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(54) **WEARABLE PROTECTIVE DEVICE**

(57) The present disclosure relates to a wearable protective device (100) for at least partially protecting the torso of a user and a method for operating the wearable protective device (100). The wearable protective device (100) comprises an inflatable element (20) configured to be able to assume a deflated condition and an inflated condition. The wearable device (100) includes a layer (30) having one side facing an internal user-side area. The layer (30) comprises at least one back portion (34) intended to cover a user's back. The back portion (34) comprises a right lateral peripheral portion (31), a left lateral peripheral portion (35), a first free edge towards the neck (55), or neck-side free edge, and a second free edge (52) towards the bottom of the back, or back bottom-side free edge. The wearable protective device (100) includes an access opening (50) for accessing the inflatable element (20) and/or other component of the personal protection device. The access opening (50) extends at least partially along a perimeter of the back portion, except for, or apart from, an edge selected from among the right lateral peripheral edge (31), the left lateral peripheral edge (35), said first free edge (55) of the back portion (34) and said second free edge (52) of the back portion (34). The wearable protective device includes a closure device (56) for closing at least partially said access opening (50).

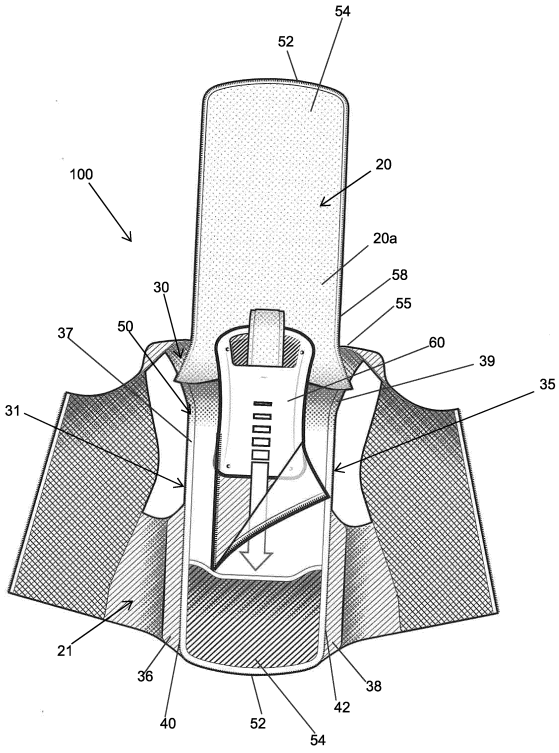

FIG. 1

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Description

[0001] The present disclosure relates in general to a personal protection device intended to protect a user when performing an activity. In particular, the present disclosure relates to a personal protection device of the wearable type, referred to below as "wearable protective device", comprising an inflatable element. The present disclosure relates furthermore to a method for operating a wearable protective device.

[0002] During recent years, following constant research into safety during all sporting activities, but more generally all those dangerous activities practised in extreme conditions, or at high speeds, in particular in the motorcycling sector, there has been an increase in the wearable protective devices which have been developed with a view to providing both practical and effective protection of the upper portion of a user's body, with the aid of an inflatable element. During an impact, a sliding action or generally a fall, the inflatable bag is placed in fluid communication with a gas or fluid source. A gas or fluid source is for example a compressed-gas canister or more generally a device able to generate a pressurised fluid, also called fluid generator. In the inflated condition, the inflatable element creates an energy absorption cushion around the portion of the user's body.

[0003] An impact may be detected by means of sensors, such as accelerometers, position sensors, or similar sensors known in the sector, the detected data thereof being processed by a control unit of the electronic type which, in the event of given parameters or threshold values being exceeded, sends an activation signal, or "triggering command" to the gas source. The assembly comprising, the sensors, the electronic control unit and the gas source may be understood as being a functional component assembly of the wearable protective device.

[0004] Generally, the wearable protective device is configured as a garment for covering the torso and, consequently, since it consists of a wearable protective device, the inflatable element normally has a shape or form similar to that of a jacket or vest such that it may be easily worn as such by a user or in any case such that it covers the most important zones of the torso.

[0005] The inflatable element is arranged hidden underneath further layers, such as the inner or outer layers of the wearable protective device. These layers form an internal and external covering, which defines a kind of pocket inside which the inflatable element is housed. The internal covering may coincide, at least partly, with the lining of the wearable protective device

[0006] It may be understood that sometimes it is required to access the inflatable element or a component of the functional component assembly, for example, in order to remove or replace the inflatable element, if necessary, or replace or carry out maintenance on a component of the functional component assembly.

[0007] For this purpose one or more access openings are provided. The access openings are usually provided on the inner layer, namely on the lining, so as to limit the negative visual impact of the wearable protective device.

[0008] It may be understood that, since the garments in question have internal components which are heavier, when it is required to access these internal components, for example, in order to access the inflatable element or functional components, the entire wearable protective device, or just the lining, must always be kept still, making sure that there is no undesirable movement of the entire wearable protective device. Basically, when removing the inflatable element, or other component of the functional component assembly, it is necessary to prevent all of the remaining part of the device from also moving, which would make it impractical to use, or also the external covering from moving, which would generally make fitting/removal of the inflatable element or other component difficult or awkward, in particular when the user is travelling or performing a dynamic activity and has to stop unexpectedly in order to replace it.

[0009] A technical problem underlying the present disclosure is therefore that of providing a wearable protective device which is able to offer an adequate degree of protection by means of an inflatable element, but in which the inflatable element and/or other component of the functional component assembly may be easily accessed for removal or repair, avoiding or reducing the difficult direct insertion or removal operations, and in which, at the same time, the access openings are visible as little as possible so as not to affect the aesthetic appearance of the wearable protective device.

