



US 20150314843A1

(19) **United States**(12) **Patent Application Publication**
Ashard et al.(10) **Pub. No.: US 2015/0314843 A1**(43) **Pub. Date: Nov. 5, 2015**(54) **SAFETY DEVICE AND ADAPTER THEREFOR****Publication Classification**(71) Applicant: **ZACTILL INTELLECTUAL
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(AU)(51) **Int. Cl.**
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CPC **B63C 9/19** (2013.01); **B63C 2009/0029**
(2013.01)(73) Assignee: **Zactill Intellectual Property Pty Ltd**,
Tingira Heights, NSW (AU)(57) **ABSTRACT**(21) Appl. No.: **14/762,131**(22) PCT Filed: **Jan. 21, 2014**(86) PCT No.: **PCT/AU2014/000033**

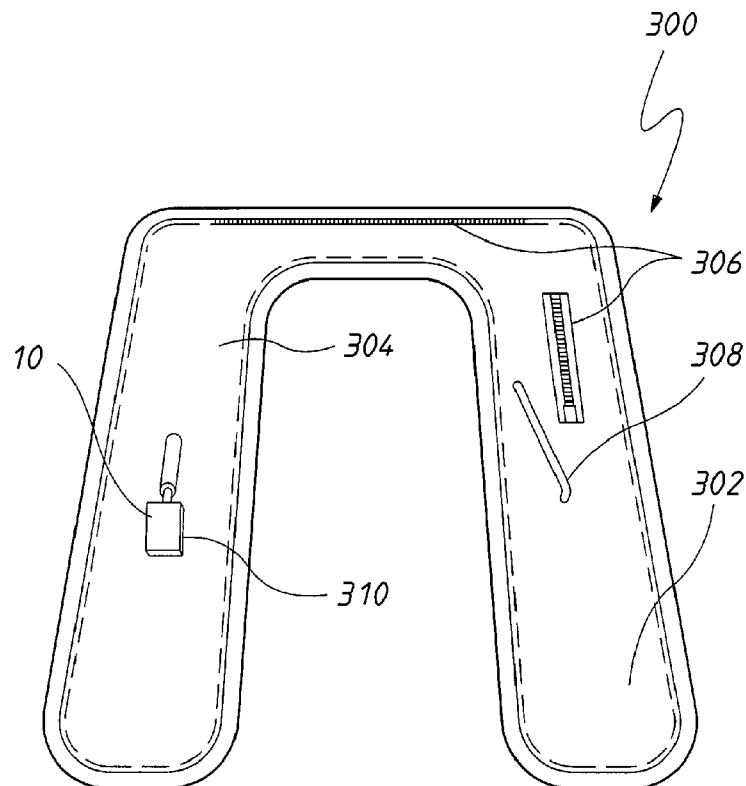
§ 371 (c)(1),

(2) Date: **Jul. 20, 2015**

The safety device comprises an inflating product container which holds an inflating product and is operatively associated with an inflatable bladder to be worn by a user. The inflating product container is adapted to be placed in an open condition in which an inflating product is allowed to inflate the inflatable bladder. An adapter provides fluid communication between the inflating product container and the inflatable bladder and includes (i) a container coupling formation adapted to secure the adapter to the inflating product container and (ii) an actuator operatively adapted to place the inflating product container in the open condition. A controller includes a sensor assembly so that in use, the controller is adapted to generate an activation signal responsive to measurements taken by the sensor assembly. The actuator is operatively adapted to place the inflating product container in the open condition responsive to the controller generating the activation signal.

(30) **Foreign Application Priority Data**

Jan. 21, 2013	(AU)	2013900184
Apr. 22, 2013	(AU)	2013901401
Apr. 26, 2013	(AU)	2013901452
Sep. 26, 2013	(AU)	2013903719



