



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
23.03.2022 Bulletin 2022/12

(51) International Patent Classification (IPC):
A62B 15/00 (2006.01) A62B 31/00 (2006.01)

(21) Application number: **20197425.0**

(52) Cooperative Patent Classification (CPC):
A62B 31/00; A62B 15/00

(22) Date of filing: **22.09.2020**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(72) Inventor: **Cunningham, David**
Maghera, Londonderry BT46 5DR (GB)

(74) Representative: **White, Jonathan Patrick**
JP White Intellectual Property Limited
25-27 Fitzwilliam Hall
Fitzwilliam Place
Dublin 2, D02 T292 (IE)

(71) Applicant: **Cunningham Covers Limited**
Maghera, Londonderry BT46 5DR (GB)

(54) **A PROTECTIVE ENCLOSURE APPARATUS**

(57) The present invention relates to a protective enclosure apparatus configured to move between a stowed portable configuration and an extended deployed configuration providing shelter in the form of an enclosure for at least one operator, the apparatus comprising: a portable casing fully containing the apparatus when in the stowed portable configuration, a human breathable air supply means, an enclosure configured to receive air from the air supply means, controller means to regulate

the supply of air from the human breathable air supply means into the enclosure when the apparatus is in the extended configuration and to maintain pressure within the enclosure that is higher than pressure outside of the enclosure. whereby, the casing comprises activation means operable when triggered to activate a support member to move the apparatus from a stowed portable configuration in which the enclosure is stored within the casing to an extended configuration in which the enclosure is automatically deployed out of the casing and provides a fully sealable shelter that extends from the casing.

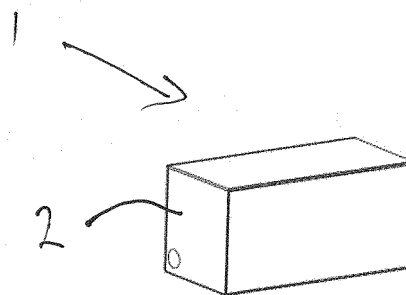
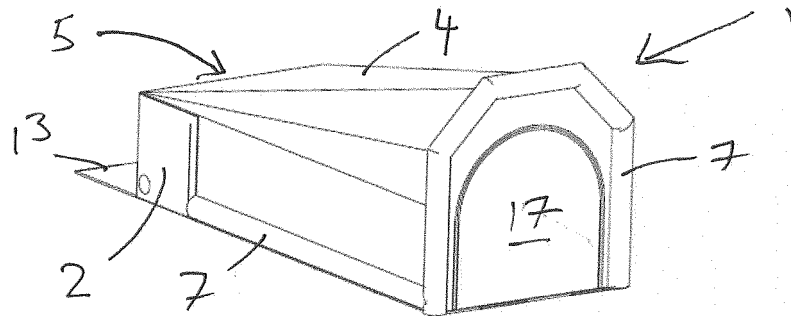
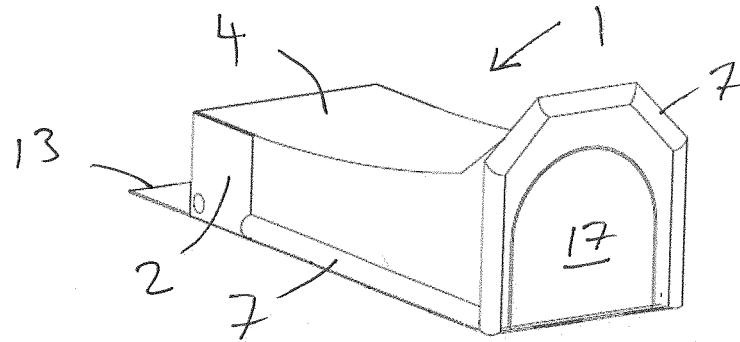
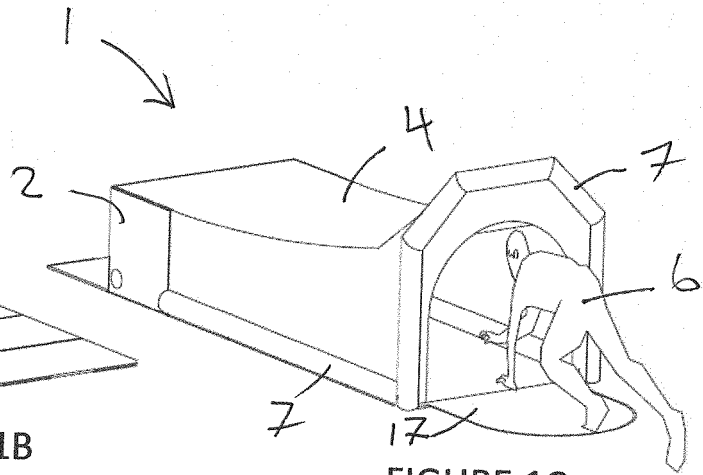
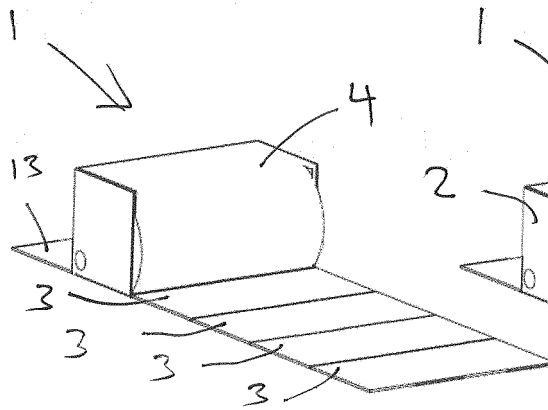


FIGURE 1A



Description

[0001] The present invention relates to a protective portable deployable enclosure apparatus.

