripheral edge portion (8) of the airbag (100), or from the inner peripheral edge portion (11) of the central opening (10) of the C-shaped neck portion (4).
3. The airbag according to claim 1 or 2, further comprising a first and a second elongated chest portion (7) extending from the C-shaped neck portion (4) in an area adjacent the mouth (9), and on opposite sides of the mouth (9).

4. The airbag according to claim 3, wherein a second attachment portion (22) of one of the two opposing long sides of the first elongated face portion (5) is attached to the first chest portion (7), and a second attachment portion (22) of one of the two opposing long sides of the second elongated face portion (5) is attached to the second chest portion (7). 5
5. The airbag according to claim 4, wherein the first and/or the second attachment portions (22) of the first and second elongated face portions (5) are provided as tabs (24) projecting away from an outer peripheral edge (8) of the airbag (100). 10
6. The airbag according to any of the preceding claims, wherein the first and the second elongated face portions (5) extend from the C-shaped neck portion (4) at a common location or at different locations along the outer peripheral edge portion (8) of the airbag (100). 15
7. The airbag according to any of the preceding claims, further comprising a first and a second shoulder portion (6), and wherein each shoulder portion (6) comprises at least one, and preferably at least two, elongated portions (16) in which a first wall (2) and a second wall (3) of the airbag (100) are connected. 20 25
8. The airbag according to any of the preceding claims, further comprising a gas inlet portion (19) configured to be connected to an inflator, said gas inlet portion (19) being arranged in a position between the first and second elongated face portions (5); in a position between an elongated face portion (5) and a shoulder portion (6); or in an inner peripheral edge portion (11) of the central opening (10) of the C-shaped neck portion (4). 30 35
9. The airbag according to any of the preceding claims, wherein the airbag (100) is woven in one piece to define a unitary inflatable cavity (1); or wherein the airbag (100) is formed by two panels being joined by sewing, welding or adhesive bonding to define a unitary inflatable cavity (1). 40 45
10. The airbag according to any of claims 1-8, wherein the first and the second elongated face portions (5) are formed separately from the C-shaped neck portion (4) and are joined to the C-shaped neck portion (4) to thereby define a unitary inflatable cavity (1). 50
11. The airbag according to claims 1-8, wherein the airbag (100) is woven in one piece to define a unitary inflatable cavity (1), and wherein the first and the second elongated face portions (5) are detached from a first position of the one-piece woven airbag (100) and then re-attached to the airbag (100) in a different position. 55
12. The airbag according to claim 11, wherein the first and the second elongated face portions (5) are detached from an outer peripheral edge portion of the C-shaped neck portion (4) and re-attached to an inner peripheral edge portion (11) of the central opening (10).
13. The airbag according to any of the preceding claims, wherein the airbag (100) comprises one or more tethers (26; 27).
14. The airbag according to any of the preceding claims, wherein one of two opposing wall portions (2, 3) in an interface between the C-shaped neck portion (4) and the first and second elongated face portions (5) is provided with a biasing member (27) configured to facilitate a separation of the two opposing wall portions during an inflation of the airbag (100).
15. A wearable safety system comprising a harness (200) to be worn on the torso of a wearer, said harness (200) supporting an airbag (100) according to any of claims 1-14, and wherein the C-shaped neck portion (4), the first and second elongated face portions (5) and the first and second shoulder portions (6) of the airbag (100) are received in an upper portion (203) of a back panel (202) of the harness (200), and wherein the first and second chest portions (7) are received in a respective shoulder strap (204) of the harness (200).

