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(54) **PROTECTIVE PERSONAL GARMENT**

(57) The present invention concerns a protective personal garment (10), especially a protective jacket, comprising a torso portion (11) having an inner face (12) and an outer face (13), said torso portion (11) being provided with a collar (19), a left arm sleeve (14) and a right arm sleeve (15) extending from said torso portion (11), said left arm sleeve (14) and said right arm sleeve (15) having respective inner faces and outer faces (16,17), at least a first micro-controller (27) configured to establish a data communication with a control unit, said first micro-controller (27) being provided with one or more electrical connectors (26) to connect said first micro-controller (27) with one or more sources of electrical energy, and one or more functional units electrically connected with said first micro-controller.

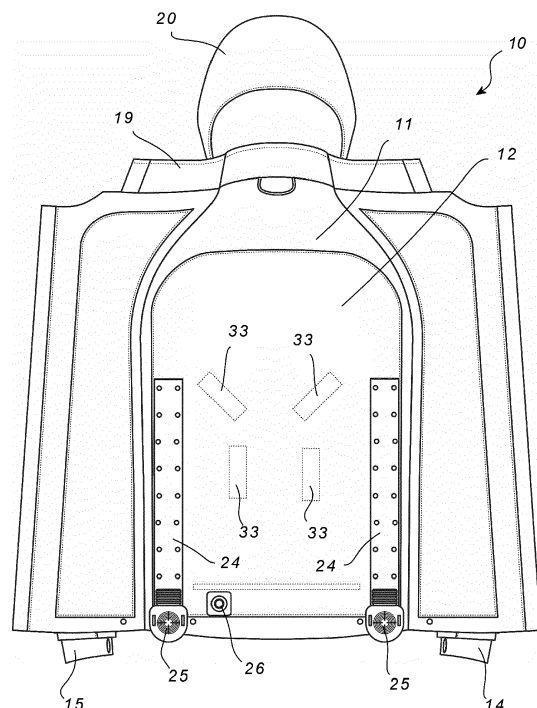


Fig. 3

Description

[0001] The present invention relates to a protective personal garment, particularly to a safety jacket worn by persons such as workers, military or security personnel, which are often working in a challenging and potentially hazardous environment.

[0002] A vast variety of protective personal garment such as safety jackets are known in the art which offer a variety of features to protect wearers from challenging influences from the environment and/or features which help the wearers accomplishing their designated tasks.

[0003] In recent years, mobile phones became a constant companion of people in private life but also at the work place. Mobile phones have long since extended their application from being a mere messenger device via telephone, instant messenger applications or e-mail applications, to a control centre for a large variety of devices such as smart home appliances, fitness and sleep tracker variables, mobility systems, such as electric bikes, electric scooters or electric cars. The success of the mobile phone stems from the fact that nowadays, a mobile phone is essentially a general purpose computer which can run an enormous variety of specialized software applications (apps) and which is already equipped with a variety of wireless communication means, such as cellular network connectivity, WLAN connectivity or Bluetooth connectivity.

[0004] The technical problem underlying the present invention is to provide a protective personal garment, especially a protective jacket, which can make use of the versatility of modern day mobile phones in order to increase the protective functionality of the garment and/or assist the wearer in accomplishing designated tasks.

[0005] This technical problem is solved by the protective personal garment as defined in appended claim 1. Preferred embodiments of the protective personal garment of the invention are subject of the dependent claims.

[0006] Accordingly, the present invention concerns a protective personal garment comprising a torso portion having an inner face and an outer face, said torso portion being provided with a collar, a left arm sleeve and a right arm sleeve extending from said torso portion, said left arm sleeve and said right arm sleeve having respective inner faces and outer faces. According to the invention, the protective personal garment comprises at least a first micro-controller configured to establish a data communication with a control unit, said first micro-controller being provided with one or more electrical connectors to connect said first micro-controller with one or more sources of electrical energy. Further, the protective personal garment is equipped with one or more functional units which are electrically connected with the first micro-controller.

[0007] The present invention suggests to allow a protective personal garment, such as a safety jacket, to communicate with a control unit in order to exchange data with functional units of the protective personal garment

via a micro-controller of this garment.

[0008] A "control unit" in the sense of the present invention denotes any input means or input/output means, which are suitable to command/control the functional units of the protective personal garment. For instance, press buttons or touch buttons, which are functionally connected to the first micro-controller, can be employed to trigger certain operations of the functional units. A "control unit" in the sense of the present invention can be a single device such as a single board having various control buttons or a distributed device having various control buttons, which are arranged at different places at or in the protective personal garment. Likewise, a "control unit" in the sense of the present invention can be integrated with the personal garment or can be a separate device which can establish a wire-based or wireless communication with the first micro-controller. For instance, in one embodiment, the "control unit" can be configured as a touch panel. In another embodiment, the "control unit" can include a display and can, for instance, be configured as a touch-sensitive display. Preferably, however, the control unit is a mobile phone and the protective personal garment is able to communicate with an appliance running on the mobile phone.