[0010] In order to solve the said technical problem, a wearable protective device and a method for operating a wearable device are provided, the main characteristics of said device and method being described in the respective independent claims.

[0011] Secondary characteristics of the subject of the present disclosure are defined in the corresponding dependent claims.

[0012] The present disclosure arises from the technical problem of providing a wearable protective device and a respective method for operating a wearable protective device which are able to satisfy the requirements mentioned above with reference to the prior art and which at the same time do not have a negative impact on the aesthetic appearance.

[0013] This is obtained by means of a wearable protective device and a method for operating a wearable protective device according to the respective independent claims. Secondary characteristics of the subject of the present disclosure are defined in the corresponding dependent claims.

[0014] In particular, in accordance with the present disclosure, a wearable protective device for at least partially protecting the torso of a user is proposed, the wearable protective device including a layer having an inner side designed to face an internal user-side area. In other words, the layer has an inner side, or user side, designed to face a user's body, namely the layer includes

a surface, or side, which is directed towards the user when the wearable protective device is worn by the user.

[0015] The layer comprises at least one back portion designed to cover the back of a user, wherein the back portion comprises a right lateral peripheral edge, a left lateral peripheral edge, a first free edge towards the neck, or neck-side free edge, and a second free edge towards the bottom of the back, or back bottom-side free edge.

[0016] The wearable protective device further comprises at least one inflatable element. Consequently, said layer may act as a user side or inner side covering, or lining, for the inflatable element where the latter is present, namely in the areas of the torso where the inflatable element is present. Preferably, the back portion of said layer covers also a back portion of the inflatable element.

[0017] The layer of the wearable protective device includes an access opening for accessing the inflatable element, or other component of the wearable protective device, wherein said access opening extends at least partially along a perimeter of said back portion, with the exception of, or apart from, an edge selected from among the right lateral peripheral edge, the left lateral peripheral edge of the back portion, the first free edge of the back portion and the second free edge of the back portion, so that the back portion may be opened, preferably in its entirety, in the manner of a book. In other words, owing to the perimetral arrangement, over almost the whole of the perimeter, of the access opening, it is possible to raise completely the back portion with respect to a single lateral edge or with respect to a single free edge, which is in fact a hinge edge, and ensure that the remaining portion of the wearable protective device remains still. Preferably, therefore, the selected hinge edge is a single edge selected from among the right lateral peripheral edge, the left lateral peripheral edge, said first free edge of the back portion and said second free edge of the back portion, and said single hinge or connecting edge acts as a hinge precisely for opening said back portion. Consequently, preferably, the remaining edges not selected from among the right lateral peripheral edge, the left lateral peripheral edge, said first free edge of the back portion and said second free edge of the back portion define said access opening.

[0018] This allows access to the inflatable element or components of the wearable protective device in a simple manner and with the minimum difficulty.

[0019] Preferably, the access opening extends along the right peripheral lateral edge, along the left peripheral lateral edge of the back portion, and one of said first free edge of the back portion and said second free edge of the back portion, so that the back portion, preferably in its entirety, may be opened in the manner of a book upwards or downwards.

[0020] Preferably, the layer of the wearable protective device comprises a right side portion and a left side portion. In this case, the right lateral peripheral edge extends along a rear area of the right armhole and along a respective right joining area which connects the respective right side portion to the back portion, and the left lateral peripheral edge extends from a rear area of the left armhole and along a respective left joining area which connects a respective left side portion with the back portion.

[0021] It can be understood that, if sleeves are present in the wearable protective device, "rear area of the armhole" is to be understood as meaning, or defines, a connection or joining area, of the back portion with the sleeves; alternatively, if no sleeves are present, for example if the wearable protective device is formed as vest, the rear armhole area is a free edge area on the back around the opening for each arm.

[0022] The term "back portion" is understood as meaning a piece or a set of pieces of the layer which cover overall the back of a user. Similarly, "side portion" is understood as meaning a piece or a set of pieces of the layer which cover overall the respective side of the user and which may also extend towards the front or front-facing area.

[0023] "Free edge" is understood as meaning in the broadest sense a terminal or edge area of the back portion which is open and free and respectively faces the neck and the bottom of the back, or which faces, along the armhole area, if no sleeves are present, the hole for introducing the arms.

[0024] "Access opening" is understood as meaning a passage, or an entranceway, formed in the layer or in the wearable protective device for accessing the inflatable element or other functional components.

[0025] At the same time, owing to the layout of the parts described above, it may be understood that the first free edge and the second free edge each extend between the right lateral peripheral edge and the left lateral peripheral edge. More specifically and preferably, the second free edge, or back bottom-side free edge, connects respectively the areas of the sides, while the first free edge connects the rear area of the armholes, in particular at the start of the respective rear armhole.

[0026] Preferably, the access opening extends along the entire right lateral peripheral edge and along the entire left lateral peripheral edge, namely along the right joining area, along the left joining area, along said rear area of the right armhole, and said rear area of the left armhole.

[0027] The wearable protective device includes a closure device for closing at least partially said access opening.

[0028] Basically, it may be understood that, preferably, the access opening is in fact situated on a main part of the perimeter of the back portion, said perimeter including the right joining area, the right rear armhole, the free neck edge and the free back bottom edge, the left rear armhole and the left joining area.

[0029] Preferably, the access opening is absent only along the free neck edge. Basically, the free edge of the access opening is the second free edge and this second free edge is to be understood as being a terminal area of a

bottom region or lumbar area of the back portion. In this case, the back portion opens like the page of a book upwards.

[0030] Alternatively, the access opening is not present along the free edge of the back area. Basically, the free edge of the access opening is the first free edge and this first free edge is to be understood as being a terminal area of a neck region at the top end of the back portion. In this case, the back portion opens like the page of a book downwards.