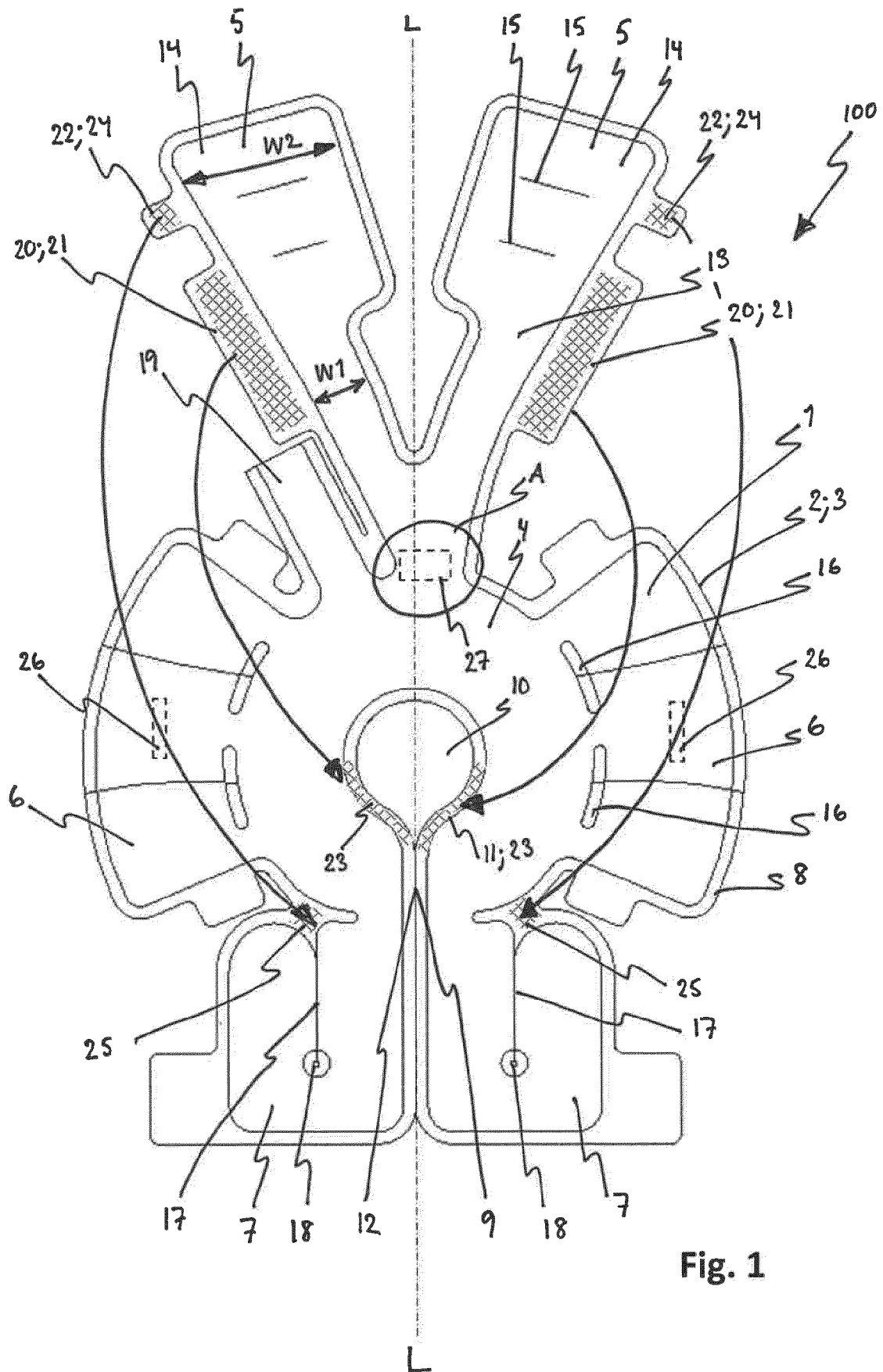