[0009] A "mobile phone" in the sense of the present invention can be any typical, commercially available smartphone which runs a dedicated app for communicating with the micro-controller of the protective personal garment. However, "mobile phone" in the sense of the present invention can also be a dedicated mobile device having the sole purpose of being used in connection with the protective personal garment of the present invention. The term "mobile phone" has therefore to be construed more broadly as encompassing any mobile device which can establish a data communication with the micro-controller of the protective personal garment and which is further connected to a wireless network. This will usually be a cellular network of a mobile phone service provider but it can also be a private WLAN network or any other wireless data communication network. Therefore, while in most use cases, the "mobile phone" will also have a telephone capability, such a telephone capability is not necessarily required for the purpose of the present invention.

[0010] One of the most important environmental effects of a hard working wearer of a protective personal garment is related to the ambient temperature in the environment which can range from temperatures -20 °C or lower to +50 °C and higher. Therefore, in certain embodiments of the protective personal garment of the present invention, the functional units comprise heating elements which can be arranged at various places of the protective garment. Preferably, heating elements are arranged at the inner face of the torso portion. Additionally or alternatively, heating elements can also be arranged at the inner faces of the left arm sleeve or the right arm sleeve. Again additionally or alternatively, heating elements can be arranged at the inner face of the collar of the torso

portion of the protective personal garment. The heating elements are preferably controllable and in one embodiment, the heating elements are resistive heaters which can be controlled via an electrical current passed through the resistive heaters.

[0011] Temperature control may also involve cooling the wearer of the protective personal garment. Therefore, in one embodiment of the present invention, the functional units comprise cooling elements arranged at the inner face of the torso portion. Additional cooling elements can also be provided in other areas of the inner faces of the garment.

[0012] A variety of different controllable cooling elements can be envisioned. In one embodiment, the cooling elements comprise at least one cooling duct arranged at the inner face of the torso portion and at least one electrical fan arranged at one end of the cooling duct.

[0013] Preferably, the protective personal garment comprises both heating elements and cooling elements.

[0014] In certain embodiments, the heating elements and/or cooling elements can be actively controlled by the user, for instance using a suitable control feature of the application running on the mobile phone or any other control element of the control unit such as suitably configured buttons or control knobs.

[0015] Preferably, however, the heating and/or cooling functionality of the protective personal garment is at least partially automatized.

[0016] To this effect, in certain embodiments of the present invention, the functional units comprise at least a first environmental sensor arranged at the inner face of the torso portion. The environmental sensor preferably comprises at least a first temperature sensor but can also comprise additional sensors relevant to the wellbeing of the wearer, such as a humidity sensor. Based on the data provided by the first environmental sensor, the heating elements and/or cooling elements can be engaged automatically, without the wearer having to actively engage with the application running on the mobile phone. In certain embodiments, the application running on the mobile phone will still, however, allow the user an active control of the heating elements and/or cooling elements or may even allow to specify certain temperature ranges for the temperature read by the first temperature sensor and, optionally, including data of a first humidity sensor of the first environmental sensor so that heating or cooling will only be activated if the detected temperature leaves the predetermined ranges.

[0017] In certain embodiments, the functional units can comprise a second environmental sensor arranged at the outer face of the torso portion thus allowing to detect the ambient environmental sensor as well. Preferably, both a first environmental sensor for the inner temperature and, optionally, the inner humidity near the torso of the wearer and a second environmental sensor for detecting the ambient temperature and, optionally, the ambient humidity will be employed thus allowing a more elaborate control scheme for temperature regulation of

the protective personal garment.

[0018] In certain embodiments, the functional units comprise lighting elements arranged at the outer face of the torso portion thus allowing to illuminate the immediate surrounding in front of the face of the wearer. Preferably, the lighting elements comprise LED strips.

[0019] The functional units of the protective personal garment of the present invention can also comprise a communication system comprising one or more microphones and one or more speakers which are preferably arranged at the collar of the torso portion, i.e. close to the mouth and ears of the wearer. Accordingly, the wearer can use the phone capabilities of the mobile phone without having to remove the mobile phone from the storage where it is located.

[0020] The microphones and/or speakers can be controlled by the first micro-controller. In other embodiments, the communication system comprises a second, dedicated micro-controller which is electrically connected to the first micro-controller and to said one or more microphones and said one more speakers.

[0021] In certain embodiments, the functional units comprise a fall sensor which typically comprises an accelerometer. The fall sensor can be a dedicated element or an element integrated within the first micro-controller. It is also possible to use an accelerometer of commercially available mobile phones for this purpose. In essence, data of the accelerometer allow determining, whether the wearer of the protective garment is experiencing sudden unusual accelerations, which can, by suitable software analysis, be attributed to a fall or an inadvertent tripping of the wearer of the protective garment. If a fall is detected, the control unit can trigger a warning and/or an alarm, for instance by relaying an emergency message to an emergency response center and/or other nearby users of the mobile phone app and/or flashing the lighting elements of the personal garment and/or by using the speakers of the personal garment to sound an alarm in order to notify other people in the area of the wearer.

