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(54) Systems and methods for inflatable avalanche protection with reinflation

Systeme und Verfahren für aufblasbaren Lawinenschutz mit Wiederaufblasmechanismus

Systèmes et procédés de protection d'avalanche gonflable avec regonflage

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Description

FIELD OF THE INVENTION

[0001] The invention generally relates to inflatable avalanche safety systems and methods of operation. In particular, the present invention relates to systems and methods for efficient inflation of an avalanche safety chamber.

BACKGROUND OF THE INVENTION

[0002] One type of emergency life-preserving equipment is an inflatable safety system configured to inflate a chamber in response to an emergency event such as an impact or a potential impact. For example, automobile driver inflatable safety systems are designed to automatically inflate a chamber over the steering wheel in response to an impact between the automobile and another object so as to protect the driver from forceful impact with interior structures of the automobile. Likewise, avalanche inflatable safety systems are designed to manually inflate a chamber adjacent to the user in response to the user's triggering of an inflation mechanism. Inflatable safety systems generally include an inflatable chamber, an activation system, and an inflation system. The inflatable chamber is designed to expand from a compressed state to an inflated state so as to cushion the user or dampen potential impact. The inflatable chamber may also be used to encourage the user to elevate over a particular surface. The elevation of the inflatable chamber is achieved by the concept of inverse segregation, in which larger volume particles are sorted towards the top of a suspension of various sized particles in motion. The activation system enables manual or automatic activation of the inflation system. The inflation system transmits a fluid such as a gas into the inflatable chamber, thus increasing the internal pressure within the inflatable chamber and thereby transitioning the inflatable chamber from the compressed state to the inflated state.

[0003] Unfortunately, conventional inflatable avalanche safety systems fail to provide an efficient safety system. First, conventional systems are limited to single use in-field operation. The portable compressed gas canisters used in the conventional systems are generally configured to only contain a sufficient volume for a single deployment and therefore must be completely replaced to rearm the system. Therefore, if a user inadvertently deploys the system, it cannot be rearmed without replacing the canister. Second, conventional systems include one or more combustible or pressurized components that are not permitted on airplanes and helicopters, thus limiting the systems' use in travel situations. Third, conventional avalanche inflatable systems require a complex rearming procedure that includes replacing at least one component to enable repeated use. This may compromise user safety or system operation if performed incorrectly.

[0004] A known prior art avalanche safety system with an inflatable chamber having a reinflation mechanism to ensure the inflatable chamber remains filled is disclosed in US 2012/0060267 A1.

[0005] Another problem of conventional inflatable avalanche systems is the susceptibility to system failure as a result of a tear or rip in the inflatable chamber. The inflatable chamber is generally inflated for a predetermined period of time corresponding to the inflation mechanism. The inflation period is intended to be performed by the user prior to avalanche contact. Therefore, during avalanche contact and transport, the inflatable chamber may contact various debris contained within the avalanche medium. For example, sharp objects such as ice and rock may be transported within the avalanche at differing speeds with respect to the user. Contact between the sharp objects and the inflatable chamber may thereby result in a puncture or tear and subsequent deflation. Deflation of the inflatable chamber will then compromise the safety provided by the inflatable avalanche system and expose the user to increased danger.

[0006] Therefore, there is a need in the industry for an efficient and reliable inflatable avalanche safety system that overcomes the problems with conventional systems.

SUMMARY OF THE INVENTION

[0007] An inflatable avalanche safety system according to the present invention is defined in independent claim 1. Advantageous and alternative embodiments of the inflatable avalanche safety system of the present invention are set forth in the dependent claims.

[0008] The present invention generally relates to inflatable avalanche safety systems and methods of operation. One embodiment of the present invention relates to an avalanche safety system including an inflatable chamber, activation system, inflation system, and a harness. The inflatable chamber is a three-dimensionally, partially enclosed region, entirely on a dorsal side in proximity of a user. The inflatable chamber having an inflated state and a compressed state. The inflated state may form a particular three dimensional shape configured to protect the user from impact and/or provide inverse segregation during an avalanche. The activation system is configured to receive a user-triggered action to activate the system. The activation system also includes a reinflation algorithm configured to automatically reactivate the inflation system after a predetermined period of time to maintain the inflated state of the inflatable chamber. The inflation system may include an air intake, battery, fan, and internal airway channel. The inflation system is configured to transmit ambient air into the inflatable chamber. The harness may be a backpack that enables a user to transport the system while engaging in activities that may be exposed to avalanche risk. The harness may include hip straps, shoulder straps, internal compartments, etc.

[0009] According to the present invention the harness is configured to support the inflatable chamber, activation

system, and inflation system in proximity to the user, wherein the fan is disposed in a bottom of the harness. The inflation system comprises an air intake and an internal airway channel, wherein the air intake comprises an air intake frame, which is a partially rigid member with a lateral vent structure having a channel to the internal airway channel, and the air intake frame has a curved end portion in the bottom to support the fan. The internal airway channel connects the lateral vent structure, fan and inflatable chamber. The internal airway channel and the fan are disposed in the curved end portion of the air intake frame.

[0010] Embodiments of the present invention represent a significant advance in the field of avalanche safety systems. The limitations of conventional avalanche safety systems are overcome by using ambient air rather than a canister of compressed gas. The use of ambient air avoids the explosive dangers associated with compressed gas canisters, rendering the device legal for air transportation. Likewise, ambient air is unlimited and therefore enables multiple inflations and/or inadvertent deployments. Finally, the procedure to rearm the system is simplified to enable intuitive user operation.

[0011] In addition, embodiments of the present invention overcome or minimize the susceptibility of the inflatable chamber to deflate as a result of a rip or tear. Embodiments of the present invention include an activation system with a reinflation algorithm. The activation system may include any sequential deactivating and reactivating of the inflation system to maintain inflation of the inflatable chamber. Furthermore, the activation system may also include a pressure sensor within the airbag system which will allow the system to automatically identify a leak and provide airflow as required to maintain proper inflation.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The following description of the invention can be understood in light of the Figures, which illustrate specific aspects of the invention and are a part of the specification. Together with the following description, the Figures demonstrate and explain the principles of the invention. In the Figures, the physical dimensions may be exaggerated for clarity. The same reference numerals in different drawings represent the same element, and thus their descriptions will be omitted.

Figure 1 illustrates a profile view of an avalanche safety system in accordance with embodiments of the present invention;

Figure 2 illustrates a schematic of the avalanche safety system illustrated in Figure 1;

Figures 3a-d illustrates perspective views of inflation system components;

Figure 4 illustrates a perspective view of the air intake frame, internal airway channel, and fan;

Figure 5 illustrates an exploded view of the air intake with respect to the remainder of the avalanche safety

system;

Figure 6 illustrates a flow chart of a method in accordance with another embodiment of the present invention;

Figures 7A-7C illustrate an operational sequence of the system in Figure 1 and the method of Figure 6; and

Figures 8A-C illustrate an operational inflation and reinflation sequence in accordance with embodiments of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0013] The present invention generally relates to inflatable avalanche safety systems and methods of operation. One embodiment of the present invention relates to an avalanche safety system including an inflatable chamber, activation system, inflation system, and a harness. The inflatable chamber is a three-dimensionally, partially enclosed region, entirely on a dorsal side in proximity of a user. The inflatable chamber having an inflated state and a compressed state. The inflated state may form a particular three dimensional shape configured to protect the user from impact and/or provide flotation during an avalanche. The activation system is configured to receive a user-triggered action to activate the system. The activation system also includes a reinflation algorithm configured to automatically reactivate the inflation system after a predetermined period of time to maintain the inflated state of the inflatable chamber. The inflation system includes an air intake, fan, and internal airway channel, and may include a battery. The inflation system is configured to transmit ambient air into the inflatable chamber. The harness may be a backpack that enables a user to transport the system while engaging in activities where they may be exposed to avalanche risk. The harness may include hip straps, shoulder straps, internal compartments, etc.

[0014] Reference is initially made to Figure 1, which illustrates a profile view of an avalanche safety system, designated generally at 100. The illustrated system 100 includes an inflatable chamber 140, an inflation system 160, an activation system (not shown), and a harness 120. The inflatable chamber 140 is a three dimensional, inflatable, partially enclosed structure. In particular, the inflatable chamber 140 includes an inlet (not shown) and a particular inflated shape. The inflatable chamber 140 is illustrated in the compressed state in Figure 1. The compressed state includes substantially expelling air from within the inflatable chamber and compressing the external surface of the inflatable chamber upon itself. Figure 7C illustrates the inflated state of the inflatable chamber. The inflated state of the inflatable chamber includes expansion of the external surface away from its compressed state, substantially analogous to the inflation of a balloon. However, the inflatable chamber may include a particular three dimensional inflated shape such that upon inflation, the external surfaces are forced to form

the shape. For example, the inflatable chamber may be configured to include multiple chambers, multiple regions, etc. Figure 7C illustrates one embodiment of an inflated shape including a substantially pillow-shaped form with two horn members. It will be appreciated that various other shapes may be practiced in accordance with embodiments of the present invention.