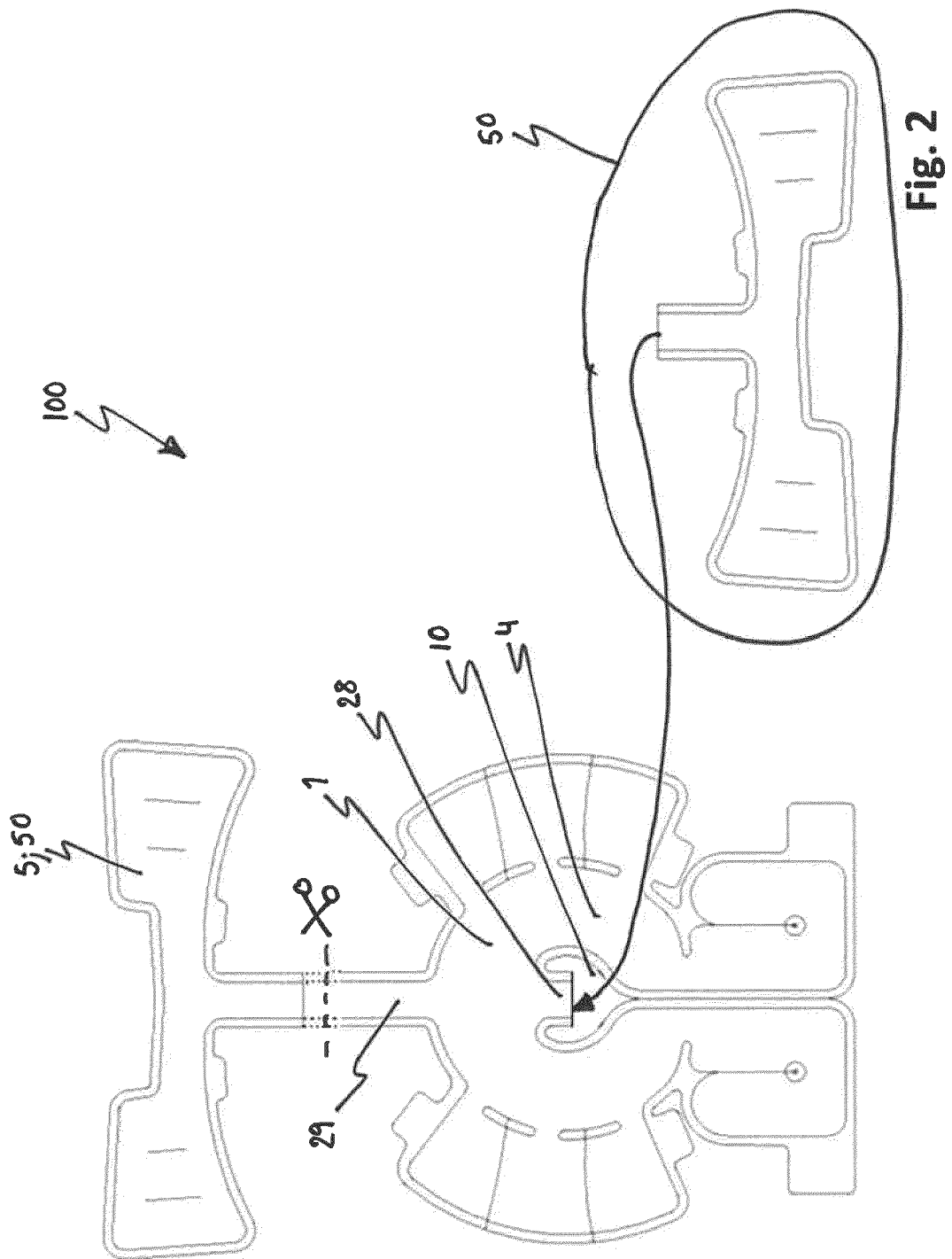