[0022] The micro-controller can also comprise a geolocation unit, for instance a satellite-based geolocation unit, such as a GPS sensor, which allows determining the location of the protective personal garment. The geolocation unit can be part of the first micro-controller or can be a dedicated element. Alternatively, if the control unit is a mobile phone which is already equipped with a geolocation sensor, it is also possible to use the geolocation sensor of the mobile phone for determining the location of the protective personal garment. The geolocation data can be included in an alarm message or emergency call if, for instance, an emergency is detected via the above-described fall sensor.

[0023] The mobile phone itself can be stored in various places as long as the mobile phone is capable of establishing a data communication with the first micro-controller. In certain embodiments, however, the protective personal garment comprises a pouch for housing the mobile

phone, with the first micro-controller being configured to establish a data communication with the mobile phone housed in the pouch.

[0024] In a preferred embodiment, the functional units comprise an inductive charging element arranged in the pouch so that the mobile phone can even be charged via the one or more sources of electrical energy used to power the micro-controller and the functional units of the protective personal garment. It is also possible to send an alarm message via the mobile phone to dedicated predetermined recipients so that the predetermined recipients are immediately informed of a potential safety hazard without requiring further intervention of the wearer of the protective personal garment. It can also be envisioned that before or immediately after an alarm is issued, the wearer of the personal garment is notified of a detected event and has the possibility to cancel the alarm within a predetermined period of time if, for instance, a fall of the wearer has been detected in error.

[0025] Preferably, the one or more sources of electrical energy are not integrated with the protective personal garment but can be worn as separate elements, for instance in pouches of a separate belt. In this case, the user simply has to establish a connection via the sources of electrical energy, for instance accumulators, and the connectors of the protective personal garment.

[0026] The present invention also concerns a protective garment system comprising the protective personal garment as described above and an application program downloadable on a mobile phone, wherein the application program is configured for data communication with the first micro-controller of the protective personal garment.

[0027] The present invention will now be described in more detail making reference to a preferred embodiment depicted in the attached drawings.

[0028] In the drawings:

- Fig. 1 shows an embodiment of the protective personal garment of the present invention in an outside front view;
- Fig. 2 shows the garment of Fig. 1 in an outside back view;
- Fig. 3 shows the inner face of the torso portion of the garment of Fig. 1;
- Fig. 4 shows a schematic transparent view of the garment of Fig. 1 indicating the connectivity of functional elements; and
- Fig. 5 shows a schematic transparent view of the garment of Fig. 2 indicating the connectivity of functional elements

[0029] In the embodiments shown in Figures 1-5, the protective personal garment of the present invention is a safety jacket. In the Figures, the safety jacket is generally designated with reference sign 10.

[0030] As can be taken from the Figures, the safety jacket 10 has a torso portion 11 having an inner face 12

(c.f. Fig. 3) and an outer face 13 (c.f. Figs. 1 and 2) and a left arm sleeve 14 and a right arm sleeve 15, both extending from the torso portion 11. The left arm sleeve 14 and the right arm sleeve 15 also have respective outer faces 16, 17 and inner faces (not specifically depicted in the drawings but can be inferred from the drawings).

[0031] From the outer views of Figs. 1 and 2, it can be taken that the protective jacket 10 is equipped with typical features of a safety jacket such as reflective strips 18 to increase visibility of the wearer applied to the outer faces 13, 16, 17 which are typically made of a resistant, durable material such as

[0032] The torso portion 11 is provided with a collar 19 at its upper end. In the depicted embodiment, a hood 20 is attached in the collar region. In preferred embodiments, the hood 20 is configured as an outer hood, e.g. a helmet hood, and an inner hood, e.g. a balaclava, allowing the user to choose whether to wear either the inner hood or the outer hood or both.

[0033] The left arm sleeve 14 is provided with a pouch 21 for housing a mobile phone (not depicted in the drawings). The pouch 21 can be provided with a protective cover and/or a removable flap.

[0034] In the middle and upper parts of the torso portion 11, lighting elements such as LED strips 22, are provided which allow to illuminate the area in front of the wearer.

[0035] In the views of Figs. 1 and 2, the jacket 10 is shown in a closed position. For instance, a zipper closure can be used (not visible in the drawings) which, in the closed position can be further protected by an external protective strip 23 provided with hook-and-loop fasteners (Velcro strip).

[0036] In the view of Fig. 3, the two front parts of the torso portion 11 are opened to reveal the inner face 12 of the torso portion. As can be taken therefrom, two cooling ducts 24 are provided on the inner back side of the jacket 10 and fans 25 are attached to the lower end of the cooling ducts 24. The fans allow to circulate air from the surrounding environment into the inner side of the jacket to cool the torso of the wearer. Also visible in Fig. 3 is an electrical connector 26 which allows establishing an electrical connection with an external energy source, such as one or more accumulators stored, for instance in a belt pouch of the wearer (not depicted in the drawings).