[0015] The inflation system 160 is configured to transition the inflatable chamber 140 from the compressed state to the inflated state. The inflation system 160 further includes an air intake 180, a fan 164, and an internal airway channel 168, and may include a battery, a motor 170, and a controller 172. The air intake 180 provides an inlet for receiving ambient air. The illustrated air intake 180 includes an elongated vent structure through which ambient air may flow. The air intake 180 is coupled to the internal airway channel 168 such that ambient air may be transmitted through the air intake 180 to the internal airway channel with minimal loss. The components and operation of the air intake will be described in more detail with reference to Figure 5 below. The fan 164, battery 166, motor 170, and controller 172 are the electrical components of the inflation system. The electrical components of the inflation system 160 are electrically coupled to the activation system as illustrated in Figure 2. The fan 164 is a rotational member configured to generate a vacuum force in a particular orientation upon rotation. The fan is oriented in the system 100 to generate the vacuum force such that ambient air is pulled into the inflatable chamber 140. It will be appreciated that fans in a variety of sizes may be used in accordance with embodiments of the present invention. The battery 166 may be any form of electrical storage device. The motor 170 converts electrical energy into mechanical rotation. The controller 172 may be any form of speed controller to facilitate particular inflation patterns such as a logarithmic increase in fan speed. The fan 164, battery 166, motor 170, and controller 172 are selected to correspond with one another to facilitate optimal inflation characteristics. For example, the size of fan 164 dictates the necessary speed and time required to inflate the inflatable chamber 140. The speed and time parameters thereby influence optimal selection of the remaining electrical components.

[0016] The activation system 190 is configured to activate the inflation system 160 to expand the inflatable chamber 140 to the inflated state. The activation system 190 is a user input device configured to a user-triggered action intended to activate the system 100. The particular user-triggered action depends on the specific type of activation system components. For example, the activation system 190 may include some form of physical switch configured to receive a physical switching motion from the user in order to activate the system 100. The switch may be any type of switching mechanism including but not limited to a rip cord, push button, toggle, etc. The activation system 190 is electrically coupled to the inflation system 160 so as to engage the inflation system upon receipt of the user-triggered action. Alternatively or

in addition, the activation system 190 may include other sensors designed to activate the system without a user-triggered action. In addition, the activation may include a deactivation switch. The deactivation switch may be used to deactivate the system in the event of an inadvertent activation.

[0017] The harness 120 couples the system 100 to the user 200 as illustrated in Figures 7A-7C. The illustrated harness 120 in Figures 1-7 is a backpack-style unit including a hip strap 124 and a shoulder strap 122. The backpack configuration provides an internal chamber separate from the inflatable chamber 140 within which the user may store items. The internal chamber is disposed between the user and the inflatable chamber 140 such that the inflatable chamber is distally disposed with respect to the remainder of the harness/backpack 120 and the user. Therefore, upon activation, the inflatable chamber will be able to inflate without obstruction. The inflation system 160 is distal to the inflatable chamber 140 in the illustrated embodiment. The inflation system 160 may be disposed within a region configured to break away or articulate upon the inflation of the inflatable chamber 140, as illustrated in Figures 7A-C. The backpack or harness may further include various other straps and compartments in accordance with embodiments of the present invention. Alternatively, the harness may be any form of simple strap apparatus configured to couple the system to the user.

[0018] Reference is next made to Figure 2, which illustrates a schematic of the avalanche safety system illustrated in Figure 1. The schematic diagram illustrates the operational relationship between various components of the system 100. The activation system 190 includes a switch 192. As discussed above, the activation system 190 is configured to receive a user-triggered action intended to activate the avalanche safety system 100 and inflate the inflatable chamber 140. The switch 192 is electrically coupled to the inflation system 160 between the battery 166 and the controller 172. As described above, the battery 166 stores electrical energy for use in inflating the inflatable chamber 140. The controller 172 is electrically coupled between the battery 166 and the motor 170. The controller 172 may provide a particular electrical inflation profile, including the modulation of current with respect to time. The motor 170 is electrically coupled to the controller 172 and fan 164 such that the modulated current from the controller 172 may be converted into mechanical rotation of the fan 164. The fan 164 is mechanically disposed between the air intake 180 and the inflatable chamber 140. In particular, an internal airway channel 168 connects the air intake 180, fan 164, and inflatable chamber 140 so as to minimize air loss. As discussed above, upon activation, the fan 164 generates a rotational force that creates a vacuum aligned with the illustrated arrows. The vacuum pulls external ambient air through the air intake 180, through the fan 164, and into the inflatable chamber 140.

[0019] Reference is next made to Figures 3a-d, which

illustrate perspective views of the inflation system components. The battery 166 may be any type of electrical storage device including but not limited to a direct current battery of the type illustrated. The fan 164 may be a circular fan that facilitates engagement with the internal airway channel 168. The motor 170 may be any type of motor 170 configured to correspond to the battery 166 and controller 172 parameters. Likewise, the controller 172 may be configured according to the inflation objectives for the inflatable chamber 140.

[0020] Reference is next made to Figure 4, which illustrates a perspective view of the air intake frame 182, internal airway channel 168, and fan 164. The air intake frame 182 is part of the air intake 180. Increasing the number of air intake regions increases reliability of the air intake system during operation. The air intake frame 182 is a partially rigid member with a lateral vent structure as illustrated. In particular, the lateral vent structure includes a channel to the internal airway channel 168. Therefore, air/gas transmitted through the lateral vents may be routed to the internal airway channel 168. The air intake frame 182 includes rigid internal structure members in order to maintain the channel. The illustrated internal airway channel 168 is a cylindrical member coupled between the air intake frame 182 and the fan 164. The internal airway channel 168 substantially encloses the coupling so as to minimize air leakage between the air intake frame 182 and the fan 164. The fan 164 is coupled to the internal airway channel 164. The inflatable chamber 140 (not shown in Figure 4) is coupled to the fan 164 either directly or via another internal airway channel member (not shown).

[0021] Reference is next made to Figure 5, which illustrates an exploded view of the air intake 180 with respect to the remainder of the avalanche safety system. The air intake 180 includes the air intake frame 182 (illustrated in Figure 4), a battery compartment 186, and a cover 184. The battery compartment 186 is configured to be disposed within the air intake frame 182. The positioning of the battery compartment 186 and the battery (not shown) with respect to the user is important because of the relative weight of most batteries. Therefore, positioning the battery 164 in a central region enables the shoulder 122 and hip straps 124 of the backpack (harness 120) to efficiently support the battery during operation. In addition, the battery 164 must be kept above a certain temperature for proper operation, and therefore positioning adjacent to the user ensures some amount of thermal insulation from the ambient temperature. The cover 184 includes padded regions and mesh regions. The padded regions facilitate user comfort and are disposed between the user and the air intake frame 182. The mesh regions are oriented to align with the lateral venting structure of the air intake frame 182. Therefore, ambient air may transmit through the mesh regions and into the air intake frame 182 as discussed above. Likewise, the mesh regions prevent debris from obstructing the vent structure of the air intake frame 182.

[0022] Figure 5 further illustrates a frame 126 member of the backpack or harness 120. The frame 126 may include a rigid support region for further supporting the system with respect to the user. The exploded view illustrates the positioning of the air intake 180 and the frame 126 with respect to the remainder of the system 100. The hip/waist straps 124 and the shoulder straps 122 are also illustrated in the exploded view for positional reference.

[0023] Reference is next made to Figure 6, which illustrates a flow chart of a method in accordance with another embodiment of the present invention. The method for inflating an inflatable chamber within an avalanche safety system comprises a plurality of acts. The illustrated method may be performed using the avalanche safety system 100 described above or in correlation with an alternative avalanche safety system. The method includes receiving a user-triggered action intended to activate the avalanche safety system, 210. The user-triggered action may include a physical operation or gesture such as pulling a ripcord or depressing a button. Alternatively, the act of receiving a user-triggered action may include receiving a non-physical operation. Upon receipt of the user-triggered action, the method transmits ambient air to the inflatable chamber, 220. The act of transmitting ambient air to the inflatable chamber may include generating a vacuum that transmits ambient air through an internal airway channel to the inflatable chamber. The act of generating a vacuum may include using a fan and/or other electrical components. The inflatable chamber is inflated, act 230. The act of inflating the inflatable chamber may include inflation entirely with ambient air. The act of inflating the inflatable chamber may also include forming a particular three dimensional shape and internal pressure of the inflatable chamber. The inflation of the inflatable chamber thereby protects the user from an avalanche, act 240. The act of protecting the user from an avalanche may include cushioning the user from impact during the avalanche, elevating the user above the avalanche debris, and/or providing a breathing receptacle of ambient air.

[0024] Reference is next made to Figures 7A-7C, which illustrate an operational sequence of the system in Figure 1 and the method of Figure 6. Figure 7A illustrates a user 200 with an avalanche safety system 100 in accordance with embodiments of the present invention. In particular, the user 200 is wearing the system 100 via a backpack harness structure including a set of hip/waist straps 124 and shoulder straps 122. The system includes an activation system 190 (not shown), inflation system 160 and inflatable chamber 140 as described above. Figure 7A illustrates the inflatable chamber 140 in the compressed state so as to be contained within a region of the backpack. In addition, the system illustrated in Figure 7A has not been activated and therefore the user has not performed any type of user-triggered action upon the activation system 190. Prior to Figure 7B, the user performs a particular user-triggered action such as pulling a ripcord or pressing a button to activate

the system 100. As described above, the activation system includes an electrical coupling that activates the components of the inflation system 160. For example, activation of the activation system 190 may include switching a switch so as to remove electrical resistance between a battery and other electrical components. Upon activation, the inflation system 160 transmits ambient air to the inflatable chamber 140. Figure 7B represents the transition from the compressed state to the inflated state of the inflatable chamber 140. The inflatable chamber 140 is partially filled with ambient air directed through an air intake 180, internal airway channel 168, and fan 164. A controller 172 may be used to inflate the inflatable chamber 140 according to a particular inflation profile. The inflation system 160 automatically translates in response to the inflation of the inflatable chamber 140. In the illustrated embodiment, the inflation system 160 is disposed within a region that is translating to the right as the inflatable chamber 140 is expanding. The inflation system 160 may be housed within a region with a releasable coupling (such as VELCRO) to the remainder of the system, thereby enabling automatic displacement in response to inflation. Figure 7C illustrates complete transition to the inflated state of the inflatable chamber 140. The inflatable chamber 140 thereby forms a particular three dimensional shape and has a particular pressure. The particular three dimensional shape and pressure of the inflatable chamber are specifically selected to protect the user 200 from impact and provide for inverse segregation during an avalanche. Various alternative shapes and pressures may be utilized in accordance with embodiments of the present invention. The pressure within the inflatable chamber may be maintained for a particular time using a one way valve that seals the inlet from transmitting air out from the inflatable chamber 140. Likewise, the controller 172 may be configured to shut off and/or restart the fan 164 after a certain amount of time corresponding to complete inflation of the inflatable chamber 140.