[0002] Portable protective enclosures are used in many different industries and applications to provide a temporary housing for users in extreme and dangerous environments.

[0003] Such enclosures are typically activated and used on detection of certain conditions, such as when toxic or flammable fumes are detected in the ambient, during extreme weather events, as emergency shelters during non-survivable conditions and the like.

[0004] It is an object of the present invention to provide an improved portable protective enclosure apparatus.

[0005] Further aspects of the present invention will become apparent from the ensuing description which is given by way of example only.

[0006] According to the invention, there is provided a protective enclosure apparatus configured to move between a stowed portable configuration and an extended deployed configuration providing shelter in the form of an enclosure for at least one operator, the apparatus comprising:

a portable casing fully containing the apparatus when in the stowed portable configuration,

a human breathable air supply means,

an enclosure configured to receive air from the air supply means,

controller means to regulate the supply of air from the human breathable air supply means into the enclosure when the apparatus is in the extended configuration and to maintain pressure within the enclosure that is higher than pressure outside of the enclosure,

whereby, the casing comprises an activation means which is operable, when triggered, to activate a support member which moves the apparatus from a stowed portable configuration in which the enclosure is stored within the casing to an extended configuration in which the enclosure is automatically deployed out of the casing and provides a fully sealable shelter that extends from the casing.

[0007] The present invention provides a fully contained portable apparatus which provides, when activated, a gas impermeable shelter that maintains a positive air pressure within and can be easily and rapidly deployed in dangerous or hostile environments to provide an operator with an oxygen regulated breathable environment.

[0008] Preferably, the activation means is provided as a lid or removable panel of the casing, whereby opening the lid or removable panel activates the activation means

of the apparatus.

[0009] Preferably, the apparatus comprises a support member configured on activation to receive an inflating fluid, whereby when inflated the support member provides a frame support for the enclosure in the extended configuration.

[0010] The inflatable support member may be integrally formed with the enclosure.

[0011] Alternatively, the apparatus comprises a support member provided as tensioned support poles operable when activated to self-deploy to provide a frame support for the enclosure in the extended configuration.

[0012] Preferably, the casing is made from an injection moulded plastic or a lightweight metal, such as aluminium. The casing may also be flexible.

[0013] Preferably, the apparatus further comprises an inert gas fluid supply means for supplying inert gas as the inflating fluid to the inflatable support member.

[0014] Preferably, the apparatus moves between the stowed portable configuration and the extended configuration by injecting the inflating fluid into the support member.

[0015] Preferably, the enclosure is made of a flexible material, such as fabric, plastic or metal foil or combinations thereof. The flexible material is preferably gas or fluid impermeable

[0016] Preferably, the casing is configured from a plurality of connected foldable panel sections.

[0017] Preferably, the casing is a lightweight carrycase with a gas tight seal.

[0018] Preferably, the casing includes a user operated control panel device configured to be positioned within the enclosure when in the extended configuration.

[0019] Preferably, the control panel device comprises wireless and/or a wired communications means so that wireless signals and/or wired signal communications are sent and received between by a remote computer processor or computer enabled devices, such as a laptop, smart mobile phone, computer tablet or pad, or other device. Wireless signals may be provided by one or more of Bluetooth, RFID, WIFI, near field communications, SMS or other known communications methods in the art. Operators may use the control panel device within the enclosure to enable voice calls and other communications.

[0020] Preferably, a panel section of the casing is configured as a photovoltaic cell means operable to convert light energy into electrical energy to supplement a battery powering the apparatus. An electrical dynamo means is also provided to supplement the battery powering the apparatus.

[0021] Preferably, a panel section of the casing is configured as a flooring or base for the enclosure.

[0022] Preferably, the enclosure comprises a substantially gas impermeable re-sealable entrance way through which an operator can enter and exit the enclosure when the entrance way is an open position, whereby the entrance is in the open position when the apparatus is

moved between the stowed portable configuration and the extended configuration.

[0023] Preferably, the apparatus comprises an air purge gas regulator operable to control fluid flow into the enclosure.

[0024] The apparatus comprises various sensors including one or more of: a pressure differential sensor, internal gas sensor and an oxygen level sensor.

[0025] Preferably, on detection by the pressure differential sensor of a predetermined air pressure in the enclosure and on detection by the oxygen level sensor of a predetermined oxygen level concentration in the enclosure the air and purge regulator closes to prevent further air supply into the enclosure.

[0026] Preferably, the apparatus comprises circulation fan means configured to circulate air present in the enclosure through a carbon dioxide scrubber means and back into the enclosure.

[0027] The circulation fan means is operable on a continuous loop to ensure that carbon dioxide breathed into the enclosure by the user and present in the enclosure is removed and air cleaned of the carbon dioxide is circulated back into the enclosure as breathable air. The oxygen level sensor will ensure predetermined oxygen levels are maintained in the enclosure.

[0028] Preferably, the apparatus comprises an internal gas detector operable to detect a non-human breathable or toxic gas in the enclosure, whereby when a non-human breathable or toxic gas is detected the controller means activates an alarm and beacon operable to provide a visual and audible warning to the user inside the enclosure of the presence of the non-human breathable or toxic gas.