[0037] In the outside and inside views of Figs. 1-3, functional elements arranged between various layers of the jacket are not visible. Therefore, Figs. 4 and 5 depict a representation similar to Figs. 1 and 2 but in a schematic semi-transparent view allowing to show possible locations of various elements. In contrast to Fig. 1, the hood 20 has not been depicted in Figs. 4 and 5 for simplicity reasons.

[0038] As can be taken from Figs. 4 and 5, a first micro-controller 27 is arranged in the torso portion 11 of the jacket 10 which functions an electrical control to various elements of the jacket. In the collar 19, microphones 28 and speakers 29 are provided as communication ele-

ments. In the depicted example, a second, dedicated micro-controller 30 for the communication elements is provided which is electrically connected to the first micro-controller 27. In other embodiments, the first micro-controller can also be configured to control the communication elements directly.

[0039] The first micro-controller 27 can also comprise a fall sensor which typically includes a three-axis accelerometer for determining unusual accelerations of the protective personal garment which may be attributed to a fall. The first micro-controller 27 can be configured to initiate an alarm, for instance via the built-in lighting elements 22 and/or the built-in speakers 29 to attract attention of co-workers in the immediate area of the wearer of the protective personal garment. Additionally or alternatively, the first micro-controller may initiate an emergency call via the mobile phone. The emergency call may include geolocation data obtained, for instance, via a satellite navigation sensor included in the micro-controller board or via the geolocation units typically included in a commercially available mobile phone.

[0040] A first temperature sensor 31 is arranged at the inner face 12 of the torso portion for controlling essentially the internal temperature of the safety jacket and hence allows to ensure a comfortable environment for the wearer. As can be taken from Fig. 5, a second environmental sensor 32 is provided at the outer face 13 of the torso portion for determining the ambient temperature. The first and second environmental sensors 31, 32 typically comprise a first and second temperature sensor, respectively, and, optionally, first and second humidity sensors.

[0041] As can also be taken from Figs. 4 and 5, various heating elements 33 are provided in the torso portion 11 and in the collar 19.

List of reference signs

[0042]

10 safety jacket
11 torso portion of safety jacket
12 inner face of torso portion
13 outer face of torso portion
14 left arm sleeve
15 right arm sleeve
16 outer face of left arm sleeve
17 outer face of right arm sleeve
18 reflective strips
19 collar
20 hood
21 pouch
22 lighting elements, LED strips
23 protective strip/Velcro strip
24 cooling duct
25 fan
26 electrical connector
27 first micro-controller
28 microphone

29 speaker
30 second micro-controller
31 first environmental sensor
32 second environmental sensor
33 heating element
34 inductive charging element

Claims

1. A protective personal garment (10), comprising

a torso portion (11) having an inner face (12) and an outer face (13), said torso portion (11) being provided with a collar (19), a left arm sleeve (14) and a right arm sleeve (15) extending from said torso portion (11), said left arm sleeve (14) and said right arm sleeve (15) having respective inner faces and outer faces (16,17),

at least a first micro-controller (27) configured to establish a data communication with a control unit, said first micro-controller (27) being provided with one or more electrical connectors (26) to connect said first micro-controller (27) with one or more sources of electrical energy, and one or more functional units electrically connected with said first micro-controller.

2. The protective personal garment as claimed in claim 1, wherein said control unit is a mobile phone.

3. The protective personal garment as claimed in one of claims 1 or 2, wherein said functional units comprise

heating elements (33) arranged at said inner face (12) of said torso portion (11) and/or heating elements (33) arranged at said inner faces of said left arm sleeve (14) and said right arm sleeve (15) and/or heating elements (33) arranged at said inner face of said collar (19) of said torso portion (11).

4. The protective personal garment as claimed in claim 3, wherein said heating elements (33) are resistive heaters.

5. The protective personal garment as claimed in one of claims 1 to 4, wherein said functional units comprise cooling elements (24, 25) arranged at said inner face (12) of said torso portion (11).

6. The protective personal garment as claimed in claim 5, wherein said cooling elements comprise at least one cooling duct (24) arranged at said inner face (12) of said torso portion (11) and at least one fan (25) arranged at one end of said cooling duct (24).