[0025] Reference is next made to Figures 8A-C which illustrate an operational inflation and reinflation sequence in accordance with embodiments of the present invention. The illustrated avalanche safety system 300 includes an inflatable chamber 340 and a harness 324, 330. The inflatable chamber 340 is coupled to the harness 324, 330 and is configured to include a compressed state (see Fig 7A) and an inflated state. The operation and specific configuration of the inflatable chamber 340 is described above. It will be appreciated that various shapes and materials may be used to manufacture the inflatable chamber 340 in accordance with embodiments of the present invention. The harness 324, 330 includes a waist strap 324 and a backpack 330 configured to support, orient, and position the inflatable chamber 340 adjacent to a user in both the compressed and inflated states. In particular, the illustrated harness 324, 330 is configured to support the inflatable chamber on the back region of a user as illustrated in Figures 7A-C. The system

300 includes an activation system (not shown) which receives the user-triggered action and automatically activates an inflation system (not shown). The inflation system is configured to actively transmit ambient air within the inflatable chamber using a fan (not shown), thereby transitioning the inflatable chamber from the compressed state to the inflated state. The term "active" is used to describe the transmission of ambient air into the inflated chamber substantially via the turbulent force generated by the fan. In contrast, "passive" transmission of ambient air is limited to air transmission generated naturally and/or assisted by the application of manual force from the user. The activation system of the system 300 includes a reinflation algorithm. The reinflation algorithm of the activation system includes automatically deactivating the inflation system for a second period of time and reactivating the inflation system for a third period of time. The reinflation algorithm of the activation system is configured to maintain inflation of the inflatable chamber 340 in the event of a rip or tear 360, which causes an external transmission 370 of the ambient air contained within the inflatable chamber 340 (Figures 8B and C).

[0026] In operation, a user initially activates the system 300 via the execution of a user-triggered action. The initial activation of the inflation system causes the active transmission of ambient air 350 into the inflatable chamber for a first period of time, illustrated in Figure 8A. The duration of the first period corresponds to the battery power, fan diameter, and internal area of the inflatable chamber 340. The first period of time is selected so as to inflate the inflatable chamber to a particular pressure based on the rate at which the fan transmits ambient air. The rate at which the fan transmits ambient air through the system 300 is dependent on multiple variables, including the battery, the fan, the size of the air inlets, the size of the internal airway channel, the size of the valve disposed between the fan and the inflatable chamber, etc. The particular pressure of the inflatable chamber corresponds to a set of predetermined safety parameters of the system, including buoyancy, flotation, etc. Therefore, if a smaller battery and fan are used, a longer period of time will be necessary to properly inflate the inflatable chamber to the particular pressure.

[0027] After the initial inflation of the inflatable chamber 340 to the inflated state (Figure 8A) by the inflation system, the inflation system is deactivated for a second period of time (Figure 8B) according to the reinflation algorithm. The activation system is subsequently reactivated according the reinflation algorithm for a third period of time (Figure 8C) according to the reinflation algorithm. The deactivation (Figure 8B) and reactivation (Figure 8C) may be repeated/cycled a particular number of times to maintain proper inflation of the inflatable chamber 340. The particular duration of the second period is predetermined and the third period and the number of cycles may be predetermined and/or may correspond to one or more parameters, including inflatable chamber pressure, rip detection, user triggering action, etc. For example, the

re-inflation algorithm may dynamically adjust the duration of the first period and/or the number of cycles based on the inflatable chamber pressure. One re-inflation algorithm embodiment may include a predetermined second period of two seconds, a third period of three seconds, and a five cycle repeat. Overinflation of the inflatable chamber 340 is unlikely with ambient air and therefore it is not necessary to restrict re-inflation to the positive detection of a rip/tear 360. The re-inflation algorithm may therefore be predetermined and independent of any detected parameters. However, the re-inflation algorithm may be selected to correspond to the necessary frequency so as to maintain a necessary safety pressure of the inflatable chamber 340 in the event of the most likely sized rip/tear 360. The transmission of ambient air 350 into the inflatable chamber 340 may therefore overcome the external transmission 370 of ambient air from the rip/tear 360. The material composition or stitch pattern of the inflatable chamber 340 may also be configured to contain or restrict an external rip/tear 360 to a particular maximum size.

Claims

1. An inflatable avalanche safety system (100) comprising:

an inflatable chamber (140) including a compressed state and an inflated state, wherein the inflated state forms a pressurized three dimensional region in proximity to a user (200);
 an inflation system (160) configured to actively transmit ambient air within the inflatable chamber (140) with a fan (164) thereby transitioning the inflatable chamber (140) from the compressed state to the inflated state; and
 an activation system (190) configured to activate the inflation system (160), wherein the activation system (190) includes a re-inflation algorithm configured to automatically reactivate the inflation system (160) after a predetermined period of time to maintain the inflated state of the inflatable chamber (140); wherein
 the inflatable chamber (140) in the inflated state forms a pressurized three dimensional region entirely on a dorsal side in proximity to the user (200),
 a harness (120) is configured to support the inflatable chamber (140), activation system (190), and inflation system (160) in proximity to the user (200), wherein the fan (164) is disposed in a bottom of the harness (120),
 the inflation system (160) comprises an air intake (180) and an internal airway channel (168), wherein the air intake (180) comprises an air intake frame (182), which is a partially rigid member with a lateral vent structure having a

channel to the internal airway channel (168), and the air intake frame (182) has a curved end portion in the bottom to support the fan (164), the internal airway channel (168) connects the lateral vent structure, fan (164) and inflatable chamber (140), and the internal airway channel (168) and the fan (164) are disposed in the curved end portion of the air intake frame (182).

2. The system (100) of claim 1, wherein the activation system (190) is configured to sequentially perform the acts of:

activating the inflation system (160) to inflate the inflatable chamber (140) for a first period greater than one second;
 deactivating the inflation system (160) for a second period greater than two seconds;
 reactivating the inflation system (160) for a third period; and
 deactivating the inflation system (160) for a fourth period.

3. The system (100) of claim 2, wherein the first period is greater than ten seconds.
4. The system (100) of claim 2, wherein the second period is three seconds and the third period is two seconds.
5. The system (100) of claim 2, wherein the acts of deactivating the inflation system (160) for a second period greater than two seconds and reactivating the inflation system (160) for a third period, are repeated at least once prior to the act of deactivating the inflation system (160) for a fourth period.
6. The system (100) of claim 2, wherein the acts of deactivating the inflation system (160) for a second period greater than two seconds and reactivating the inflation system (160) for a third period are repeated at least five times prior to the act of deactivating the inflation system (160) for a fourth period.
7. The system (100) of claim 2, wherein the fourth period is greater than five minutes.
8. The system (100) of claim 2, wherein the length of the fourth period corresponds to at least one of a user triggering action, an inflatable chamber pressure, and a battery voltage.
9. The system (100) of claim 2, wherein the acts of activating and reactivating the inflation system (160) include electrically coupling the fan (164) to a battery (166).

10. The system (100) of claim 2, wherein the acts of activating and reactivating the inflation system (160) include automatically opening a valve and transmitting ambient air into the inflatable chamber (140) in response to electrically activating the fan (164). 5
11. The system (100) of claim 2, wherein the acts of deactivating the inflation system (160) include automatically closing a valve substantially maintaining pressure within the inflatable chamber (140) in response to electrically deactivating the fan (164). 10
12. The system (100) of claim 1, wherein the air intake frame (182) includes rigid internal structure members. 15
13. The system (100) of claim 1, wherein the inflation system (160) comprises a battery (166) and wherein the air intake frame (182) has a battery compartment (186) for the battery (166) in a central region. 20

Patentansprüche

1. Aufblasbares Lawinensicherheitssystem (100), das umfasst: 25
- eine aufblasbare Kammer (140), die einen komprimierten Zustand und einen aufgeblasenen Zustand beinhaltet, wobei der aufgeblasene Zustand einen druckbeaufschlagten dreidimensionalen Bereich in der Nähe eines Benutzers (200) bildet; 30
- ein Aufblassystem (160), das so konfiguriert ist, dass es Umgebungsluft innerhalb der aufblasbaren Kammer (140) mit einem Gebläse (164) aktiv leitet, um somit die aufblasbare Kammer (140) aus dem komprimierten Zustand in den aufgeblasenen Zustand zu bringen; und 35
- ein Aktivierungssystem (190), das so konfiguriert ist, dass es das Aufblassystem (160) aktiviert, wobei das Aktivierungssystem (190) einen Wiederaufblasalgorithmus beinhaltet, der so konfiguriert ist, dass er das Aufblassystem (160) nach einem vorbestimmten Zeitraum automatisch reaktiviert, um den aufgeblasenen Zustand der aufblasbaren Kammer (140) aufrechtzuerhalten; wobei: 40
- die aufblasbare Kammer (140) in dem aufgeblasenen Zustand einen druckbeaufschlagten dreidimensionalen Bereich zur Gänze auf einer dorsalen Seite in der Nähe des Benutzers (200) bildet, 50
- ein Gurtzeug (120), das so konfiguriert ist, dass es die aufblasbare Kammer (140), das Aktivierungssystem (190) und das Aufblassystem (160) in der Nähe des Benutzers 55