[0029] Preferably, the apparatus comprises a dampener actuator operable when activated by the controller means to move an air dampener between an open and closed position.

[0030] Preferably, when the internal gas detector detects a non-human breathable or toxic gas in the enclosure the dampener actuator activates and opens the air dampener and the circulation fan increases speed to expel air out of the enclosure and the air and purge gas regulator activates to pump air from the human breathable air supply means into the enclosure, replacing air in enclosure.

[0031] Preferably, when the internal gas detector no longer detects non-human breathable or toxic gas or in enclosure the dampener actuator closes the air dampener and the circulation fan returns to normal speed.

[0032] Once the pressure differential sensor detects the correct pre-determined pressure and the oxygen gas monitor detects the correct pre-determined oxygen levels the controller means will activate the air and purge regulator to close.

[0033] Preferably, if the pressure differential sensor indicates that internal pressure has dropped below a pre-determined level the controller means will activate and open the air and purge gas regulator thereby increasing the levels of oxygen and inert gas as required until the

desired pre-determined level of pressure is achieved at which point air and purge gas regulator will close.

[0034] Preferably, if oxygen gas monitor detects the oxygen gas levels are too high or too low the controller means will activate the air and purge gas regulator to open increasing the levels of oxygen or inert gas as required until a desired pre-determined level of oxygen gas is achieved at which point air and purge gas regulator will close.

[0035] The invention will be more clearly understood from the following description of some embodiments thereof, given by way of example only, with reference to the accompanying drawings, in which:

Figures 1A to 1E show a portable protective enclosure apparatus configured according to the present invention moving between a stowed stored configuration and an extended configuration providing a protective enclosure for an operator,

Figure 2 shows the portable protective enclosure apparatus of Figure 1E in the extended deployed configuration showing an operator positioned within the enclosure, and

Figure 3 shows the portable protective enclosure apparatus of Figure 1E in the extended deployed configuration with a section cut away to show internal parts of the apparatus, and

Figure 4 is a schematic representation and layout of a portable protective enclosure apparatus according to the invention,

[0036] Referring to the drawings, and initially to Figures 1A to 1E and Figures 3 and 4, there is shown a portable deployable enclosure apparatus 1 configured to move between a stowed portable configuration, as shown in Figure 1A, and an extended deployed configuration providing shelter in the form of an enclosure for an operator, as shown in Figure 1E and Figures 2 and 3.

[0037] The apparatus 1 comprises a casing, indicated generally by the reference numeral 2. The casing 2 is optionally made from an injection moulded plastic or a lightweight metal, such as aluminium. The casing 2 may also be flexible and configured from a plurality of interconnected connected foldable panel sections 3. The casing 2 is provided as a lightweight carrycase with a gas tight seal. The apparatus 1 when stowed, is thus fully contained within the casing 2 which is fully portable and may be carried by an operator.

[0038] One or more of the panel sections 3 of the casing 2 is configured as a flooring or base 16 and so extend along the ground in use so that the enclosure 4 thereby seats on the flooring or base 16 when the apparatus 1 is in the extended configuration. The provision of a flooring or base 16 for the enclosure configured from panel sections 3 of the casing 2 prevents direct contact between

the enclosure 4 and rocks or other objects on the ground and so avoids the risk of damaging the material of the enclosure 4.

[0039] The casing 2 houses and stores for subsequent deployment an enclosure 4 which is configured when deployed to extend out of the casing 2 to provide a fully sealed shelter 5 for at least one operator 6. The enclosure 4 is made of a flexible material, such as fabric, plastic or metal foil or combinations thereof, that is gas or fluid impermeable. The enclosure 4 may be rolled or folded within the casing 3 for efficient and seamless deployment to extend from the casing 2.

[0040] The casing 2 comprises an activation means provided as a lid or removable part or panel 3 of the casing 2, whereby opening or engaging the lid or removable panel triggers the activation of the support member 7 of the apparatus 1, which, when activated, moves the apparatus 1 from a stowed portable configuration in which the enclosure 4 is stored within the casing to an extended configuration in which the enclosure 4 is deployed out of the casing 2 and provides a fully sealed shelter 5 for at least one person or operator 6. In use the operator will upon activation of the apparatus 1 roll out the panels section 3 as shown on Figure 1B. The panel section 3 may also be automatically deployed upon activation of the casing 2.

[0041] The support member 7 is configured when activated to receive an inflating fluid, whereby when inflated the support member 7 provides a frame support for the enclosure 4 in the extended configuration. The enclosure 4 comprises a substantially gas impermeable re-sealable entrance or doorway 17 through which an operator can enter and exit the enclosure 4. In Figure 1C the entrance is in the open position while the apparatus 1 is transitioning from the stowed portable configuration to the extended configuration. The activation of the enclosure 4 is shown in Figure 1C, where the operator 6 is entering an entrance 17, and the entrance 17 is sealed in Figure 1D.

[0042] The inflatable support member 7 may be integrally formed as an arrangement of fluidly interconnected tubes or tubing within the fabric or material of the enclosure 4 and forms a skeleton to maintain the desired shape of the enclosure 4 when inflated. Alternatively, or in addition to the inflatable support member 7, the apparatus 1 may comprise a support member 7 provided as tensioned support poles operable when activated to self-deploy to provide the frame support for the enclosure 4 in the extended configuration.