7. The protective personal garment as claimed in one claims 1 to 6, wherein said functional units comprise a first environmental sensor (31) arranged at said inner face (11) of said torso portion (12).
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8. The protective personal garment as claimed in claim 7, wherein said functional units comprise a second environmental sensor (32) arranged at said outer face (13) of said torso portion (11).
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9. The protective personal garment as claimed in one claims 7 or 8, wherein said first environmental sensor (31) and/or said second environmental sensor (32) comprise a temperature sensor.
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10. The protective personal garment as claimed in one claims 1 to 9, wherein said functional units comprise lighting elements (22) arranged at said outer face (13) of said torso portion (11), said lighting elements preferably comprising LED strips (22).
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11. The protective personal garment as claimed in one of claims 1 to 10, wherein said functional units comprise a communication system comprising one or more microphones (28) and one or more speakers (29) arranged at said collar (19) of said torso portion (11).
25
12. The protective personal garment as claimed in claim 11, wherein said communication system comprises a second micro-controller (30) which is electrically connected to said first micro-controller (27) and to said one or more microphones (18) and said one or more speakers (19).
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13. The protective personal garment as claimed in one of claims 1 to 12, further comprising a fall sensor.
14. The protective personal garment as claimed in one of claims 1 to 13, further comprising a pouch (21) for housing said mobile phone, said first micro-controller (27) being configured to establish a data communication with said mobile phone housed in said pouch (21), wherein said functional units preferably comprise an inductive charging element (34) arranged in said pouch (21).
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15. A protective garment system comprising said protective personal garment as claimed in one of claims 1 to 14 and an application program downloadable on a mobile phone, said application program being configured for data communication with said first micro-controller (27).
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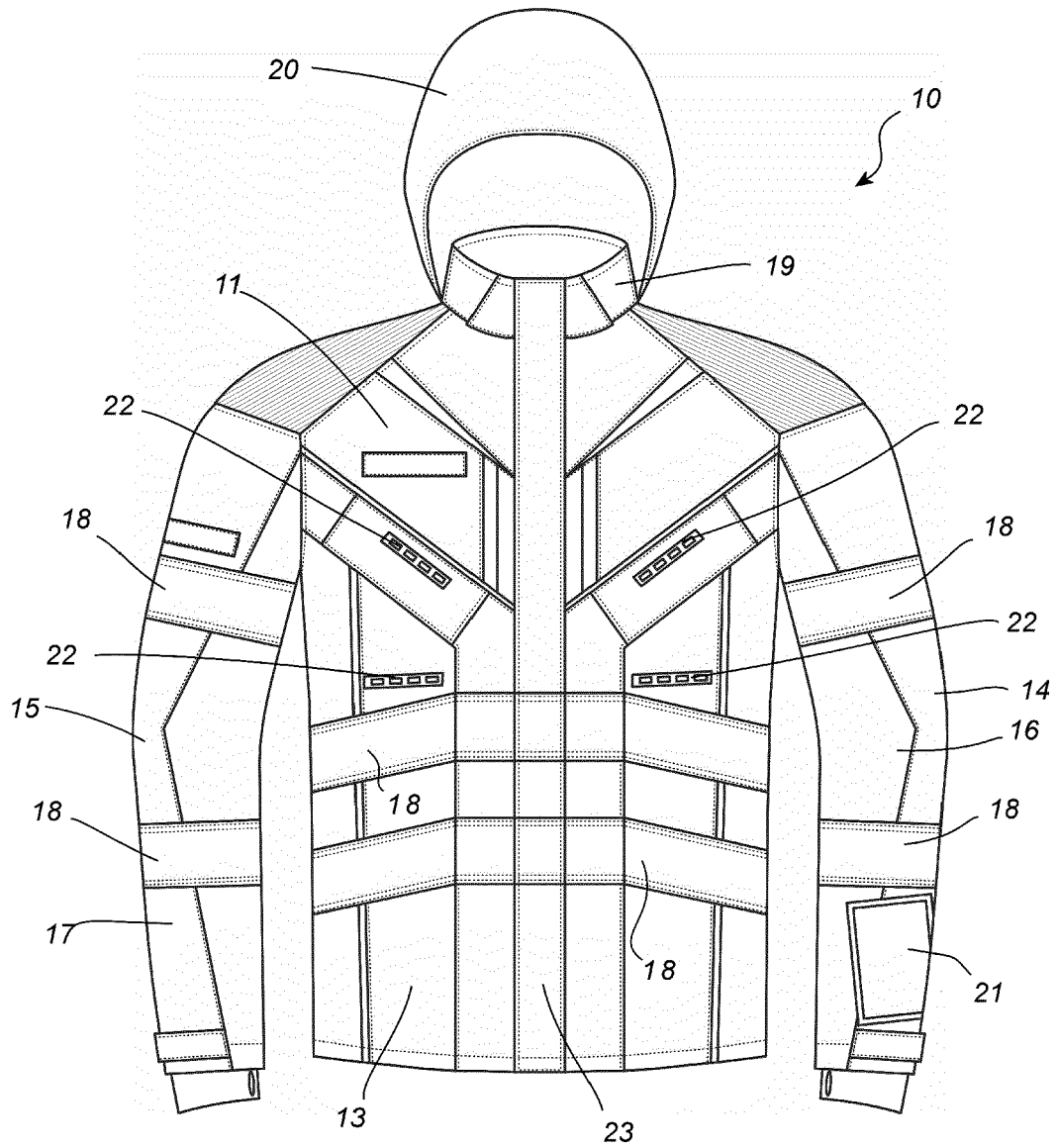