Fig. 1



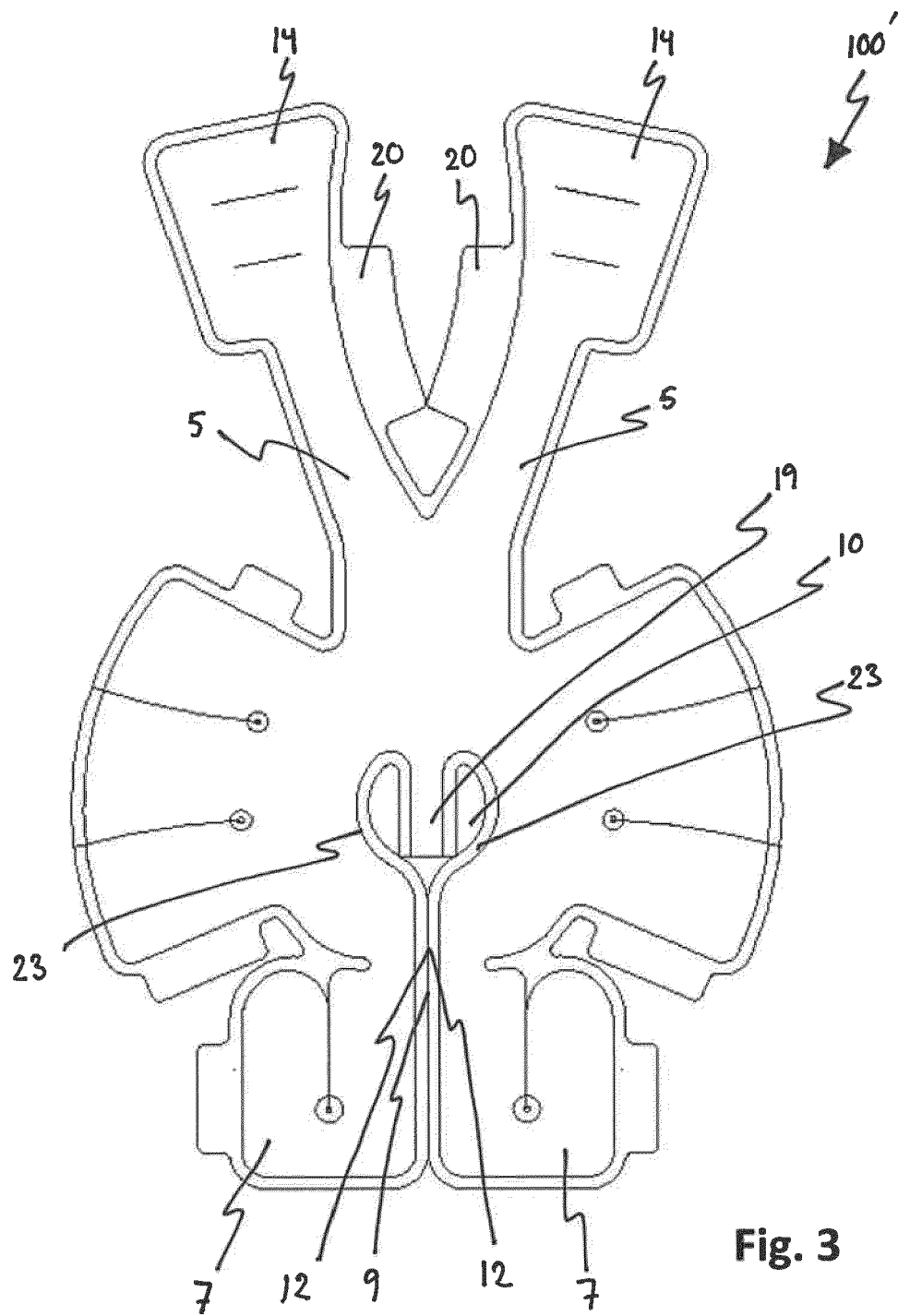


Fig. 3

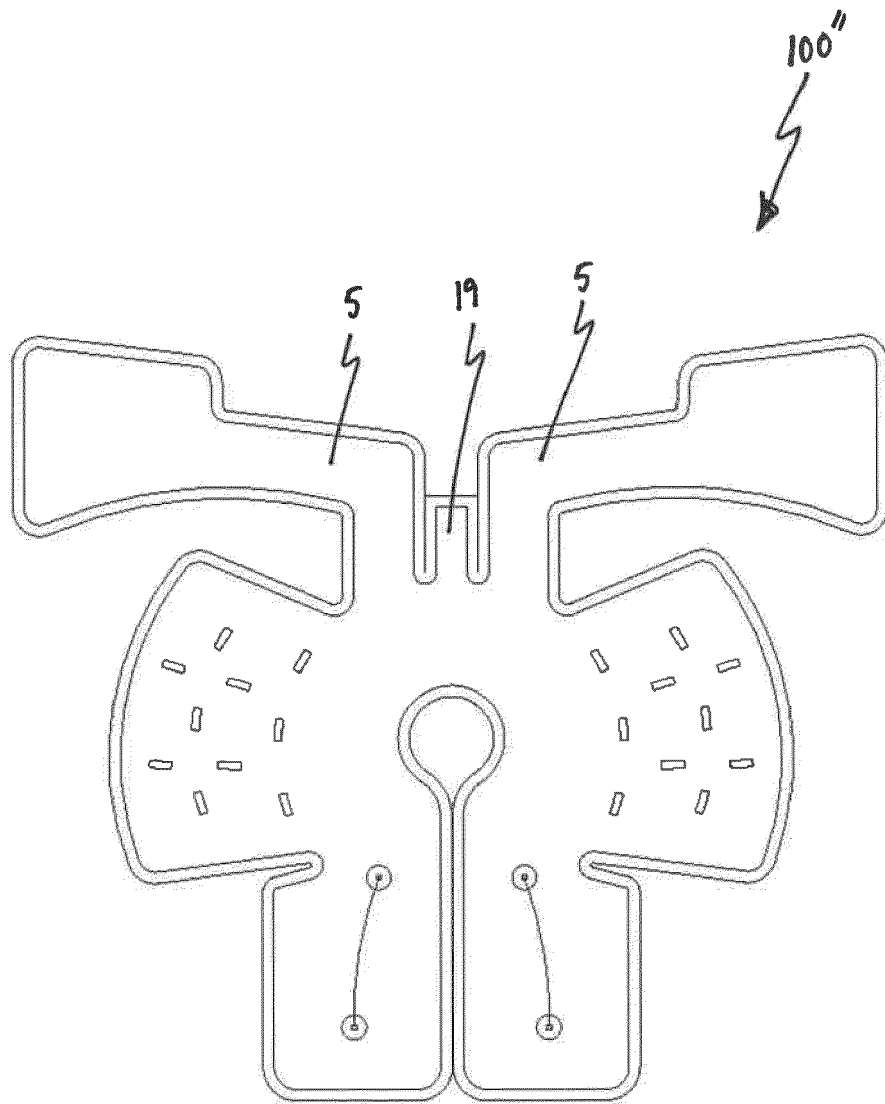


Fig. 4

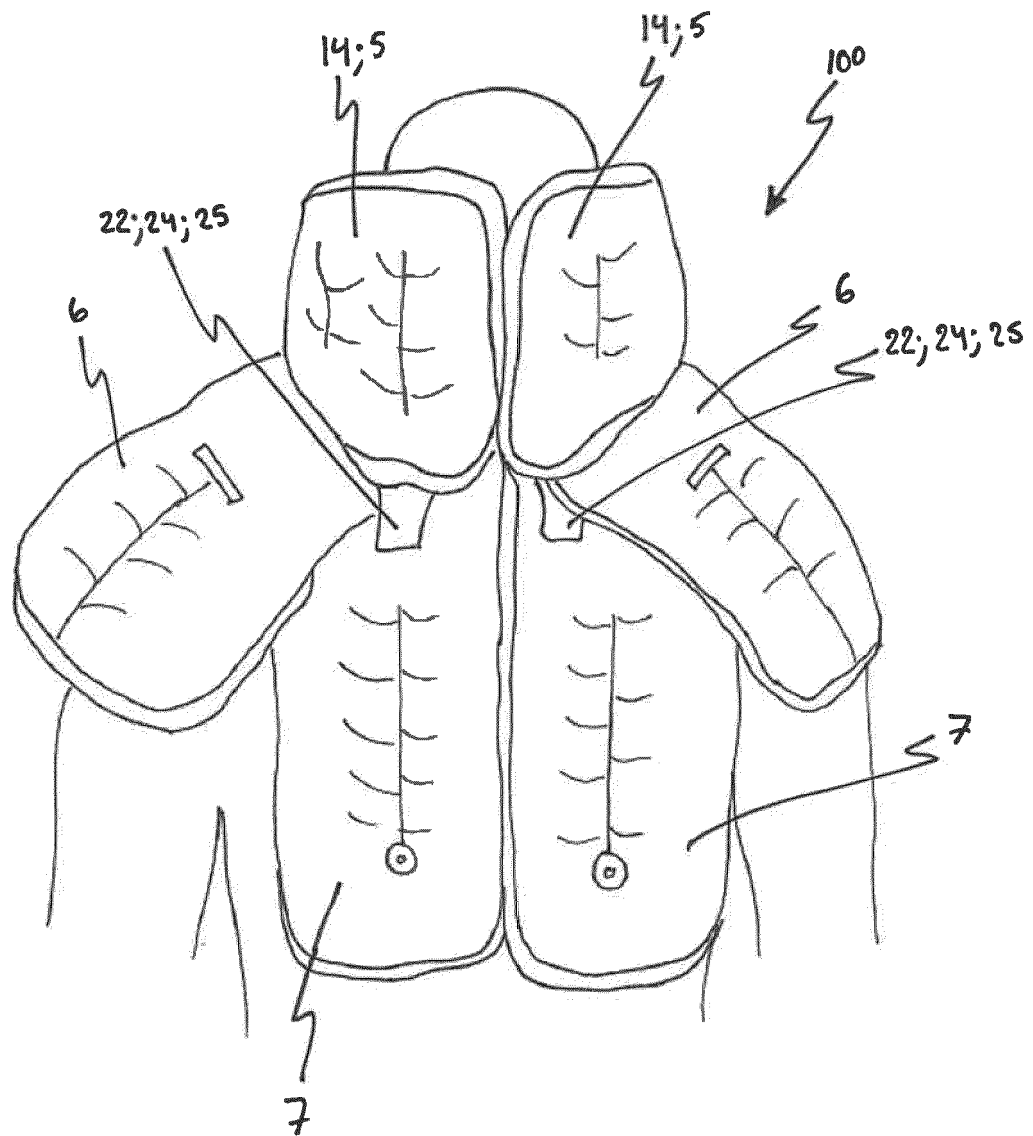


Fig. 5A

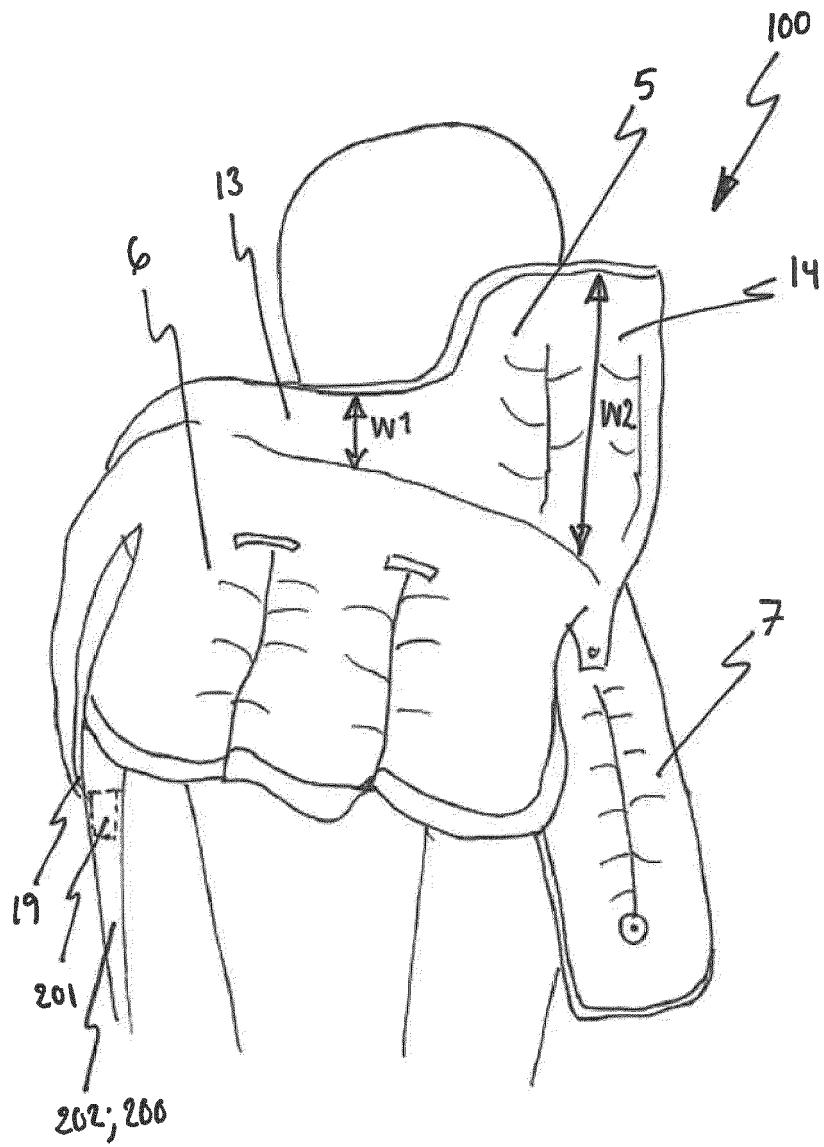


Fig. 5B

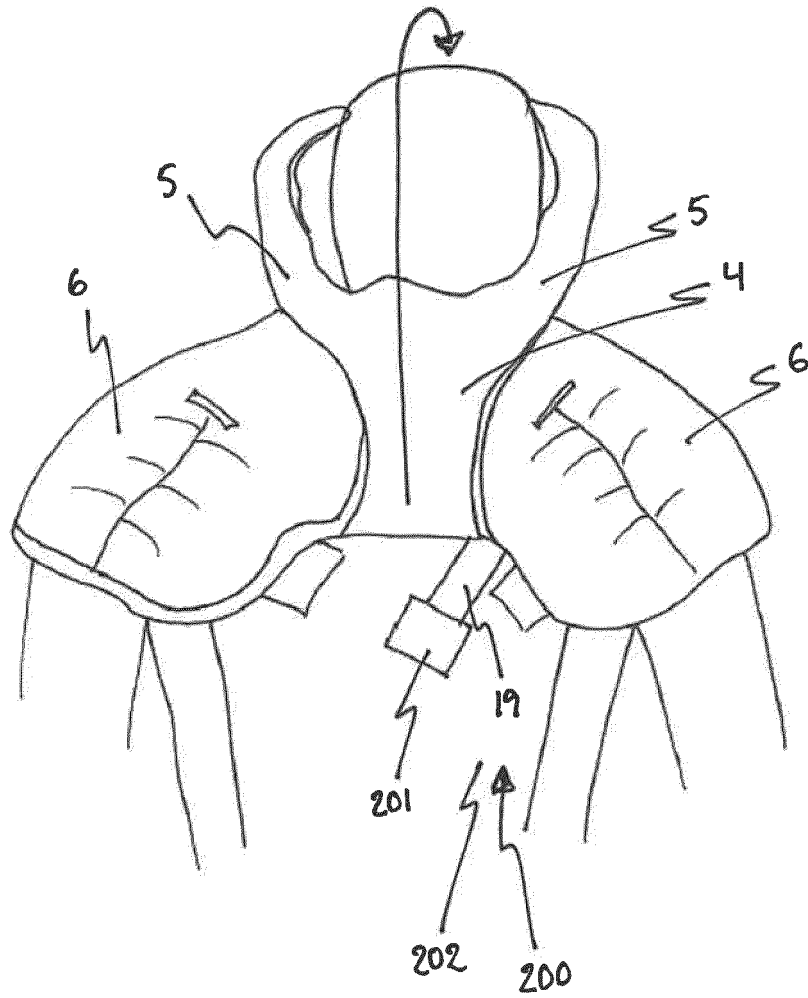


Fig. 5C