[0043] In addition to the human breathable air supply means 8, the apparatus 1 further comprises an inert gas fluid supply means 9 for supplying inert gas as the inflating fluid to the inflatable support member 7. The apparatus 1 is configured to move between the stowed portable configuration and the extended configuration upon activation by injecting or allowing the inflating fluid to flow into the support member 7, as shown in Figures 1C and 1D. The flow of the inflating fluid into the support member is permitted on triggering of the activation means of the

apparatus 1. Conversely, should the support member 7 be only provided as tensioned support poles, the inert gas fluid supply means need not be required for inflating the support member 7.

[0044] Also provided within the casing 2 is a human breathable air supply means 8 which may be provided as bottled gas or as a chemical oxygen generator. The enclosure 4 receives air supply from the human breathable air supply means 8 to fully inflate the enclosure 4 with breathable air and provide an over or positive pressure with the enclosure 4, as shown in Figure 1E.

[0045] The apparatus 1 this has a two-stage inflation deployment process, the first part involves inflating the inflatable support member 7 with inert gas from the inert gas fluid supply means 9 to provide the skeleton for the enclosure allowing the operator to enter the enclosure 4 via entrance 17, and the second part, once the operator is inside the enclosure 4 and the entrance 17 is sealed, manually or automatically activating the human breathable air supply means 8 to fully inflate the enclosure 4 with breathable air to provide an over or positive pressure within the enclosure 4 to thereby maintain pressure within the enclosure 4 that is higher than pressure outside of the enclosure 4.

[0046] As shown in Figure 3, also provided is a user operated control panel device 10 configured to be positioned within the enclosure 4. The control panel device 10 comprises wireless and/or a wired communications means so that wireless signals and/or wired signal communications may be sent and received by a remote computer processor or computer enabled devices, such as a laptop, smart mobile phone, computer tablet or pad, or other device, to facilitate communication between the operator sheltering in the enclosure 4 and third parties, such as rescue service personnel. Wireless signals may be provided by one or more of Bluetooth, RFID, WIFI, near field communications, SMS or other known communications methods in the art. An operator 6 may use the control panel device 10 within the enclosure 4 to enable voice calls and other communications by using phone device 11 and global positioning system 12 communicatively coupled with the control panel device 10.

[0047] As shown in Figure 4 one or more of the interconnected connected foldable panel sections 3 of the casing 2 is configured as a photovoltaic cell means 13 operable to convert light energy into electrical energy to supplement a battery 14 supplying energy to power functions of the apparatus 1. An electrical dynamo means 15 is also provided to supplement the battery 14 powering the apparatus 1.

[0048] Controller means 20 is operable to regulate the supply of human breathable air into the enclosure 4 when the apparatus 1 is in the extended configuration. The controller means 20 operates the breathable air supply means 8 and the inert gas fluid supply means 9 to regulate air pressure within the enclosure and ensure that pressure within the enclosure 4 is higher than pressure outside of the enclosure 4 in the ambient air. By maintaining

such positive pressure within the enclosure 4 toxic gases in the ambient air outside the enclosure 4 are preventing from flowing into the enclosure 4.

[0049] The apparatus 1 comprises various sensors including a pressure differential sensor 21, internal gas sensor 22 and an oxygen level sensor 23.

[0050] When the activation means is triggered power to the controller is put into a standby mode and the support member 7 deploys with the enclosure 4. The panel provided as the photovoltaic cell means 13 is also deployed. If the support member 7 is provided as inflatable tubing it will be inflated with inert gas from the inert gas supply means 9. Alternatively, or additionally, flexible poles held in tension will self-deploy on triggering the activation means to provide the support member skeleton.

[0051] The enclosure 4 deploys with the entrance having 17 comprising a resealable gas tight seal 18 in its open position to allow the operator 6 seeking shelter to enter the enclosure 4. Once inside the enclosure 4 the operator 6 closes the entrance 17 by sealing the gas tight seal 18 and activates the controller means 20 by interacting with a user interface provided on the control panel device 10.

[0052] When activated the controller means 20 activates an air purge gas regulator 24 which opens and closes to permit and restrict the flow of air from the human breathable air supply means 8 thereby inflating the enclosure 4 with a breathable atmosphere. Circulation fan 25, pressure differential sensor 21, internal gas detector 22 and oxygen gas level sensor 23 are all activated.

[0053] Pre-set or predetermined desired pressure and oxygen levels operable within the enclosure 4 are pre-set or may be adjusted at user interface means of the control panel 10. Once the controller means 20 receives a signal detecting the desired pressure and oxygen levels within the enclosure at the respective pressure differential sensor 21 and oxygen level sensor 23 the air and purge regulator 24 will close and the controller means 20 will enter a monitoring mode during which conditions within the enclosure 4 are continually monitored by sensors 21, 22, 23.

[0054] The circulation fan 25 will pass the air within the enclosure 4 on a continuous loop through a carbon dioxide scrubber 26 to remove carbon dioxide gas exhaled by the operator 6. The cleaned air will then pass through the oxygen gas sensor 22 for recirculation back into the enclosure 4 when the oxygen gas sensor 22 detects the correct predetermined oxygen level in the recirculated air. If the oxygen levels in the air received from the carbon dioxide scrubber 26 are too low, then the air is recirculated back to the carbon dioxide scrubber 26 for further cleaning.

[0055] The apparatus 1 will continue to operate in monitoring mode maintaining a breathable over /positive pressure atmosphere within the enclosure 4.