(200) trägt, wobei das Gebläse (164) in einem Boden des Gurtzeugs (120) angeordnet ist, das Aufblassystem (160) einen Lufteinlass (180) und einen Innenluftwegkanal (168) umfasst, wobei der Lufteinlass (180) einen Lufteinlassrahmen (182) umfasst, der ein teilweise starres Element mit einer lateralen Belüftungsstruktur mit einem Kanal zu dem Innenluftwegkanal (168) ist, und der Lufteinlassrahmen (182) einen gekrümmten Endabschnitt im Boden aufweist, um das Gebläse (164) zu tragen, der Innenluftwegkanal (168) die laterale Belüftungsstruktur, das Gebläse (164) und die aufblasbare Kammer (140) verbindet, und der Innenluftwegkanal (168) und das Gebläse (164) in dem gekrümmten Endabschnitt des Lufteinlassrahmens (182) angeordnet sind.

2. System (100) nach Anspruch 1, wobei das Aktivierungssystem (190) so konfiguriert ist, dass es sequentiell die Aktionen durchführt:

Aktivieren des Aufblassystems (160), um die aufblasbare Kammer (140) aufzublasen, für einen ersten Zeitraum, der länger als eine Sekunde ist;
Deaktivieren des Aufblassystems (160) für einen zweiten Zeitraum, der länger als zwei Sekunden ist;
Reaktivieren des Aufblassystems (160) für einen dritten Zeitraum; und
Deaktivieren des Aufblassystems (160) für einen vierten Zeitraum.

3. System (100) nach Anspruch 2, wobei der erste Zeitraum länger als zehn Sekunden ist.
4. System (100) nach Anspruch 2, wobei der zweite Zeitraum drei Sekunden beträgt und der dritte Zeitraum zwei Sekunden beträgt.
5. System (100) nach Anspruch 2, wobei die Aktionen des Deaktivierens des Aufblassystems (160) für einen zweiten Zeitraum, der länger als zwei Sekunden ist, und des Reaktivierens des Aufblassystems (160) für einen dritten Zeitraum zumindest einmal wiederholt werden, bevor die Aktion des Deaktivierens des Aufblassystems (160) für einen vierten Zeitraum durchgeführt wird.
6. System (100) nach Anspruch 2, wobei die Aktionen des Deaktivierens des Aufblassystems (160) für einen zweiten Zeitraum, der länger als zwei Sekunden ist, und des Reaktivierens des Aufblassystems (160) für einen dritten Zeitraum zumindest fünfmal wieder-

holt werden, bevor die Aktion des Deaktivierens des Aufblassystems (160) für einen vierten Zeitraum durchgeführt wird.

7. System (100) nach Anspruch 2, wobei der vierte Zeitraum länger als fünf Minuten ist. 5
8. System (100) nach Anspruch 2, wobei die Länge des vierten Zeitraums zumindest einem von einer Benutzerauslöseaktion, einem Druck der aufblasbaren Kammer und einer Batteriespannung entspricht. 10
9. System (100) nach Anspruch 2, wobei die Aktionen des Aktivierens und Reaktivierens des Aufblassystems (160) das elektrische Verbinden des Gebläses (164) mit einer Batterie (166) beinhalten. 15
10. System (100) nach Anspruch 2, wobei die Aktionen des Aktivierens und Reaktivierens des Aufblassystems (160) das automatische Öffnen eines Ventils und Leiten von Umgebungsluft in die aufblasbare Kammer (140) in Reaktion auf das elektrische Aktivieren des Gebläses (164) beinhalten. 20
11. System (100) nach Anspruch 2, wobei die Aktionen des Deaktivierens des Aufblassystems (160) das automatische Schließen eines Ventils, wobei ein Druck innerhalb der aufblasbaren Kammer (140) im Wesentlichen aufrechterhalten wird, in Reaktion auf das elektrische Deaktivieren des Gebläses (164) beinhalten. 25
30
12. System (100) nach Anspruch 1, wobei der Lufteinlassrahmen (182) starre interne Strukturelemente beinhaltet. 35
13. System (100) nach Anspruch 1, wobei das Aufblassystem (160) eine Batterie (166) umfasst und wobei der Lufteinlassrahmen (182) ein Batteriefach (186) für die Batterie (166) in einem mittleren Bereich aufweist. 40

Revendications

1. Système de sécurité gonflable en cas d'avalanche (100) comprenant : 45
 une chambre gonflable (140) comportant un état comprimé et un état gonflé, dans lequel l'état gonflé forme une région tridimensionnelle sous pression à proximité d'un utilisateur (200) ;
 un système de gonflage (160) configuré pour transmettre activement l'air ambiant à l'intérieur de la chambre gonflable (140) avec un ventilateur (164) faisant ainsi passer la chambre gonflable (140) de l'état comprimé à l'état gonflé ; et
 un système d'activation (190) configuré pour ac- 50

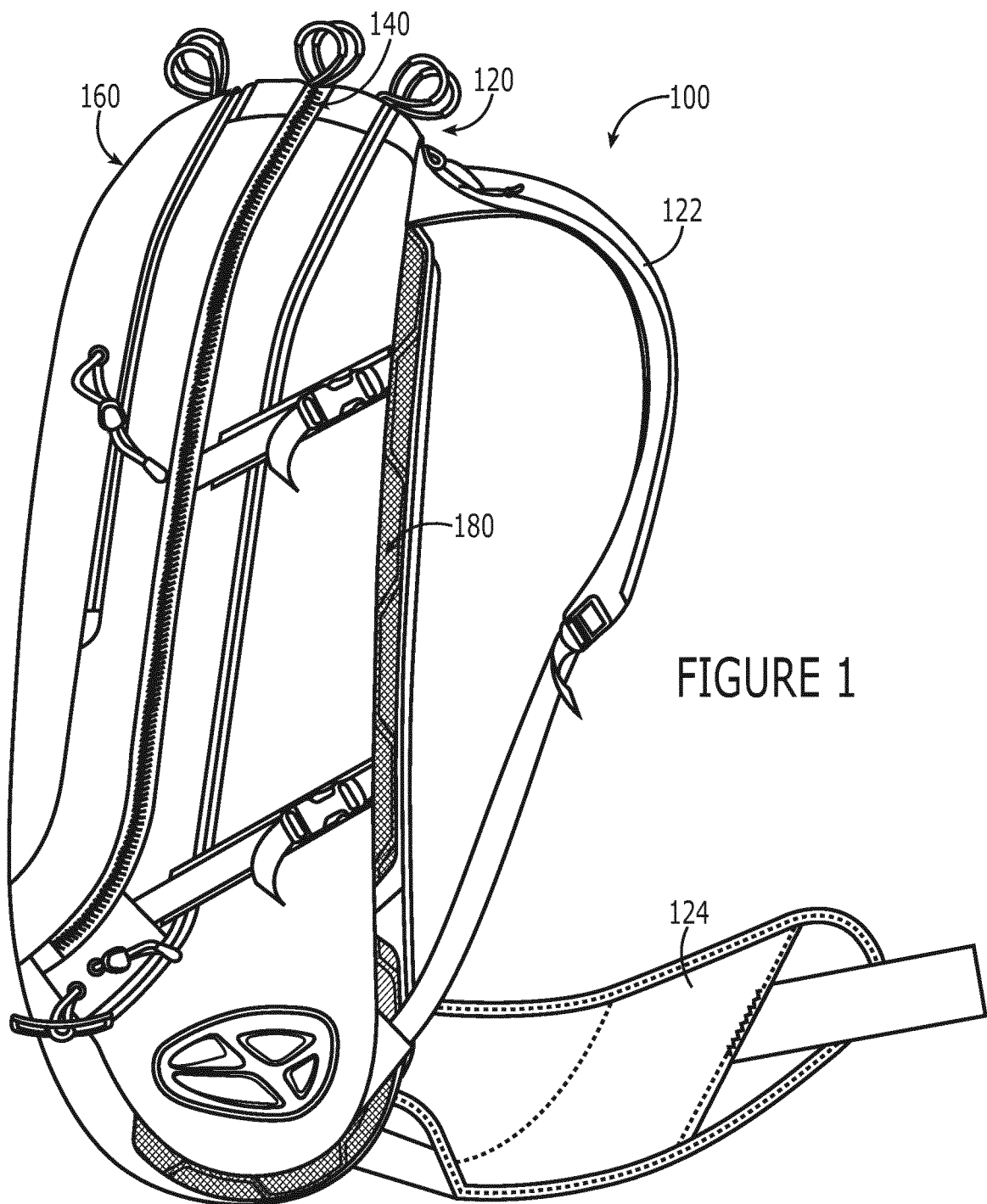
tiver le système de gonflage (160), dans lequel le système d'activation (190) comporte un algorithme de regonflage configuré pour réactiver automatiquement le système de gonflage (160) après une période de temps prédéterminée pour maintenir l'état gonflé de la chambre gonflable (140) ; dans lequel la chambre gonflable (140) à l'état gonflé forme une région tridimensionnelle sous pression entièrement sur un côté dorsal à proximité de l'utilisateur (200), un harnais (120) est configuré pour supporter la chambre gonflable (140), le système d'activation (190) et le système de gonflage (160) à proximité de l'utilisateur (200), dans lequel le ventilateur (164) est disposé dans un fond du harnais (120), le système de gonflage (160) comprend une entrée d'air (180) et un canal de voie respiratoire interne (168), dans lequel l'entrée d'air (180) comprend un cadre d'entrée d'air (182), qui est un élément partiellement rigide avec une structure de ventilation latérale ayant un canal vers le canal de voie respiratoire interne (168), et le cadre d'entrée d'air (182) a une partie d'extrémité incurvée dans le fond pour supporter le ventilateur (164), le canal de voie respiratoire interne (168) relie la structure de ventilation latérale, le ventilateur (164) et la chambre gonflable (140), et le canal de voie respiratoire interne (168) et le ventilateur (164) sont disposés dans la partie d'extrémité incurvée du cadre d'entrée d'air (182).