[0031] It can be understood that the back portion, the right side portion and the left side portion are, as mentioned, pieces or parts of the layer or of several layers (not necessarily single pieces). Therefore, the access opening and the respective closure device are preferably arranged in edge areas, such as the first right joining area and the second left joining area, or the rear area of the left armhole, or the free edge, which are usually characterized by the presence of a stitching.

[0032] In fact, usually there is provided a stitching which connects the back portion with the side portions, with the sleeves (if present) or which run around the hole through which the arms pass, and a stitching along free edge of the back portion connects the back portion for example, with an outer layer of the wearable protective device. The closure device is better hidden in these stitching areas.

[0033] The access opening is preferably a single opening. In this way, when operating the closure device, the back portion may be removed by means of a single action along the perimeter. The back portion can therefore be raised, for example with respect to the side portions and along the rear armhole, by means of a single action.

[0034] Preferably, the access opening is, as mentioned, only along one of said first free edge of the back portion and said second free edge of the back portion. The other portion of the free edge therefore remains always connected and acts as a hinge when the back portion is raised.

[0035] In other words, preferably the access opening extends on the right and on the left as far as areas on the sides of the armpits and the shoulder blades, so that the back portion may be raised completely, apart from said free edge which acts a hinge area. In other words, owing to the layout of the parts described above, the area of the back portion where the access opening is situated may extend from the sides as far as the armpits/sleeves and up beyond the shoulder blades. Expressed in yet other words, the remaining edges not selected from among the right lateral peripheral edge, the left lateral peripheral edge, said first free edge of the back portion and said second free edge of the back portion (i.e. those edges which do not act as a hinge) define said access opening.

[0036] According to a preferred aspect, the closure device is a zip closure. Such a zip closure may be covered with a tape or webbing so that it is not readily visible to a user and may blend in with normal stitching.

[0037] The device according to the present disclosure may be an autonomous device, namely be configured to inflate said inflatable element from the deflated condition into the inflated condition in an autonomous manner. The device therefore comprises all the functional components, such as sensors, inflation means and a control unit for controlling the inflation of the inflatable element.

[0038] Preferably, the back portion is designed to cover the functional components of the wearable protective device, such as, as mentioned, an inflation device, configured to inflate said inflatable element from said deflated condition into said inflated condition, one or more sensors configured to detect data relating to a condition of a user, and a control unit configured to process said data and identify a danger situation or fall situation based on said data. The wearable protective device includes, for example, a support base for supporting the components. The functional components and the support base may be fixed to further internal layers of the wearable protective device.

[0039] Preferably, as already mentioned, the inflatable element also comprises a back portion of the inflatable element which is designed to cover the back of said user and is freely housed between said layer, which therefore acts as an internal lining of the wearable protective deice, and an outer layer of the wearable protective device. In this way, when the back portion of the layer is raised, the back portion of the inflatable element may also be raised, reducing the risk of further undesirable movements of the entire wearable protective device.

[0040] The present disclosure also proposes a method for operating a wearable protective device comprising an inflatable element, configured to be able to assume a deflated condition and an inflated condition, wherein the wearable protective device includes a layer having an inner side facing the user in a condition of use, wherein the layer comprises a back portion of the layer designed to cover the back of a user. The method includes the steps of:

- creating an access opening at least partially along a perimeter of the back portion, apart from a hinge edge selected from among a left lateral peripheral edge of the back portion, a right lateral peripheral edge of the back portion, a first free edge towards the neck, or neck-side free edge, and a second free edge towards the bottom of the back, or back bottom-side free edge;
- providing a closure device for closing at least partially said access opening, wherein, in order to access an area hidden under the layer, a closing constraint of said closure device is removed and the back covering portion is raised at least partially around said hinge edge.

[0041] Preferably, the right lateral edge extends along a right joining area which connects the back portion of the layer and a right side portion, and along a rear area of the right armhole, and the left lateral edge of the back portion

extends at least partially along a rear area of the left armhole and at least partially along a left joining area comprised between the back portion of the layer and a left side portion. In this way, when the back portion is raised, only the back portion is raised and the rest of the layer remains still.

[0042] More preferably, the access opening is situated along the second free edge of the bottom of the back and, when the closing constraint of the closure device is removed, the back portion is raised from the bottom area towards the shoulder area, so as to enlarge the access opening from the bottom upwards away from a user who is situated in front of the inner side of the device.

[0043] Preferably, the protective device is like the device described in the preceding paragraphs.

[0044] Further advantages, characteristic features and modes of use forming the subject of the present disclosure will become clear from the following detailed description of embodiments thereof, provided by way of a non-limiting example.

[0045] It is evident however how each embodiment forming the subject of the present disclosure may have one or more of the advantages listed above; in any case it is not required that each embodiment should have simultaneously all the advantages listed.

[0046] Reference will be made to the figures of the attached drawings in which:

- Figure 1 shows a view from the inner side of a wearable protective device according to an embodiment of the present invention, wherein a back portion of the layer and a back portion of the inflatable element are raised;
- Figure 2 shows the view of Figure 1 in which the back portion of the layer is closed;
- Figure 3 shows a view of a detail of Figure 2.

[0047] With reference to the attached figures, an embodiment of a wearable personal protection device for protecting at least partially the torso of a user is denoted overall by the reference number 100.

[0048] "Wearable personal protection device" or more simply "wearable protective device" is understood as meaning a device which may be worn, namely placed on the torso of a user with a protective function, or which can be associated with or is designed to be associated with a garment or an undergarment, such as a motorcycling suit, a jacket or a vest. Since it is a wearable device, in the context of the present disclosure reference will be made for greater clarity to parts of the body which said protective device is intended to protect, such as back portions, side portions, neck-side free edge, etc., and in general spatial references such as above, below, rear, front, front-facing, bottom, top, inner and outer and similar references which are to be understood in a non-limiting manner as though the device were being worn.