[0056] If the internal gas detector 22 detects non-breathable or toxic gas in the enclosure 4 the controller

means 20 will enter alarm mode and an alarm and beacon 27 will trigger providing a visual and audible warning to the operator 6 of the situation regarding the existence of a non-breathable or toxic gas in the enclosure 4. A dampener actuator 28 triggers the opening of an air dampener 29 and the circulation fan 25 increases speed expelling contaminated air out of the enclosure via the air dampener 29. The air and purge gas regulator 24 is activated and air from the breathable air supply means 8 is supplied into the enclosure 4. When the internal gas detector 22 no longer detects the non-breathable or toxic gas in the enclosure 4, the dampener actuator 28 triggers the closure of the air dampener 29 and the circulation fan 25 returns to normal speed. Once the controller means 20 detects the desired predetermined pressure detected at the pressure differential sensor 21 and the oxygen levels as detected by the oxygen level sensor 23 are returned to the desired level the air and purge regulator 24 will close and the apparatus will return to monitoring mode.

[0057] If the pressure differential sensor 21 detects that internal pressure within the enclosure 4 has dropped below a certain desired or predetermined or pre-set level the controller means 20 is signalled to activate the air and purge gas regulator 24 which permits the flow of air from the breathable air supply means 8 increasing the levels of oxygen within the enclosure 4 and also inert gas from the inert gas fluid supply means 9 as required until the desired positive or over pressure is achieved within the enclosure 4, at which point the air and purge gas regulator 24 will close.

[0058] If the oxygen gas sensor 23 detects that oxygen gas levels in the enclosure 4 are too high or too low the controller means will activate the air and purge gas regulator 24 increasing the levels of oxygen or inert gas to the desired levels as required, and when the desired levels are achieved, as detected by the oxygen gas sensor 23 the air and purge gas regulator 18 will close.

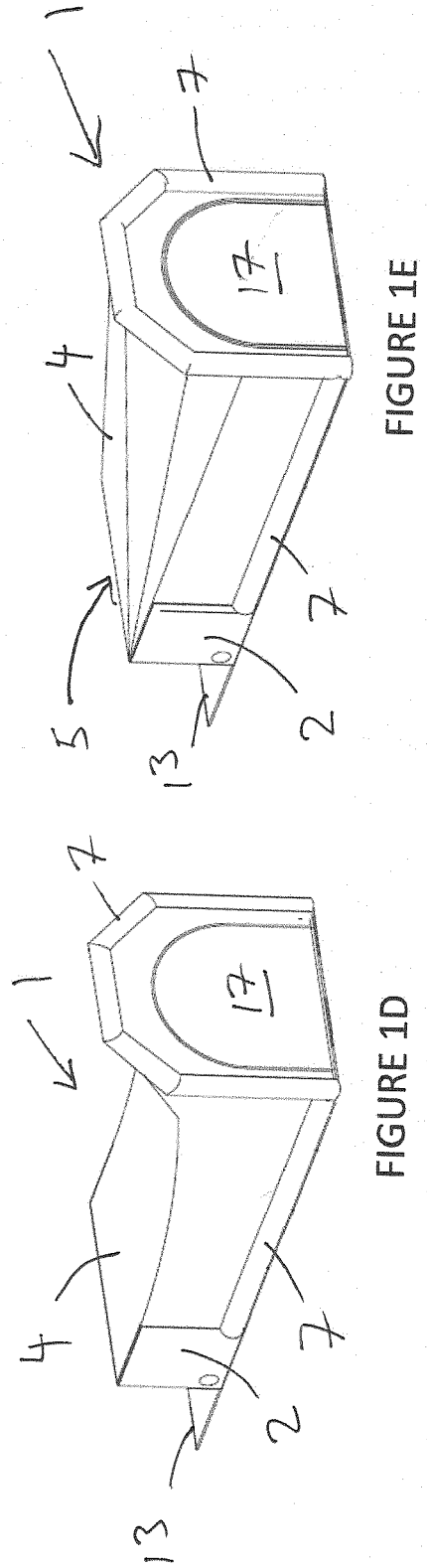
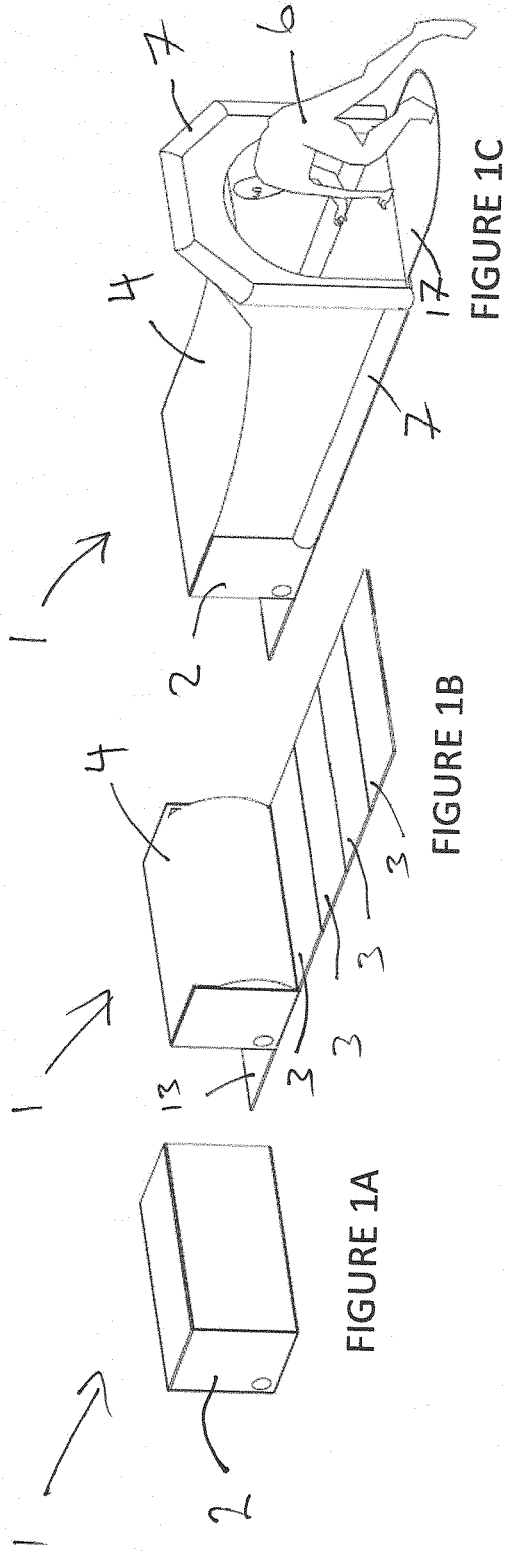
[0059] Aspects of the present invention have been described by way of example only and it should be appreciated that additions and/or modifications may be made thereto without departing from the scope thereof as defined in the appended claims.