2. Système (100) selon la revendication 1, dans lequel le système d'activation (190) est configuré pour effectuer séquentiellement les actions :
 d'activation du système de gonflage (160) pour gonfler la chambre gonflable (140) pendant une première période supérieure à une seconde ;
 de désactivation du système de gonflage (160) pendant une deuxième période supérieure à deux secondes ;
 de réactivation du système de gonflage (160) pendant une troisième période ; et
 de désactivation du système de gonflage (160) pendant une quatrième période. 55
3. Système (100) selon la revendication 2, dans lequel la première période est supérieure à dix secondes.
4. Système (100) selon la revendication 2, dans lequel la deuxième période est de trois secondes et la troisième période est de deux secondes.
5. Système (100) selon la revendication 2, dans lequel

les actions de désactivation du système de gonflage (160) pendant une deuxième période supérieure à deux secondes et de réactivation du système de gonflage (160) pendant une troisième période, sont répétées au moins une fois avant l'action de désactivation du système de gonflage (160) pendant une quatrième période.

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6. Système (100) selon la revendication 2, dans lequel les actions de désactivation du système de gonflage (160) pendant une deuxième période supérieure à deux secondes et de réactivation du système de gonflage (160) pendant une troisième période sont répétées au moins cinq fois avant l'action de désactivation du système de gonflage (160) pendant une quatrième période. 10
15
7. Système (100) selon la revendication 2, dans lequel la quatrième période est supérieure à cinq minutes. 20
8. Système (100) selon la revendication 2, dans lequel la longueur de la quatrième période correspond à au moins l'une parmi une action de déclenchement par l'utilisateur, une pression de chambre gonflable et une tension de batterie. 25
9. Système (100) selon la revendication 2, dans lequel les actions d'activation et de réactivation du système de gonflage (160) comportent le couplage électrique du ventilateur (164) à une batterie (166). 30
10. Système (100) selon la revendication 2, dans lequel les actions d'activation et de réactivation du système de gonflage (160) comportent l'ouverture automatique d'une soupape et la transmission de l'air ambiant dans la chambre gonflable (140) en réponse à l'activation électrique du ventilateur (164). 35
11. Système (100) selon la revendication 2, dans lequel les actions de désactivation du système de gonflage (160) comportent la fermeture automatique d'une soupape en maintenant sensiblement la pression à l'intérieur de la chambre gonflable (140) en réponse à la désactivation électrique du ventilateur (164). 40
45
12. Système (100) selon la revendication 1, dans lequel le cadre d'entrée d'air (182) comprend des éléments de structure interne rigides.
13. Système (100) selon la revendication 1, dans lequel le système de gonflage (160) comprend une batterie (166) et dans lequel le cadre d'entrée d'air (182) a un compartiment de batterie (186) pour la batterie (166) dans une région centrale. 50
55