[0049] In the present case the wearable protective device 100 has the form of a vest-like jacket, and hence sleeveless jacket.

[0050] In particular, the wearable protective device 100 comprises an inflatable element 20 configured to be able to assume a deflated condition and an inflated condition. More specifically, the inflatable element 20 is intended to protect at least partially a torso zone of the user. More precisely, in the embodiment shown, the inflatable element 20 includes chest parts and a spinal or back portion intended to be placed along a back region which is centred on the user's backbone. The form of the inflatable element 20 and the technology used to make the inflatable element 20 are known to the person skilled in the art and are not further described. Similarly, the modes of inflating the inflatable element 20 are to be regarded as also known and will not be described in the description below.

[0051] Moreover, the wearable protective device 100 further comprises a layer 30 having, or which presents, an internal surface, visible in Figure 1 and Figure 2 and indicated by the reference number 21, namely directed towards an internal area, i.e. facing the user in a condition of use. This internal surface 21 is to be understood as being a surface opposite to an outer layer with external surface directed towards an outer zone with respect to the user, not visible in the figures. The layer 30 defines, where the inflatable element 20 is present, an internal covering layer, also called covering lining, arranged on the inner side so as to cover the inflatable element 20, namely on the user side. Basically, the layer 30 may be a lining, or part of a covering which lines the entire inflatable element 20. An outer layer or external covering may also be provided, as mentioned, so as to define together with the layer 30 a pocket for housing the inflatable element 20. The layer 30 therefore forms part of said pocket and may have for example the function of a lining and/or a comfort function, for example provided with padding elements 33, as shown in Figure 2.

[0052] It is to be understood that the layer 30 is an inner layer even if it were covered by another garment, for example temporarily, or an undergarment.

[0053] It is pointed out moreover that the layer 30 may also not act as covering for any component, for example, on the sides of the device where the inflatable element 20 is not present. It therefore consists of a layer which has one side directed inwards, i.e. a user side, and which, in the zones where the inflatable element 20 is housed, acts as a covering on the inner side of the inflatable element.

[0054] According to one aspect of the present disclosure, the layer 30 comprises at least a back portion 34, which preferably covers the entire back of a user, and which has a right lateral peripheral edge 31, a left lateral peripheral edge 35, a first free edge 55 on the neck side and a second free edge 52 on the back bottom side.

[0055] Moreover, the wearable protective device 100 includes an access opening 50 accessing the inflatable element 20.

[0056] The access opening 50 extends at least partially along the perimeter of said back portion, apart from an

edge selected from among the right lateral peripheral edge 31, the left lateral peripheral edge 35, the neck-side first free edge 55 and the back bottom-side second free edge 52, so that the back portion may be opened like the page of a book about the edge which remains connected and which acts as a hinge edge.

[0057] More preferably, the access opening 50 extends at least partially along the left lateral peripheral edge 35, at least partially along the right peripheral edge 31, and along a free edge of the back portion 34, selected from the neck-side first free edge 55 and the back bottom-side second free edge 52, so that the edge not selected from the neck-side first free edge 55 and the back bottom-side second free edge 52 acts as a hinge edge.

[0058] Preferably, the wearable protective device 100 includes two side portions 36, 38 and the back portion 34 is connected by means of a respective right joining area 40 to a respective right side portion 36 and the back portion 34 is connected by means of a respective left joining area 42 to a respective left side portion 38. The back portion further comprises a rear area of a right armhole 37 and a rear area of a left armhole 39, wherein the rear area of the right armhole 37 defines with the right joining area 40 the aforementioned right lateral peripheral edge 35 of the back portion 34, and wherein the rear area of the left armhole 39 defines with the left joining area 42 the left lateral peripheral edge 35 of the back portion 34.

[0059] Preferably, since it consists of a vest, the rear area of the right armhole 37 and the rear area of the left armhole 39 are free edges which define openings for the arms and the right side portion 36 and the left side portion 38 are situated underneath the respective opening zones for the arms.

[0060] Consequently, preferably the access opening 50 extends along the right joining area 40 and the rear area of the right armhole 37 and preferably along the left joining area 42 and along the rear area of the left armhole 39.

[0061] It is pointed out that the free edges form together with the left lateral peripheral edge 35 and with the right lateral peripheral edge 31 and preferably with the left joining area 42, the rear area of the left armhole, the right joining area 40 and the rear area of the right armhole 37, the perimeter of the back portion 34, where usually stitches are provided for connecting together layer portions, or portions of the layer together with an outer layer. These layer portions are in fact pieces joined together in the joining areas so as to form the wearable protective device 100. The free edges are areas which connect the layer 30 with the opposite layer directed outwards.

[0062] Basically, the access opening 50 is in fact situated on a part of the perimeter of the back portion 34 which preferably extends from the right joining area 40 to the left joining area 42 and passes into the rear area of the right armhole 37 and into the rear area of the left armhole 39, and along a free edge between right and left, so that this access area blends in with a stitching and therefore overall is visible as little as possible.

[0063] In fact, the peripheral rear is the area which is usually characterized by the presence of a stitching and which connects the back portion 34 together with the side portions 36, 38.

[0064] The access opening 50 is preferably a single continuous opening along the periphery of the back portion, so that, in the form visible for example in Figure 1, the back portion 34 can be moved completely away from the side areas 36, 38 and can therefore be raised with respect to the side portions 36, 38 and in the rear areas of the shoulder armhole.