Claims

1. A protective enclosure apparatus configured to move between a stowed portable configuration and an extended deployed configuration providing shelter in the form of an enclosure for at least one operator, the apparatus comprising:

a portable casing fully containing the apparatus when in the stowed portable configuration,
a human breathable air supply means,
an enclosure configured to receive air from the air supply means,
controller means to regulate the supply of air

- from the human breathable air supply means into the enclosure when the apparatus is in the extended configuration and to maintain pressure within the enclosure that is higher than pressure outside of the enclosure, whereby, the casing comprises an activation means which is operable, when triggered, to activate a support member which moves the apparatus from a stowed portable configuration in which the enclosure is stored within the casing to an extended configuration in which the enclosure is automatically deployed out of the casing and provides a fully sealable shelter that extends from the casing.
2. The portable protective enclosure apparatus as claimed in Claim 1, in which the activation means is provided as a lid or removable panel of the casing, whereby opening the lid or removable panel automatically activates the apparatus from the stowed portable configuration to the extended configuration
 3. The portable protective enclosure apparatus as claimed in Claim 1 or Claim 2, in which the support member is configured on activation to receive an inflating fluid, whereby when inflated the support member provides a frame support for the enclosure in the extended configuration.
 4. The portable protective enclosure apparatus as claimed in Claim 3, in which the apparatus comprises an inert gas fluid supply means for supplying inert gas as the inflating fluid to the inflatable support member, and the apparatus moves between the stowed portable configuration and the extended configuration by injecting the inflating fluid into the support member.
 5. The portable protective enclosure apparatus as claimed in Claim 1 or Claim 2, in which the support member provided as tensioned support poles operable when activated to automatically self-deploy to provide a frame support for the enclosure in the extended configuration.
 6. The portable protective enclosure apparatus as claimed in any one of the preceding claims, in which the casing containing the apparatus is configured from a plurality of connected foldable panel sections, in which a panel section of the casing is configured as a flooring or base for the enclosure.
 7. The portable protective enclosure apparatus as claimed in any one of the preceding claims, in which the casing is a lightweight carrycase.
 8. The portable protective enclosure apparatus as claimed in any one of the preceding claims, in which the casing contains a user operated control panel device configured for voice calls and communications and GPS positioning signalling means, and the control panel device is fixedly located within the enclosure in the extended configuration.
 9. The portable protective enclosure apparatus as claimed in any one of the preceding claims, in which a panel section of the casing is configured as a photovoltaic cell means operable to convert light energy into electrical energy to supplement a battery powering the apparatus.
 10. The portable protective enclosure apparatus as claimed in any one of the preceding claims, in which the apparatus comprises a circulation fan means configured to circulate air present in the enclosure through a carbon dioxide scrubber means and back into the enclosure, in which the circulation fan means is operable on a continuous loop to ensure that carbon dioxide breathed into the enclosure by the operator and present in the enclosure is removed and air cleaned of the carbon dioxide is circulated back into the enclosure as breathable air.
 11. The portable protective enclosure apparatus as claimed in any one of the preceding claims, in which the apparatus comprises an internal gas detector operable to detect a non-human breathable or toxic gas in the enclosure, whereby when a non-human breathable or toxic gas is detected the controller means activates an alarm and beacon operable to provide a visual and audible warning to the operator inside the enclosure of the presence of the non-human breathable or toxic gas.