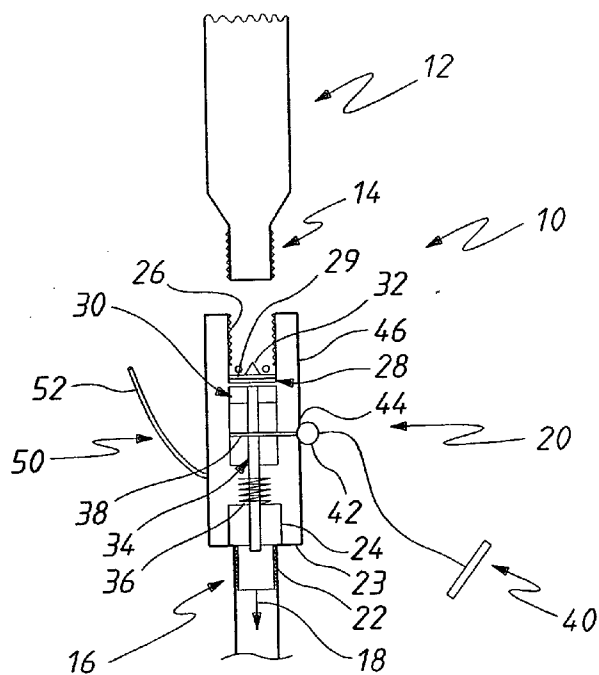


FIG. 1

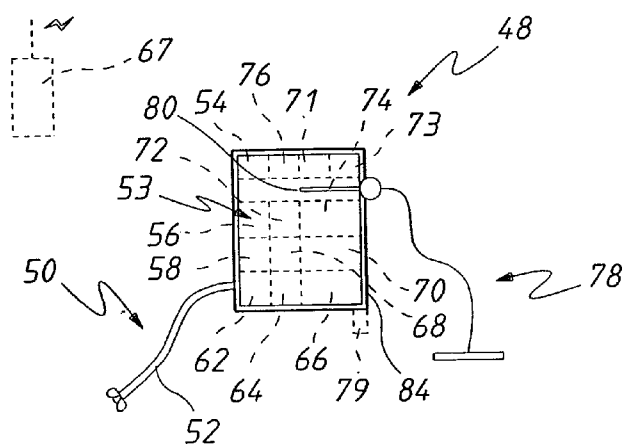


FIG. 2

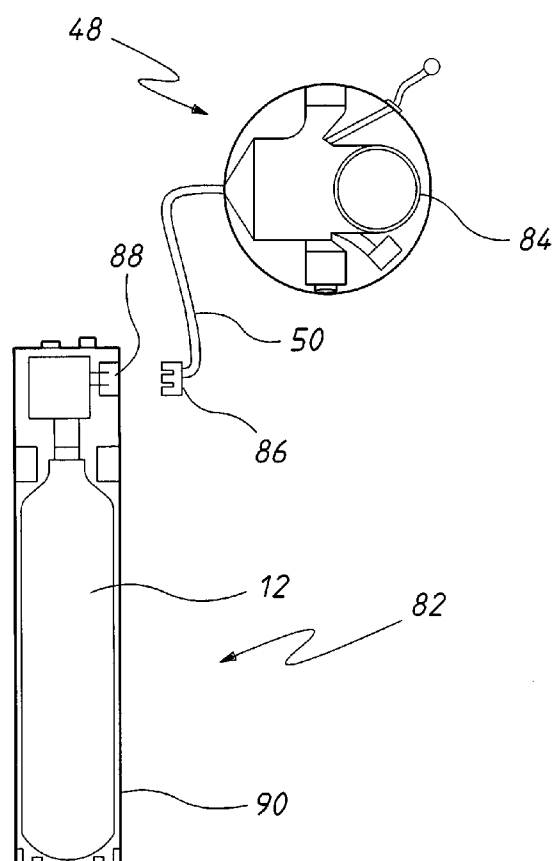


FIG. 3

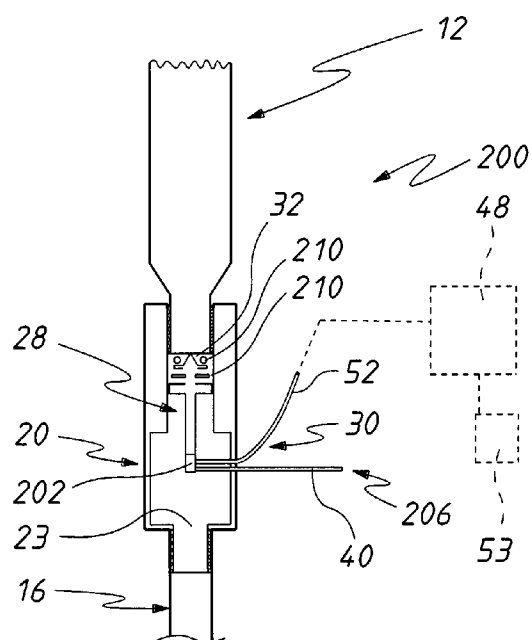