[0065] Preferably, only one free edge of the back portion 34, selected from a neck-side first free edge 55 and a back bottom-side second free edge 52, has an access opening and it is the second free edge 52. The neck-side first free edge 55 remains permanently joined to the remainder of the wearable protective device 100 and act as said hinge edge.

[0066] Moreover, preferably, the access opening 50 extends completely on the right and the left as far as areas situated on the sides of the armpits and covering the shoulder blades, namely in the rear armhole areas, so that, when the back portion 34 is raised, it may be raised almost entirely, apart from the hinge edge, in this case apart from the neck-side first free edge 55, where it remains attached to the remaining portion of the wearable protective device 100, as can be seen in Figure 1. In other words, owing to the layout of the parts described above, the peripheral area of the back portion 34 where the access opening 50 is situated may extend as far as the armpit holes and extend up beyond the shoulder blades.

[0067] The second free edge 52 is in fact a terminal region of a lumbar area or bottom area 54 of the back underneath the back portion 34, so that the back portion of the inner layer 30 may be lifted upwards. The second free edge 52 is connected, in fact, as mentioned, with an external covering of the wearable protective device 100. Preferably, said external covering forms part of the wearable protective device 100.

[0068] The access opening 50 is closed at least partially by means of a closure device 56. Preferably, the closure device 56 is a continuous device which may extend from the right joining area 40, towards the left joining area 42, as far as said second free edge 52, passing through the armhole rear areas. For example, the closure device 56 is a zip closure, as partially shown in Figure 3, which may blend in easily with a stitching.

[0069] The closure device 56 may be covered with a tape 58 or a webbing so that it is not readily visible to a user and may blend in even more closely with a normal stitching.

[0070] Owing to the peripheral arrangement of the access opening 50, the back portion 34 of the inner layer 30 may be lifted upwards completely so that the remaining portion of the wearable protective device 100 remains still, allowing access to the inflatable element 20 or the

functional components of the wearable protective device 100.

[0071] The wearable protective device 100 may in fact be an autonomous device, namely configured to allow said inflatable element to pass from the deflated condition into the inflated condition without external components. The device therefore comprises a functional component assembly which includes inflation means and a control unit for controlling the inflation of the inflatable element, not visible in the drawings.

[0072] Preferably, the inflation device configured to inflate said inflatable element from said deflated condition into said inflated condition, one or more sensors configured to detect data relating to a condition of the user, and a control unit configured to process said data and identify a danger situation or a fall situation based on said data, are arranged in the back area.

[0073] For this purpose, the wearable protective device includes, for example, a support base 60 for supporting the functional components. The functional components and the support base 60 may be fixed to further internal layers. The back portion 34 preferably covers said functional components comprising the inflation device, control unit and sensors.

[0074] Preferably, the inflatable element 20 also comprises a back portion of the inflatable element 20a which is designed to cover the back of said user and is freely housed in the pocket defined between the layer 30 and an external covering layer, and, when the back portion 34 of the inner layer 30 is raised, the back portion of the inflatable element 20a may also be raised, reducing the risk of further undesirable movements of the entire inflatable element 20.

[0075] With regard to inflation and the remaining components, it is pointed out that the inflation device, the electronic unit and the sensors are known to a person skilled in the art and therefore will not be further described in the context of the present disclosure.

[0076] The present disclosure also relates to a method for operating a wearable protective device 100 comprising an inflatable element 20, configured to be able to assume a deflated condition and an inflated condition. Furthermore, the wearable protective device has a layer having an inner side facing an inner area, i.e. facing the user in a condition of use, wherein said layer 30 comprises a back portion 34 designed to cover the back 34 of a user.

[0077] The method comprises:

- creating an access opening 50 at least partially along a perimeter of the back portion, apart from an edge selected from among a right lateral peripheral edge 31 of the back portion (comprising preferably a joining area 40 which joins the back portion 34 of the layer 30 and a right side portion 36, and a rear area of a right armhole 37), a left lateral peripheral edge 35 of the back portion 34 (comprising preferably a left joining area 42 which joins the back portion 34 of the layer 30 and a left side portion 38 and a rear area of the left armhole), a neck-side first free edge 55 and a back bottom-side second free edge 52, wherein said selected edge is a hinge edge;

- providing a closure device 56 for closing at least partially said access opening, and wherein, in order to access an area hidden under the layer 30, a closing constraint of said closure device 56 is removed and the back covering portion 34 is raised around said hinge edge. It is also pointed out that preferably the remaining edges not selected from among the right lateral peripheral edge 31, the left lateral peripheral edge 35, said first free edge 55 of the back portion 34 and said second free edge 52 of the back portion 34 (namely the edges which do not define the hinge edge), since they define said access opening 50, may be raised. Consequently, preferably, the remaining part of the wearable protective device 100 remains still when the covering portion of the back 34 is lifted up. Preferably, said hinge edge is the first free edge, and the access opening therefore extends along the second free edge on the back bottom side; therefore, when the closure device 56 is opened, the covering portion 34 of the back 34 is raised from the bottom area towards the shoulder area so as to widen even more the access opening 50 from the bottom upwards, away from a user when a user is situated facing the inner side of the wearable protective device 100, as shown in Figure 1.

[0078] The subject-matter of the present disclosure has been described hitherto with reference to its embodiments. It is to be understood that other embodiments relating to the same inventive idea may exist, all of these falling within the scope of protection of the claims which are attached below.