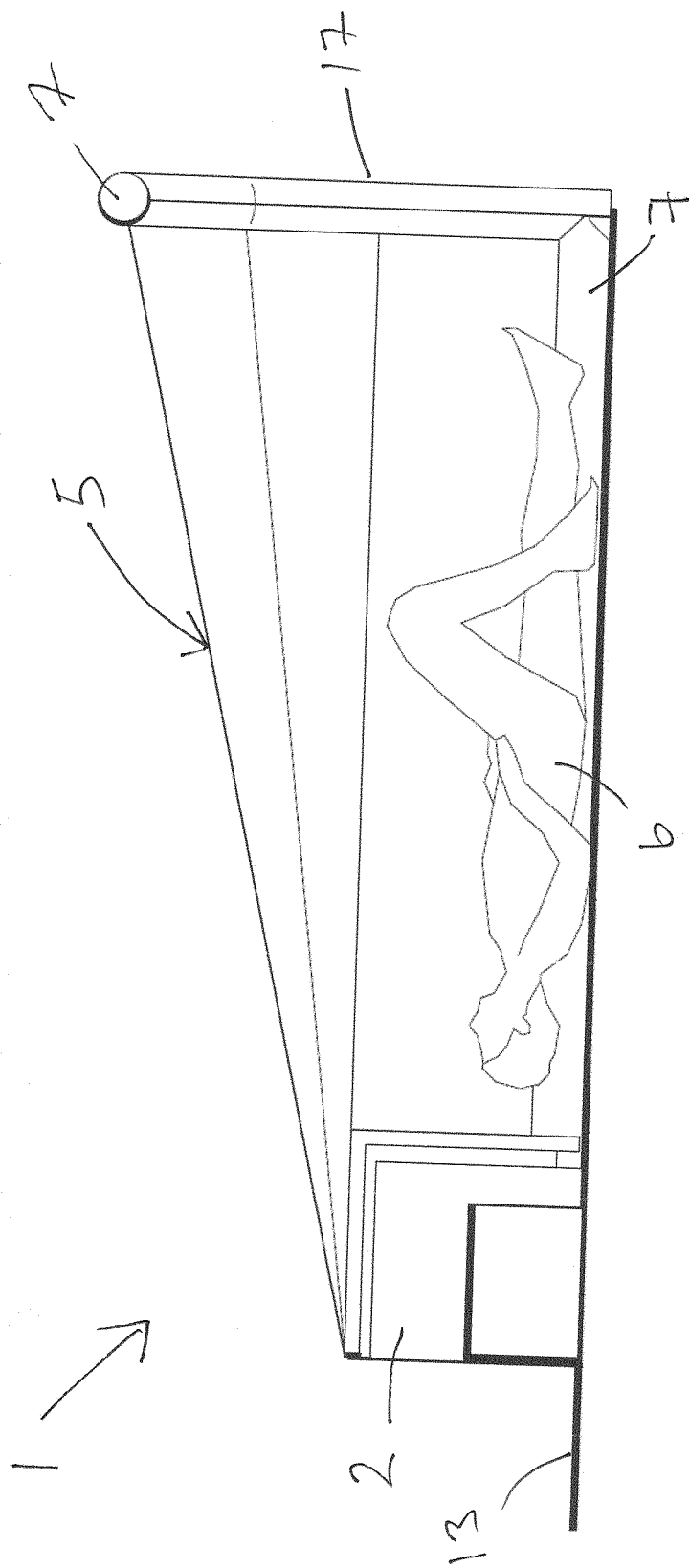
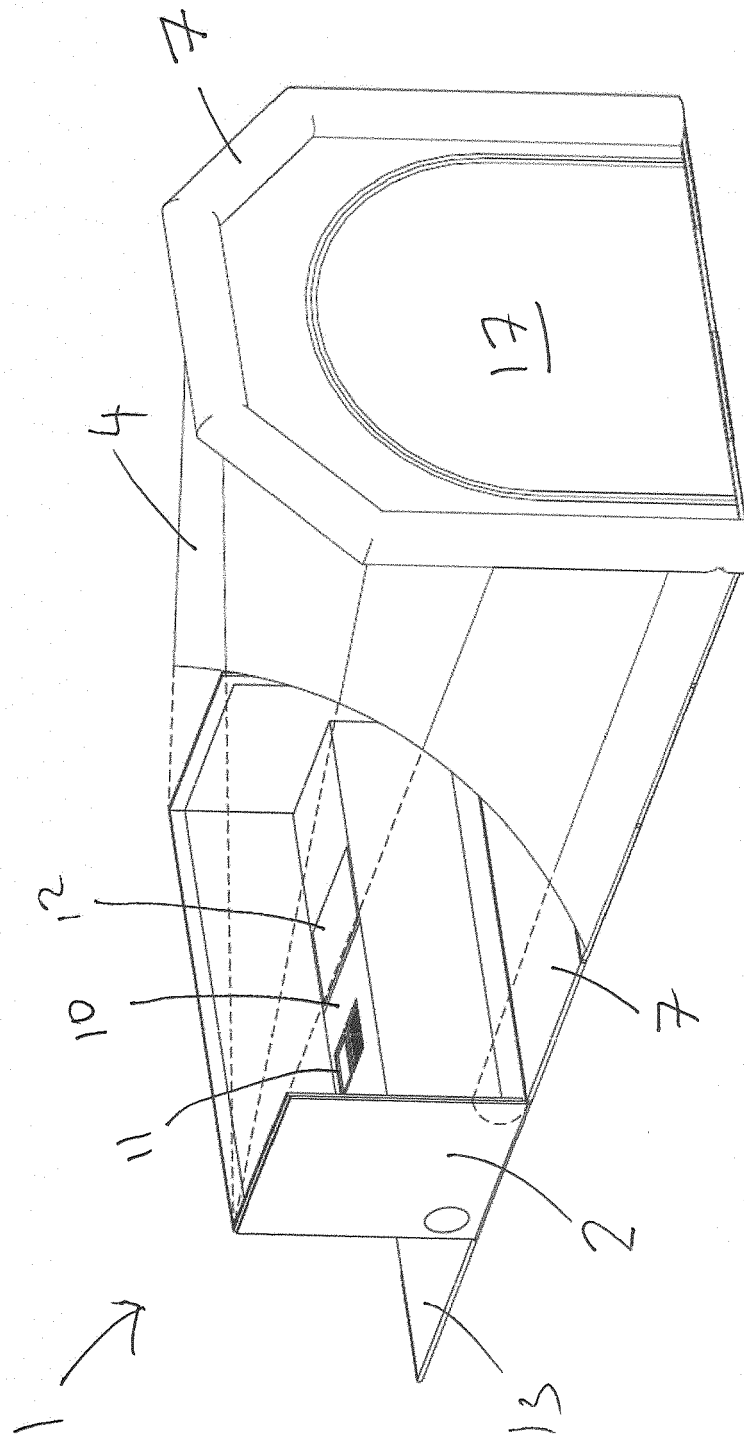