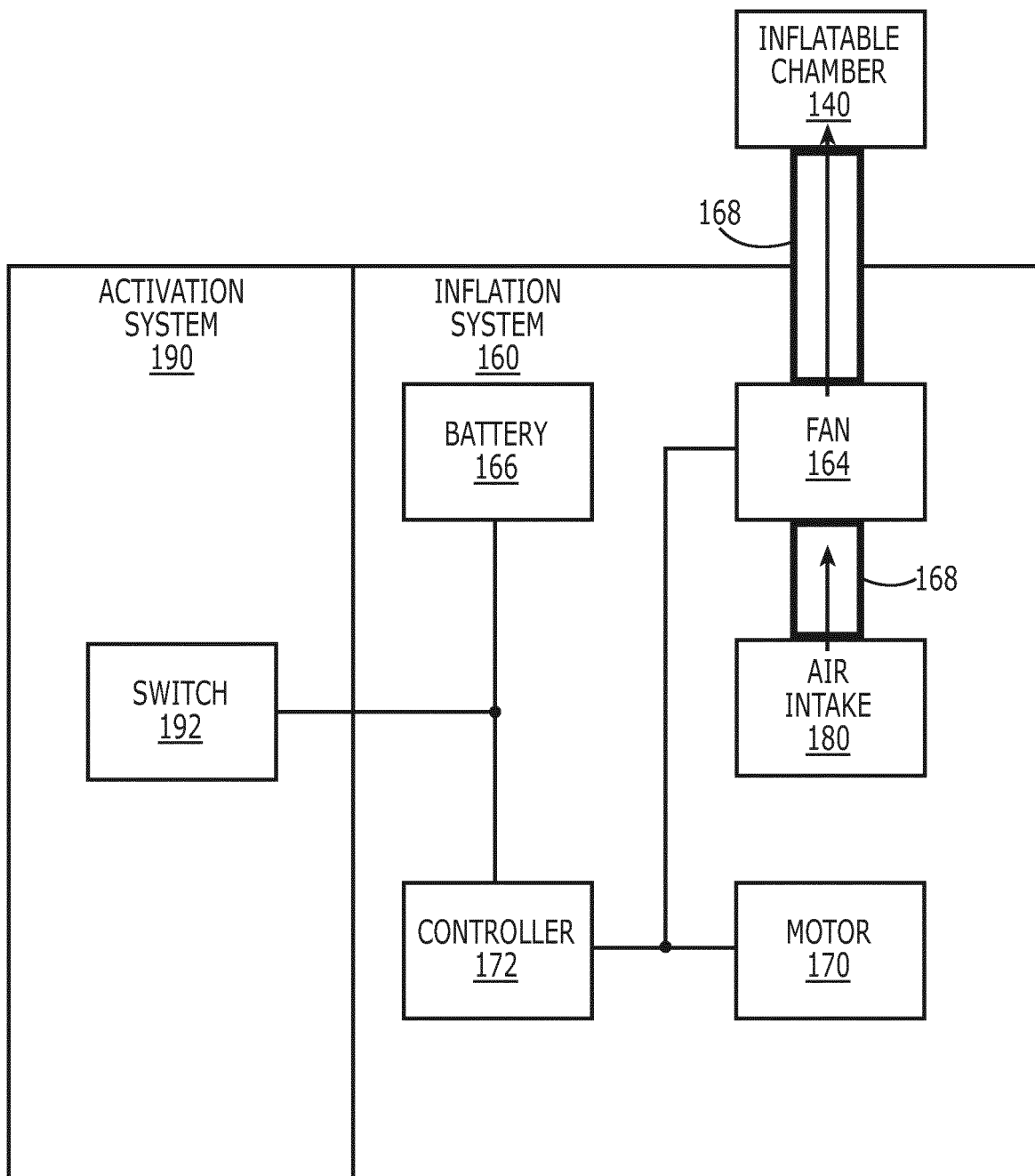


FIGURE 2

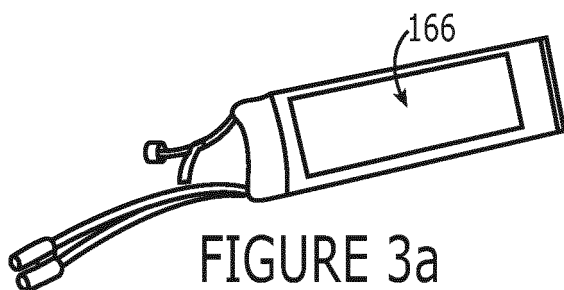


FIGURE 3a

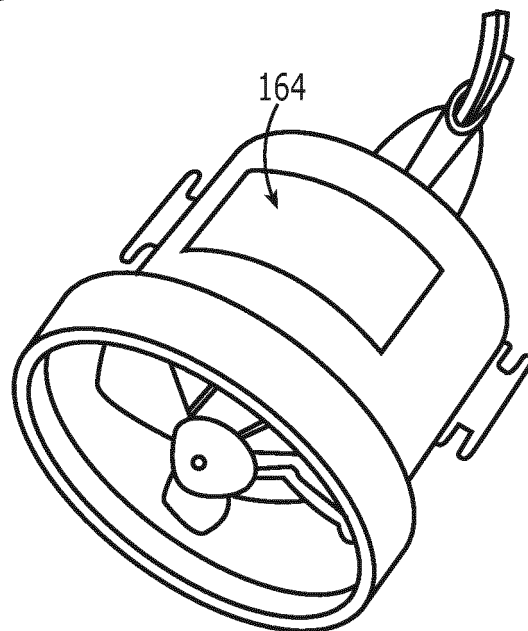


FIGURE 3b

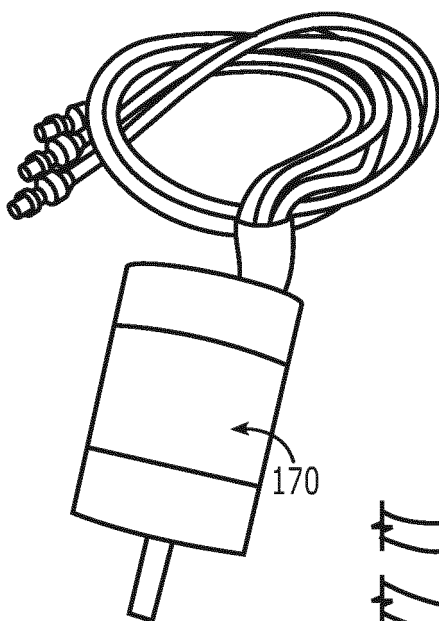


FIGURE 3c

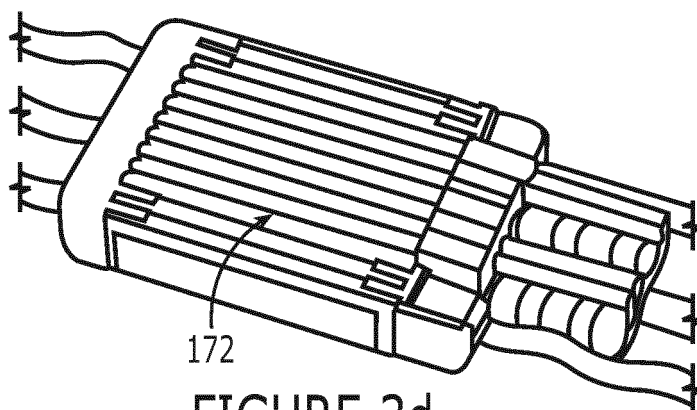
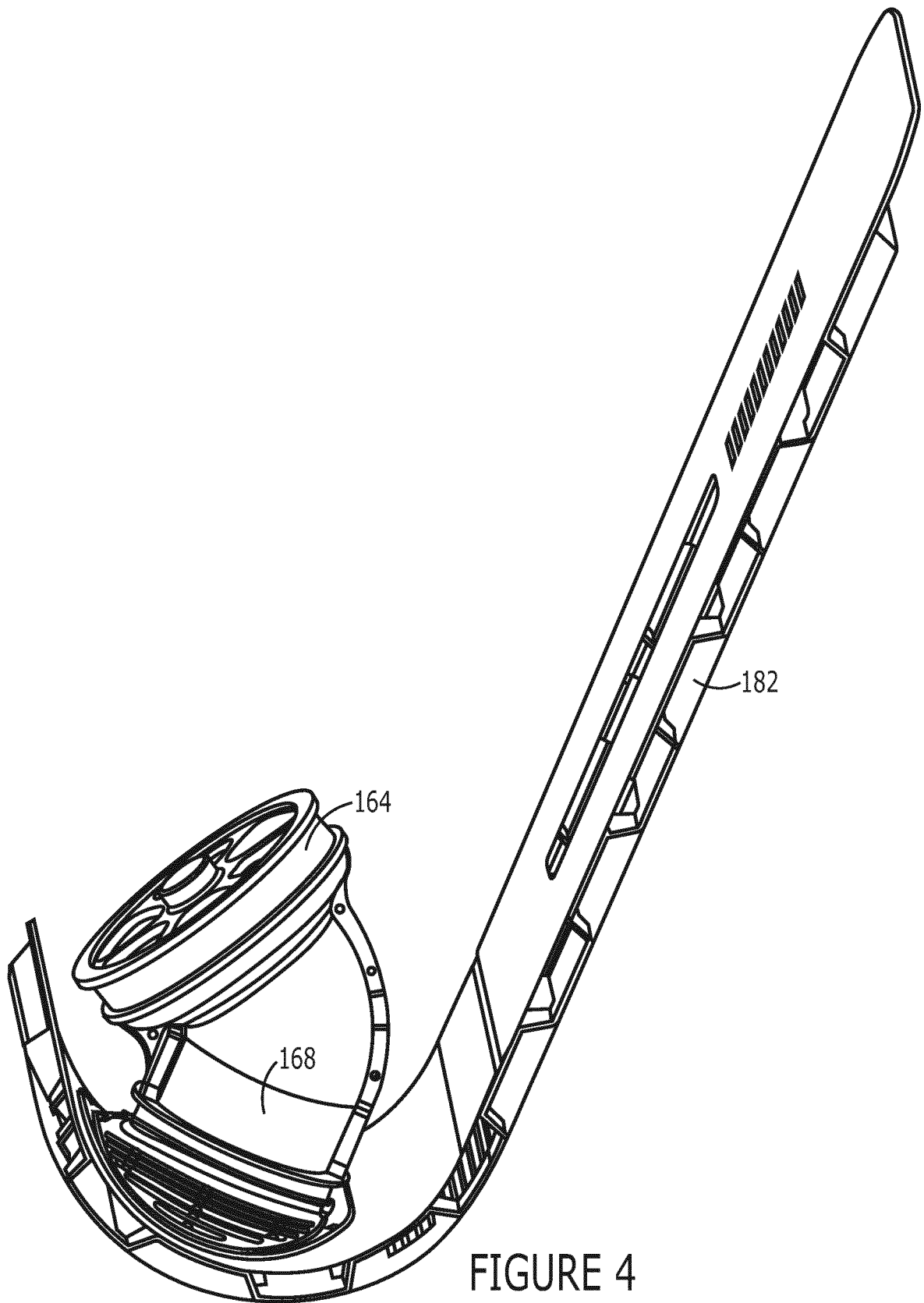
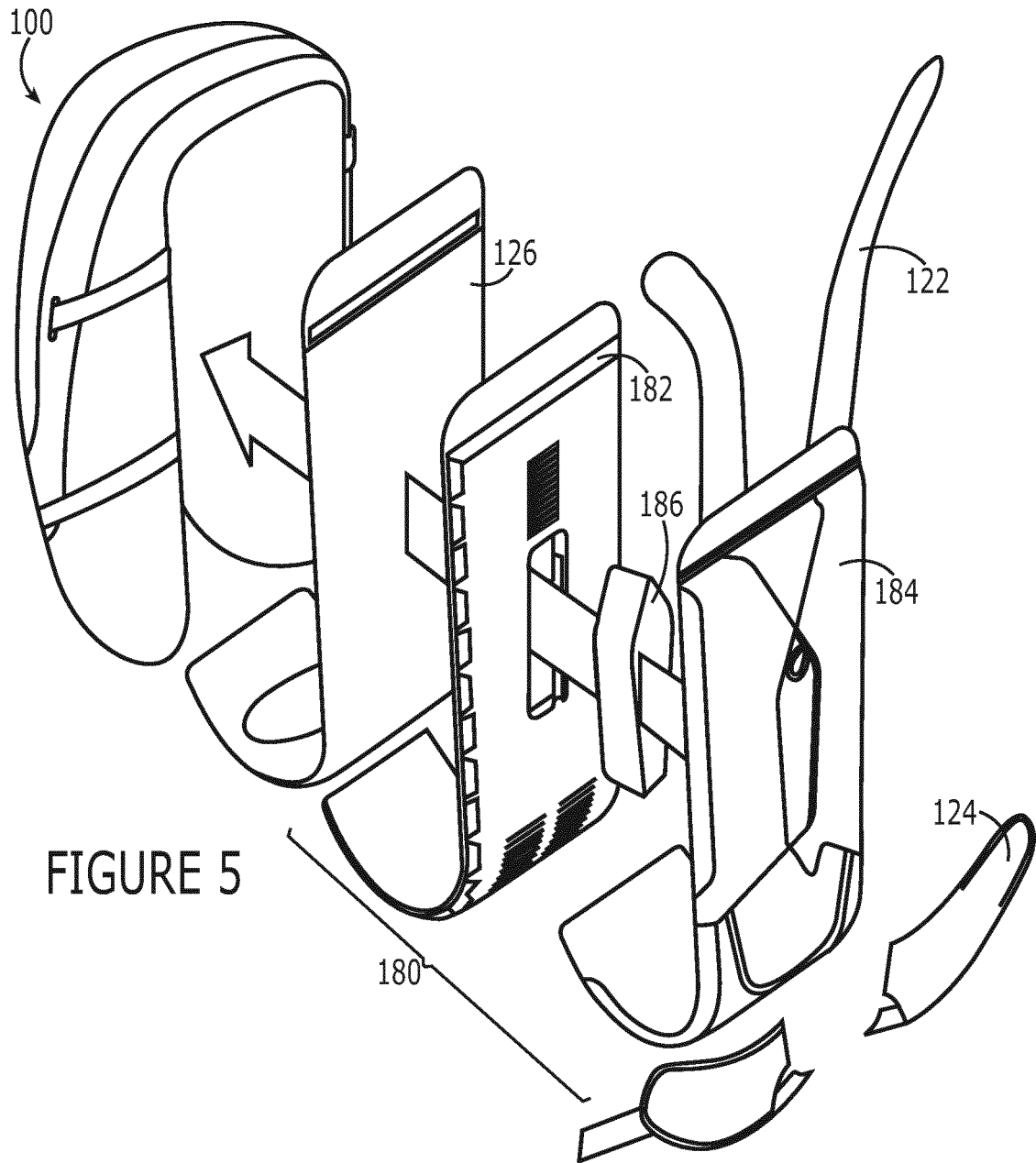