Claims

1. Wearable protective device (100) for at least partial protection of a user's torso, said wearable protective device (100) comprising an inflatable element (20), configured to be able to assume a deflated condition and an inflated condition, wherein said wearable device (100) includes a layer (30) having one side facing an internal user-side area, and

   wherein the layer (30) comprises at least a back portion (34), intended to cover the back of a user, wherein the back portion (34) comprises a right lateral peripheral edge (31), a left lateral peripheral edge (35), a first free edge towards the neck (55), or neck-side free edge, and a second free edge (52) towards the bottom of the back, or back bottom-side free edge, and wherein the wearable protective device (100) includes an

access opening (50) for accessing the inflatable element (20) and/or other component of the personal protection device, wherein said access opening (50) extends at least partially along a perimeter of the back portion, with the exception of an edge selected from among:

- the right lateral peripheral edge (31),
- the left lateral peripheral edge (35),
- said first free edge (55) of the back portion (34) and
- said second free edge (52) of the back portion (34),

and wherein the wearable protective device (100) includes a closure device (56) for at least partially closing said access opening (50).

2. Wearable protective device (100) according to claim 1, wherein said selected hinge edge is a single edge selected from among the right lateral peripheral edge (31), the left lateral peripheral edge (35), said first free edge (55) of the back portion (34) and said second free edge (52) of the back portion (34), wherein said single hinge edge acts a hinge for opening said back portion and wherein the remaining edges not selected from among the right lateral peripheral edge (31), the left lateral peripheral edge (35), said first free edge (55) of the back portion (34) and said second free edge (52) of the back portion (34) define said access opening (50).

3. Wearable protective device (100) according to claim 1 or 2, wherein said hinge edge is selected from the first free edge (55), or neck-side free edge, and the second free edge (52), or back bottom-side free edge, of the back portion (34).

4. Wearable protective device (100) according to any one of the preceding claims, comprising a right side portion (36) and a left side portion (38), and wherein the right lateral peripheral edge (31) includes a rear area of the right armhole (37) and a right joining area (40) which joins the back portion (34) with the right side portion (36) and the left lateral peripheral edge (35) includes a rear area of the left armhole (39) and a left joining area (42) which connects the back portion (34) and the left side portion (38).

5. Wearable protective device (100) according to any one of the preceding claims, wherein said selected edge is said first free edge (55) of the back portion (34), and the access opening (50) is along said second free edge (52) of the back portion (34), said first free edge (55) defining a connection side or hinge edge with a remaining part of the wearable protective device (100).

6. Wearable protective device (100) according to the preceding claim, wherein the access opening (50) is a single opening.

7. Wearable protective device (100) according to claim 5 or 6, wherein the access opening (50) extends along a perimeter of the back portion (34) as far as the sides of the armpits and shoulder blades, leaving the first free edge (55) as the only hinge and/or connection area, so as to be able to lift the back portion (34) almost completely by rotating it with respect to the hinge and/or connection area.

8. Wearable protective device according to claim 7, comprising an external covering layer opposite to said layer (30) and wherein said first free edge is a terminal area of a bottom region or lumbar area (54) of the back portion (34) and connects said layer (30) to the external covering layer.

9. Wearable protective device (100) according to any one of the preceding claims, wherein the closure device (56) is a zip closure.

10. Wearable protective device (100) according to the preceding claim, wherein the closure device (56) is covered with a tape or webbing (58).

11. Wearable protective device (100) according to one of the preceding claims, comprising functional components including a component selected from among an inflation device configured to inflate said inflatable element (20) from the deflated condition to the inflated condition, an electronic control unit, configured to control an activation of said inflation device, and one or more sensors configured to detect a danger situation for the user and to send data to said electronic unit, or an assembly of said components, wherein said back portion (34) covers said functional components.

12. Wearable protective device (100) according to one of the preceding claims, wherein said device is structured like a garment, or wherein said wearable protective device (100) is shaped like a vest.

13. Method for operating a wearable protective device (100) comprising an inflatable element (20), configured to be able to assume a deflated condition and an inflated condition, wherein the wearable protective device (100) includes a layer (30) having a side facing the user in a condition of use, wherein the layer comprises a back portion of the layer adapted to cover the back of a user and the method includes the steps of:

- creating an access opening (50) at least partially along a perimeter of the back portion (34),

with the exception of a hinge edge selected from among:

- a left lateral peripheral edge (35) of the back portion (34),
- a right lateral peripheral edge (31) of the back portion (34),
- a first free edge towards the neck (55), or neck-side free edge,
- and a second free edge towards the bottom of the back (52), or back bottom-side free edge;

- providing a closure device (56) for at least partially closing said access opening, wherein, in order to access an area hidden under the layer (30), a closing constraint of said closure device (56) is removed and the back covering portion (34) is raised by rotating it around said hinge edge.

14. Method for operating a wearable protective device (100) according to claim 13, wherein said selected hinge edge is the only selected edge and the remaining edges not selected from among the right lateral peripheral edge (31), the left lateral peripheral edge (35), said first free edge (55) of the back portion (34) and said second free edge (52) of the back portion (34) may be raised, such that, when the back portion (34) is raised, only the back portion (34) is raised, and the remaining part of the wearable protective device remains still.

15. Method for operating a wearable protective device (100) according to claim 13 or 14, wherein the hinge edge is the neck-side first free edge (55), and when the closure device (56) is operated, the back portion (34) can be raised from the bottom area towards the shoulder area, so as to enlarge the access opening (50) from the bottom upwards.

16. Method for operating a wearable protective device (100) according to any one of the preceding claims 13 to 15, wherein the wearable protective device (100) is a device according to any one of claims 1 to 12.