FIGURE 2



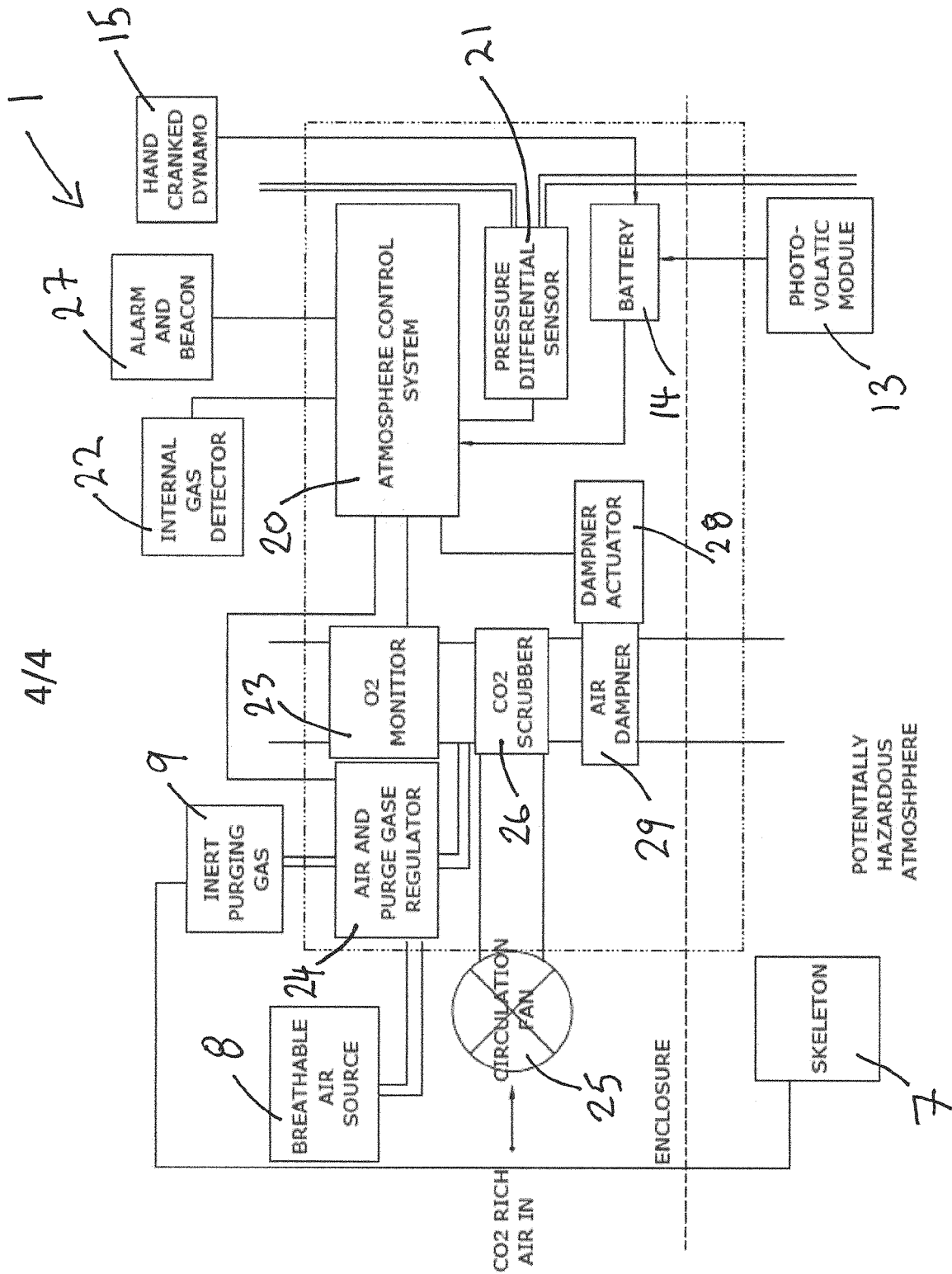


FIGURE 4



EUROPEAN SEARCH REPORT

 Application Number
 EP 20 19 7425

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EPO FORM 1503 03.82 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 6 192 633 B1 (HILBERT CLINT J [US]) 27 February 2001 (2001-02-27) * column 15, line 14 - line 44; figures * -----	1-11	INV. A62B15/00 A62B31/00
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			TECHNICAL FIELDS SEARCHED (IPC)
			A62B
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 11 March 2021	Examiner Vervenne, Koen
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.**

EP 20 19 7425

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