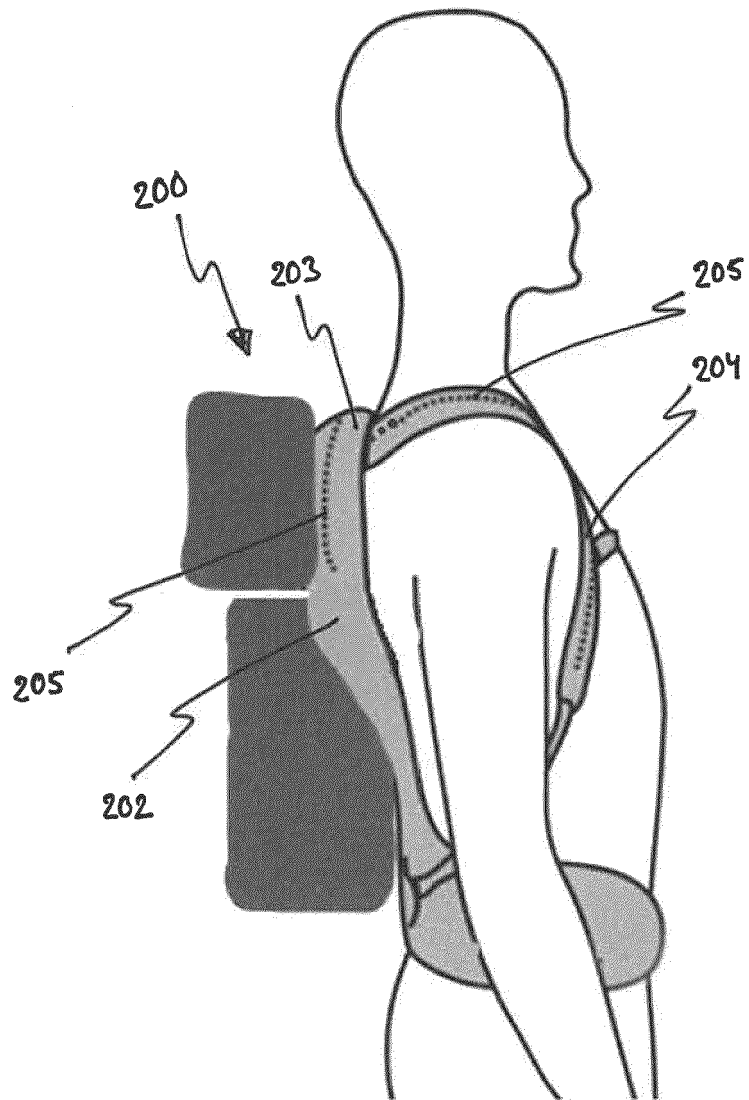


Fig. 6



EUROPEAN SEARCH REPORT

Application Number

EP 23 16 3030

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	CN 113 749 321 A (SUZHOU YIDAIBAO INTELLIGENT TECH CO LTD) 7 December 2021 (2021-12-07) * figures 1, 2 *	1-15	INV. A41D13/015 A41D13/018 A41D13/05 A42B3/04
A	DE 93 14 728 U1 (HESTERMANN KAI [DE]) 13 January 1994 (1994-01-13) * figures 1, 2 *	1-15	
			TECHNICAL FIELDS SEARCHED (IPC)
			A41D A42B
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		19 July 2023	Krüger, Sophia
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		& : member of the same patent family, corresponding document	

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

EP 23 16 3030

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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19-07-2023

10	Patent document cited in search report	Publication date	Patent family member(s)	Publication date
	CN 113749321 A	07-12-2021	NONE	
15	DE 9314728 U1	13-01-1994	NONE	
20				
25				
30				
35				
40				
45				
50				
55				

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