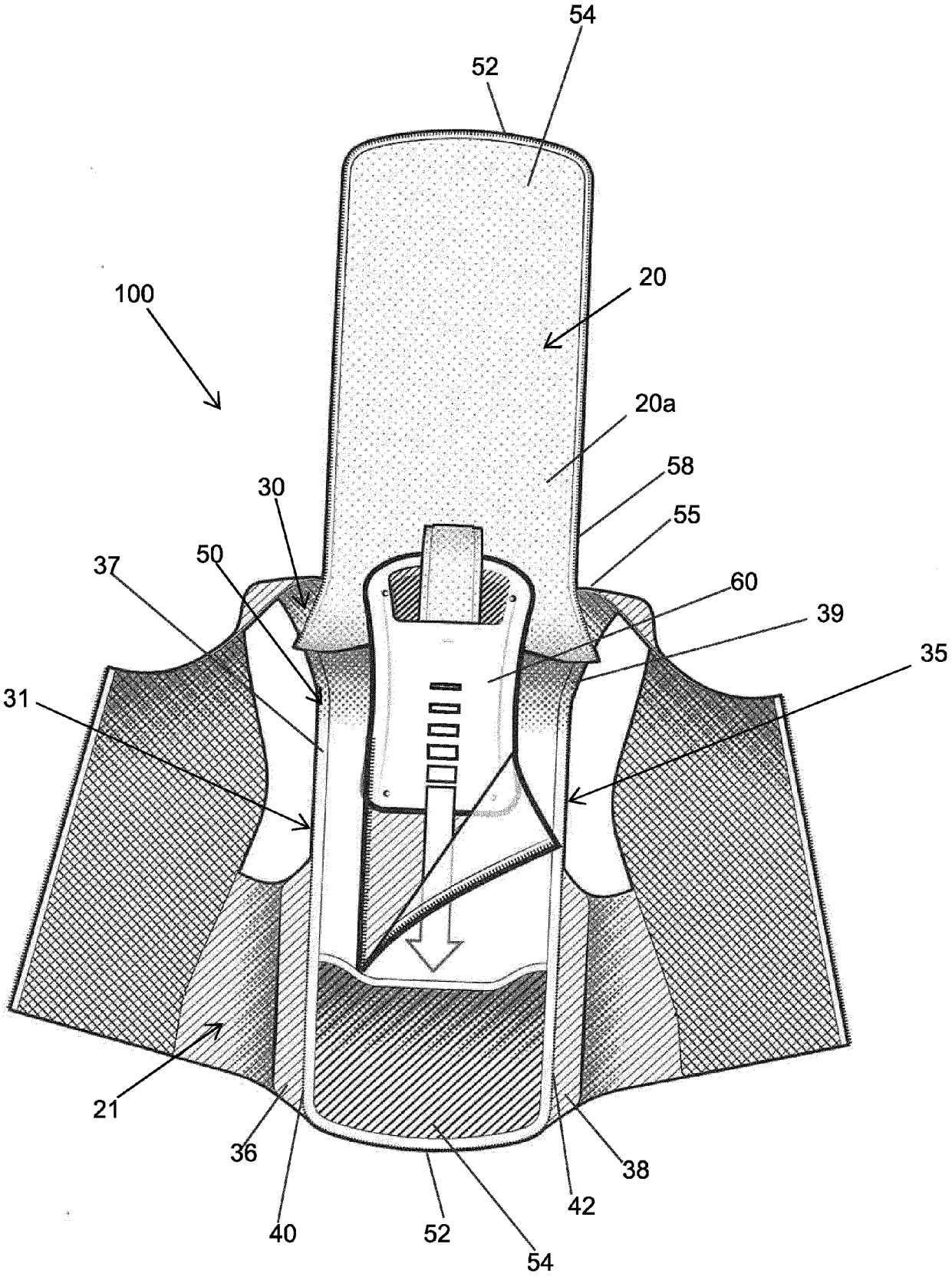

FIG. 1

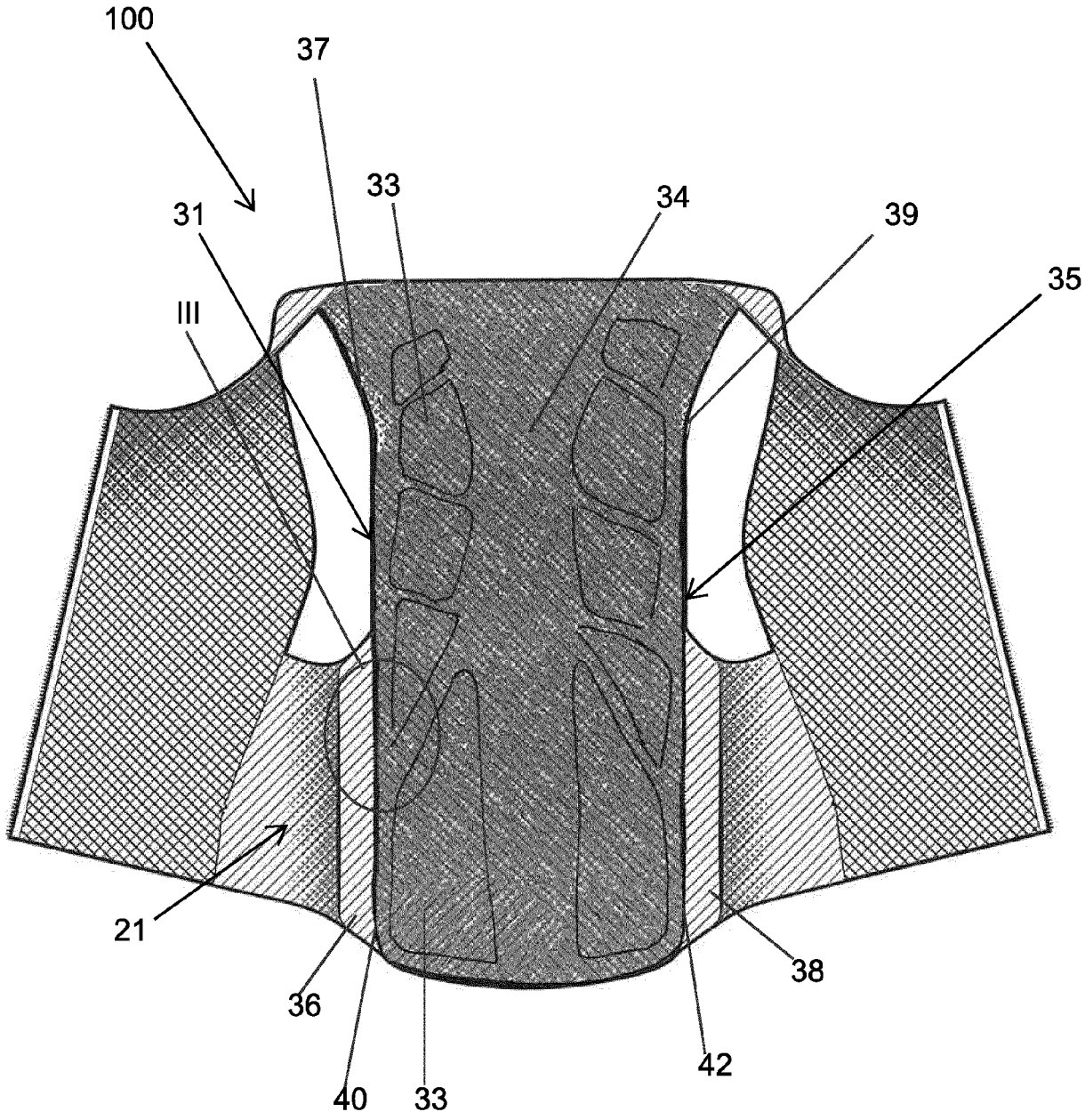

FIG. 2

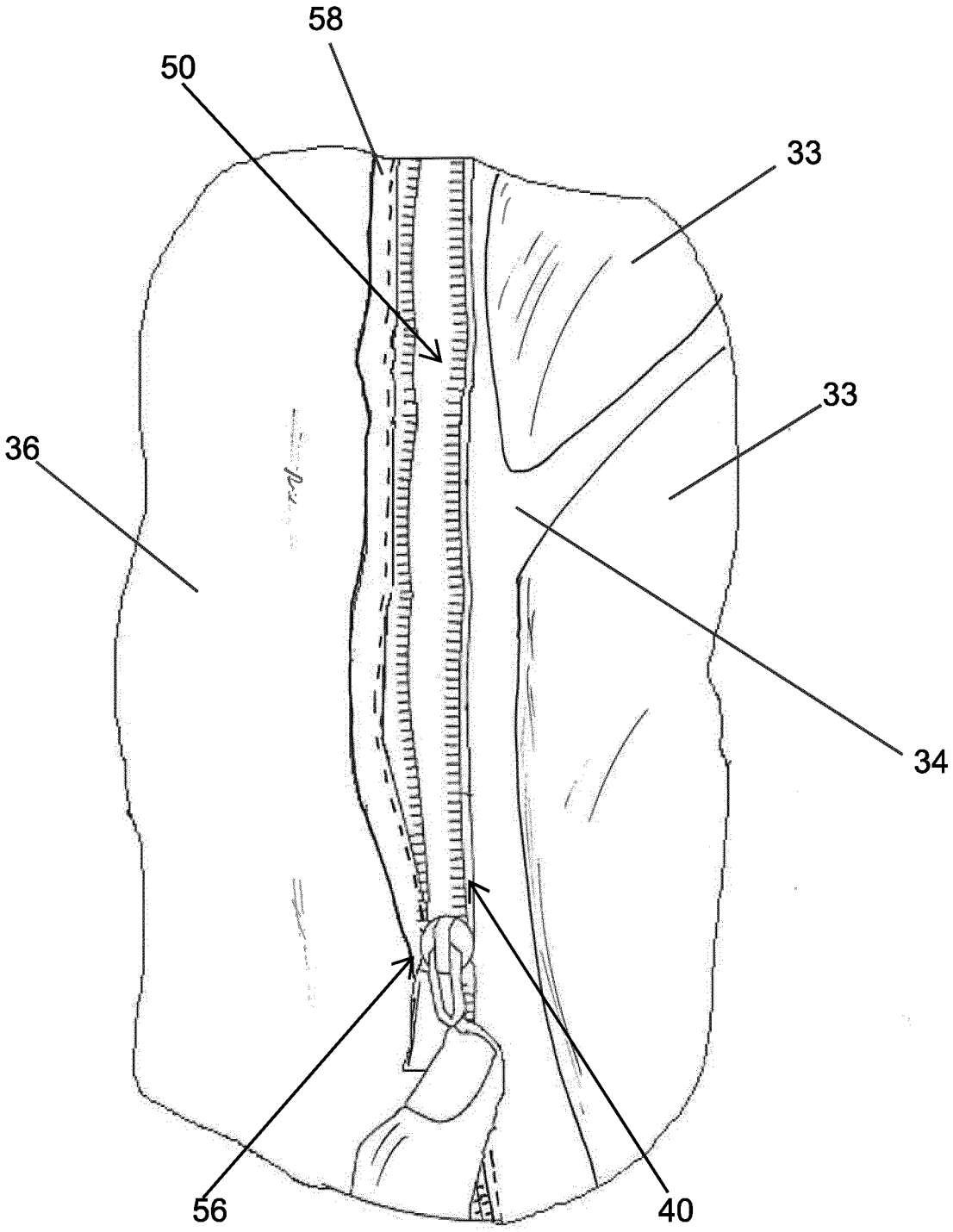

FIG. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 24 19 5349

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A41D
A44C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	29 January 2025	Nelis, Yves

CATEGORY OF CITED DOCUMENTS

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