FIGURE 3d





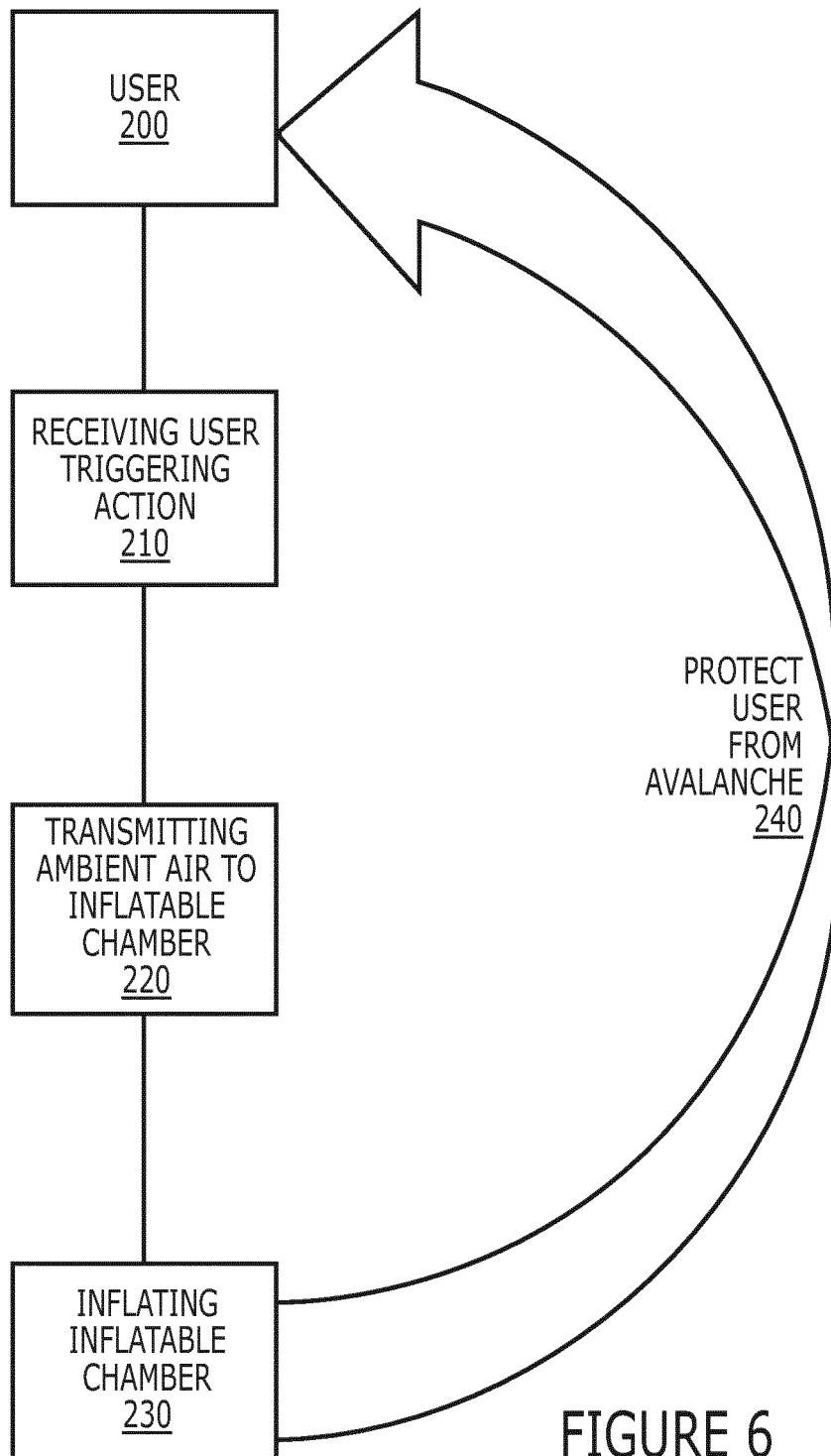


FIGURE 6

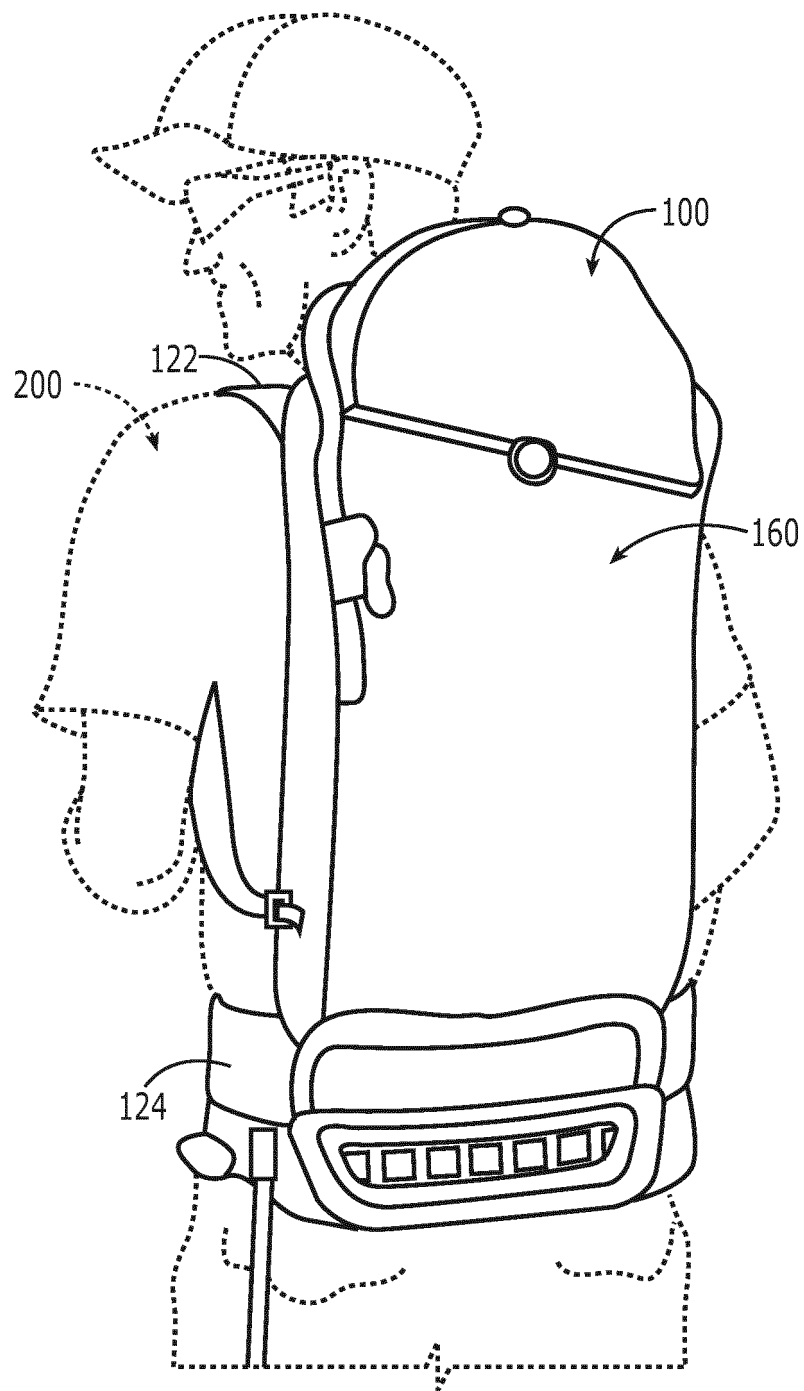


FIGURE 7A

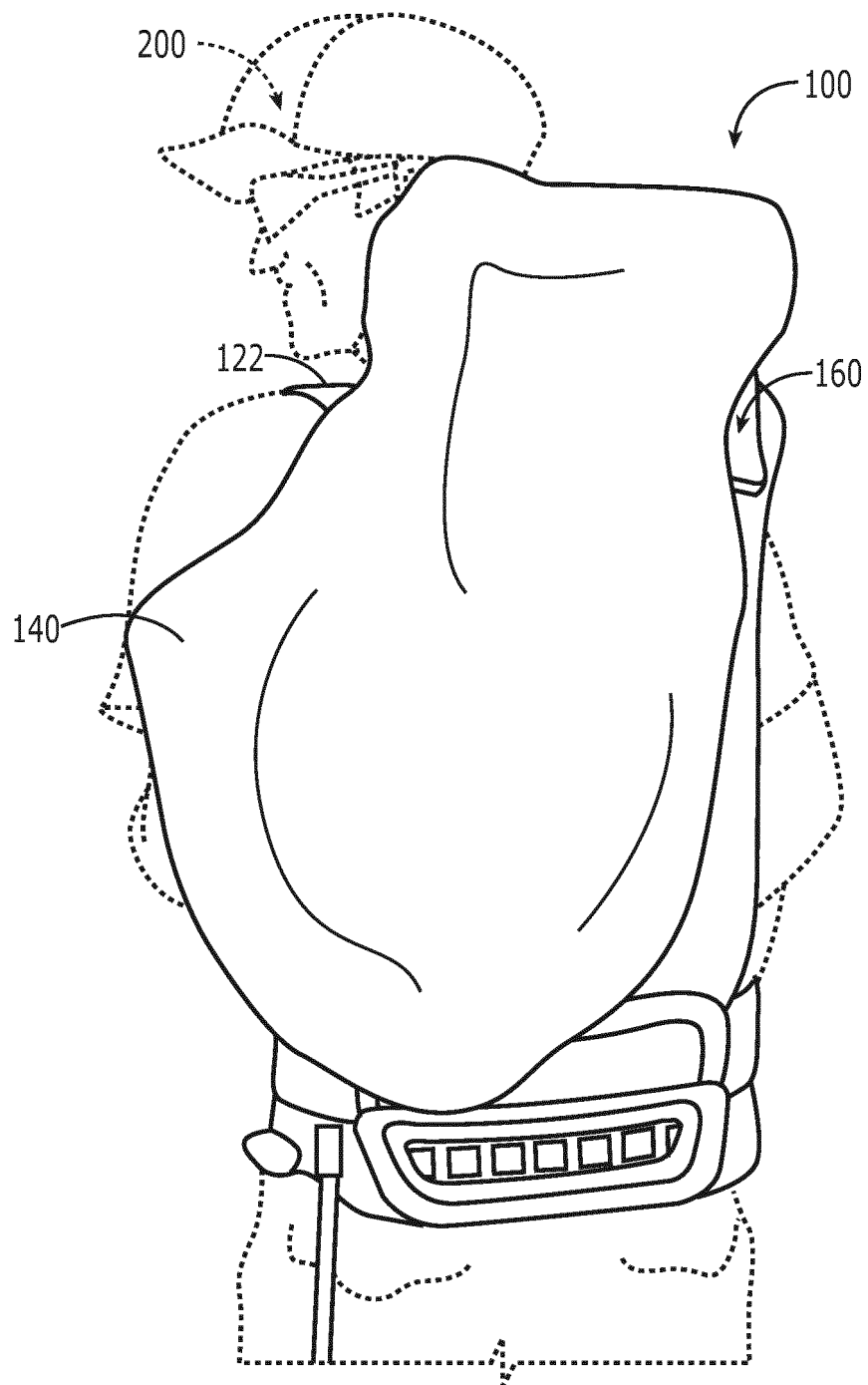


FIGURE 7B

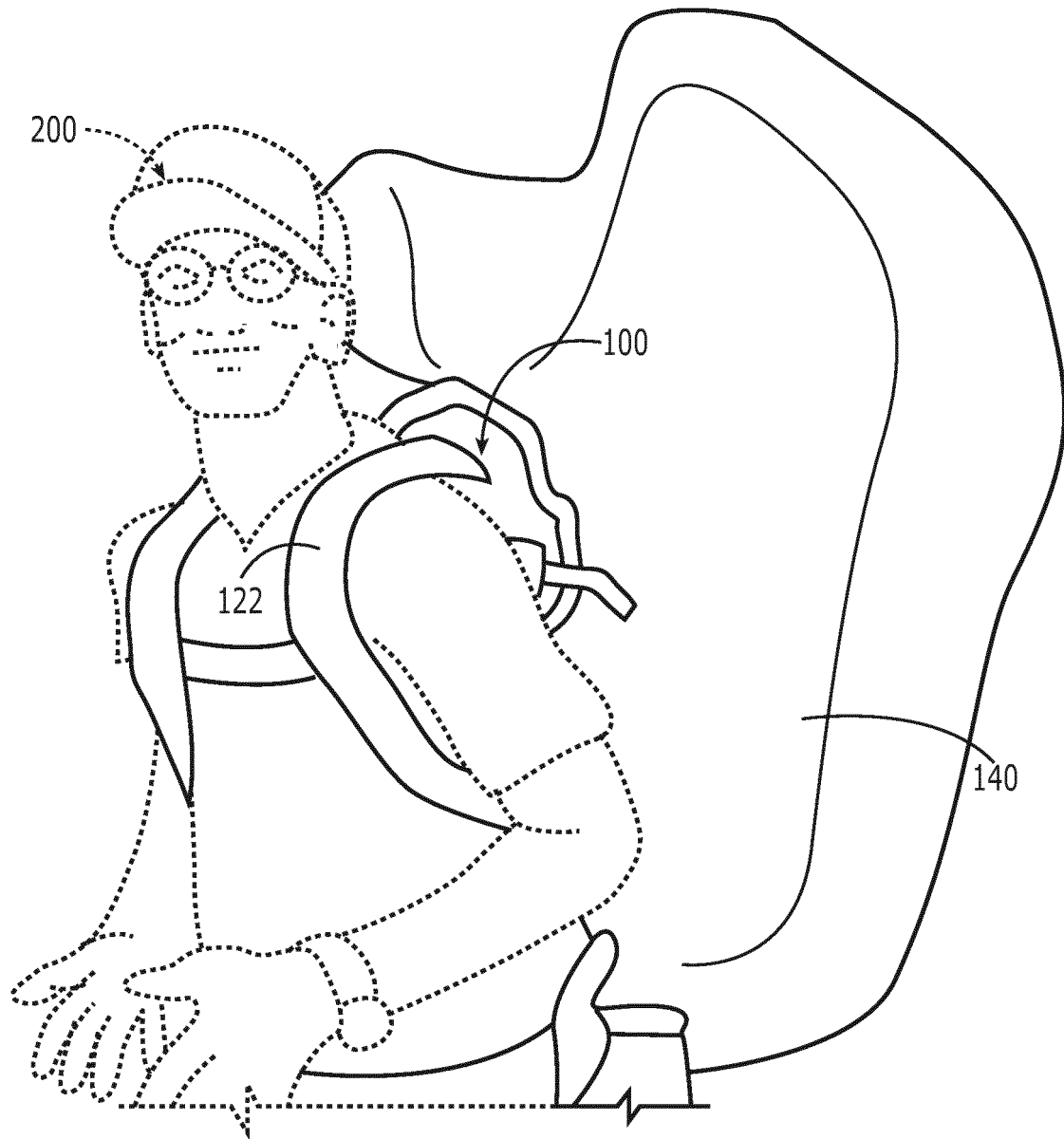