Fig. 1

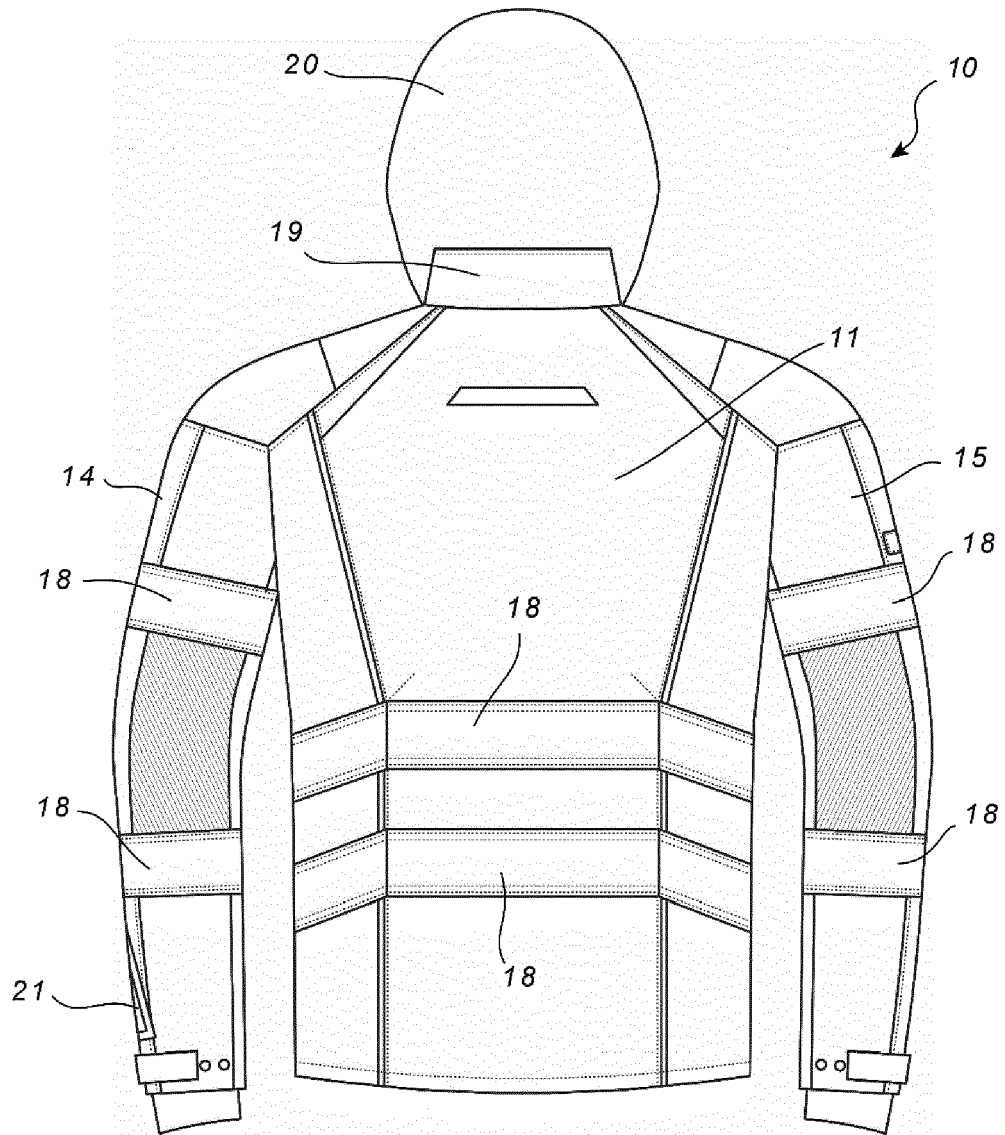


Fig. 2

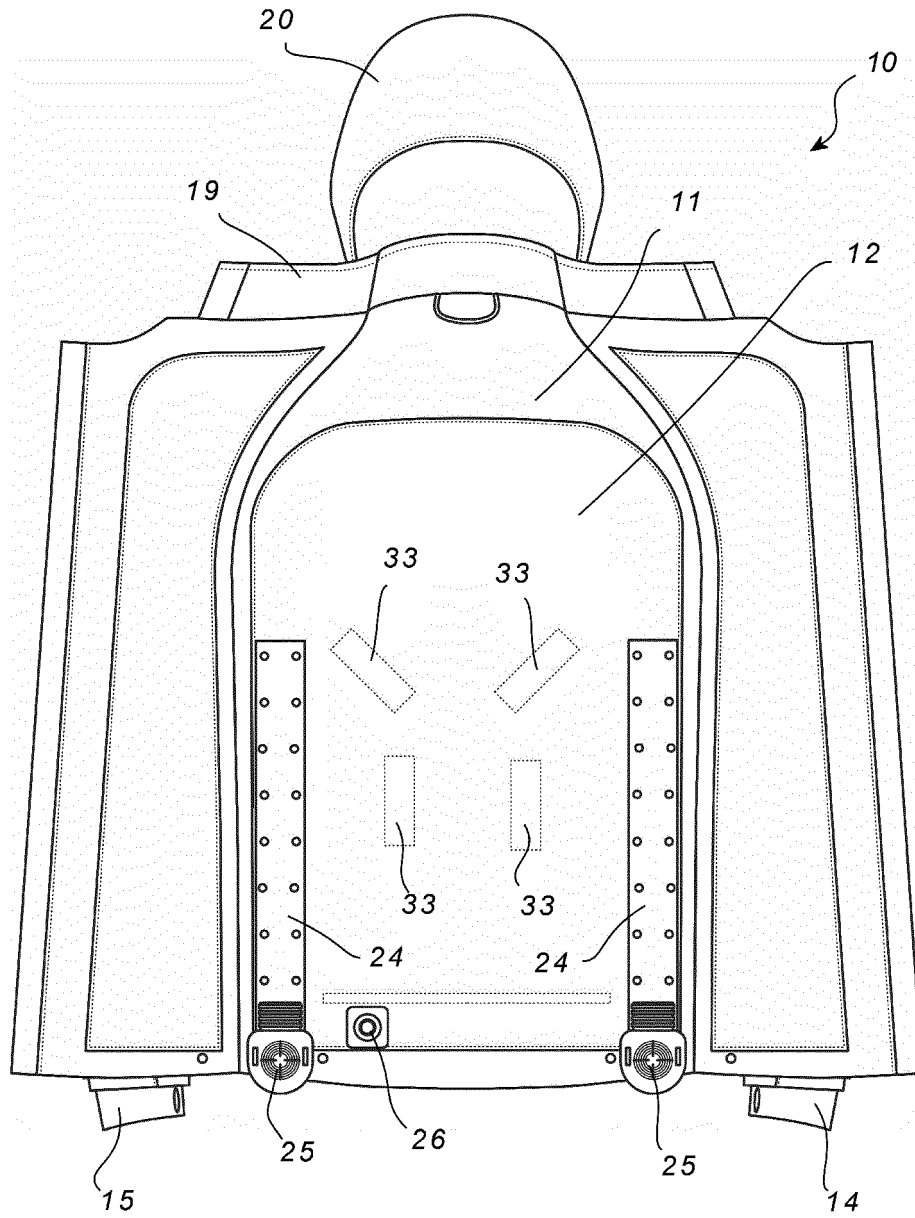


Fig. 3

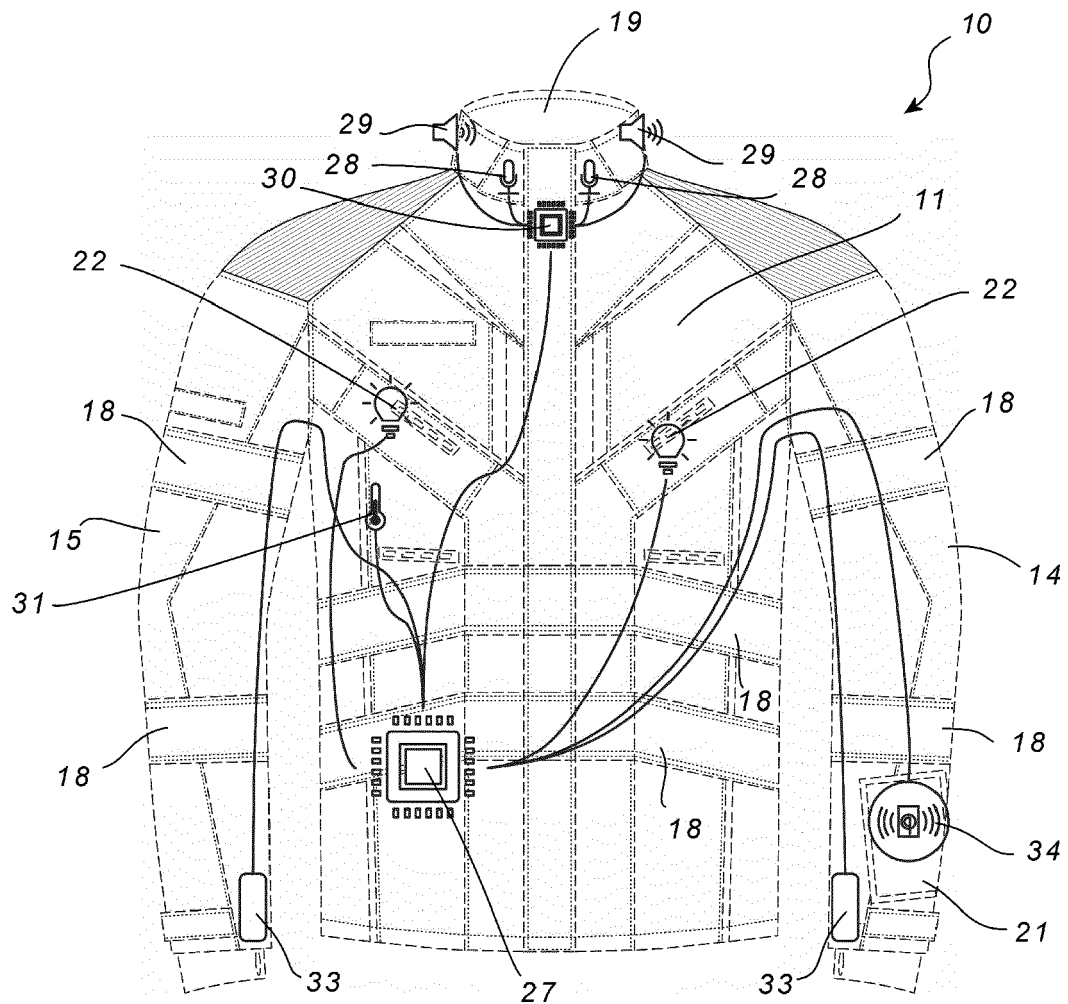


Fig. 4

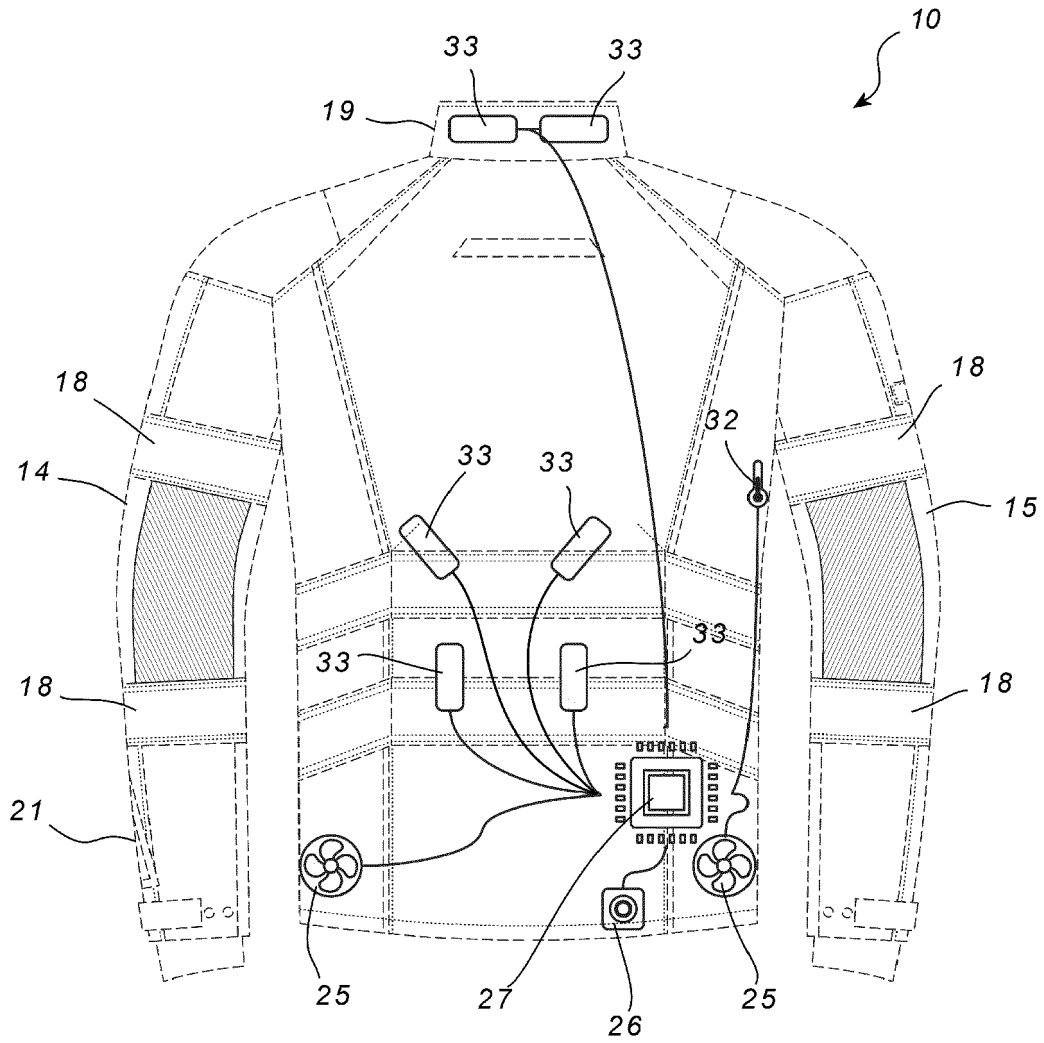


Fig. 5



EUROPEAN SEARCH REPORT

Application Number

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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 2 November 2022	Examiner da Silva, José
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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

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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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