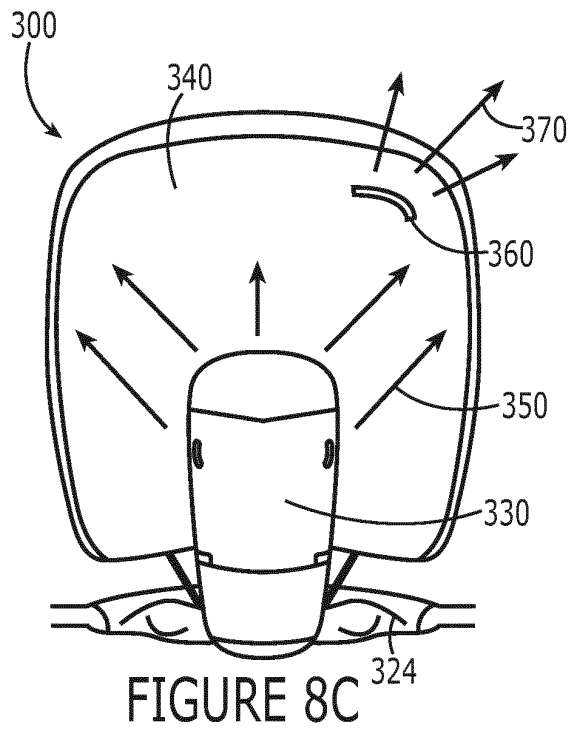
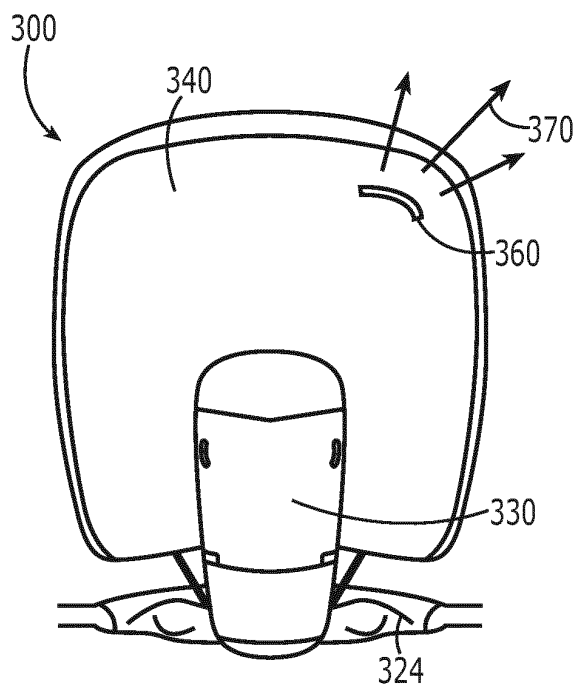
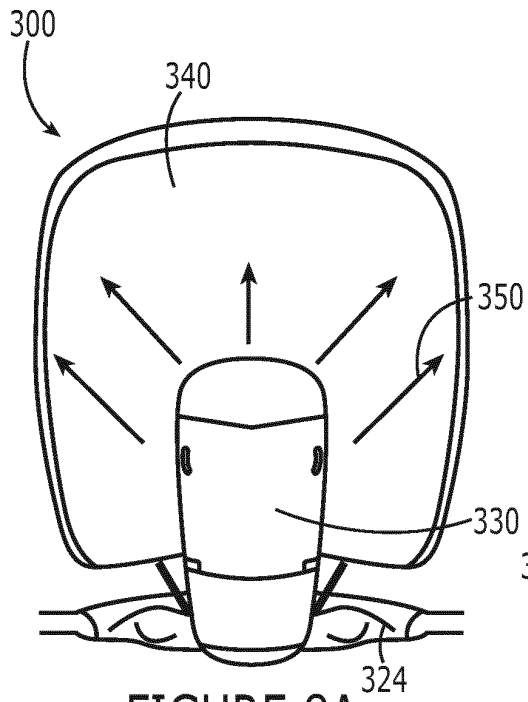


FIGURE 7C



REFERENCES CITED IN THE DESCRIPTION

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