FIG. 4

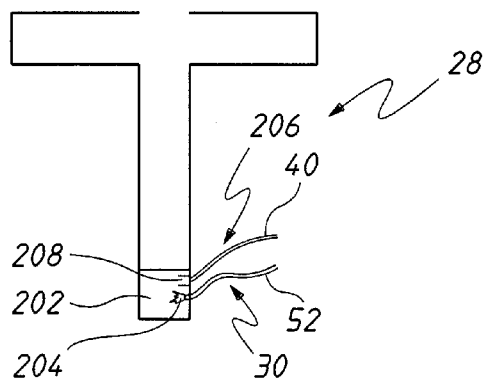


FIG. 5

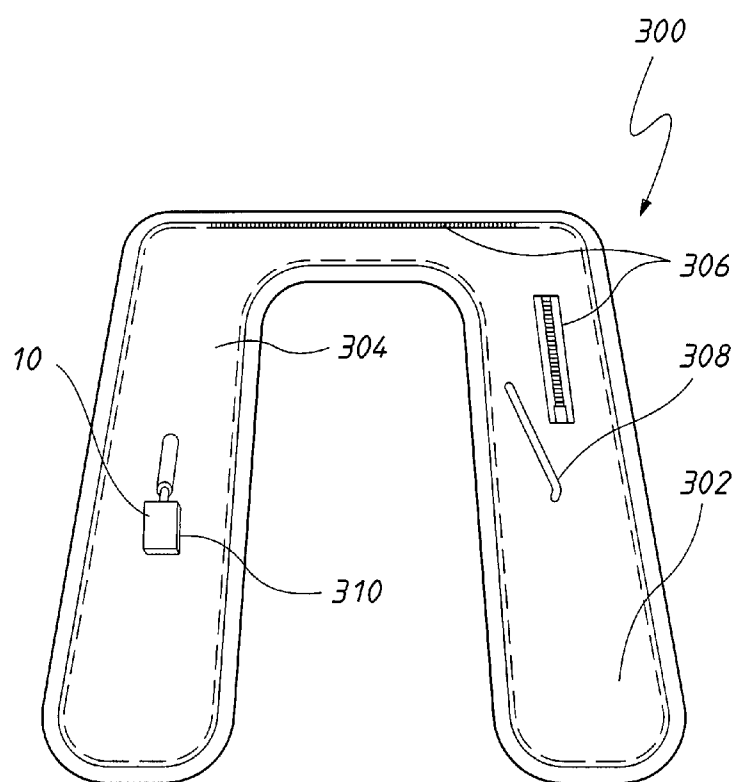


FIG. 6

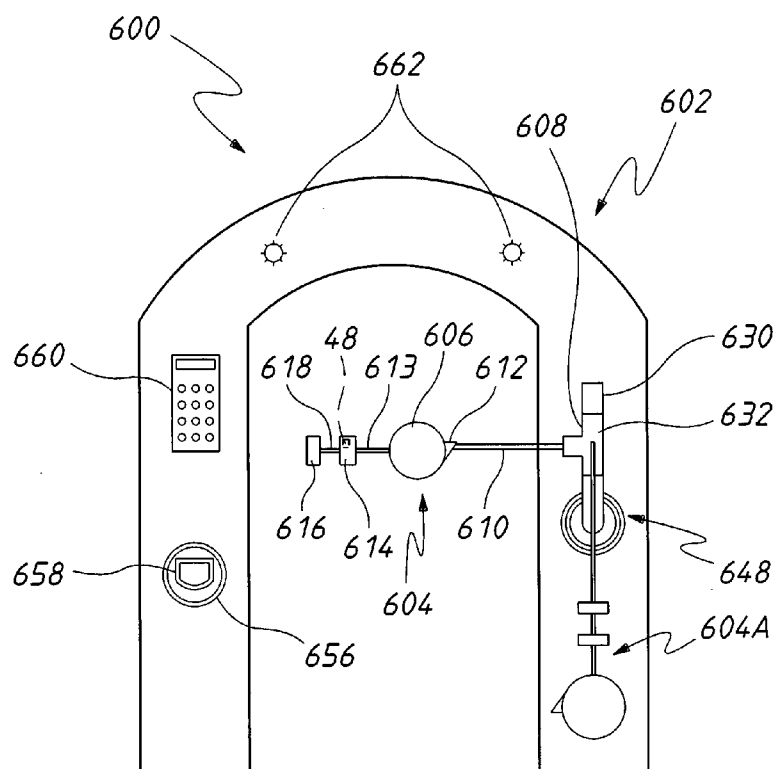


FIG. 7

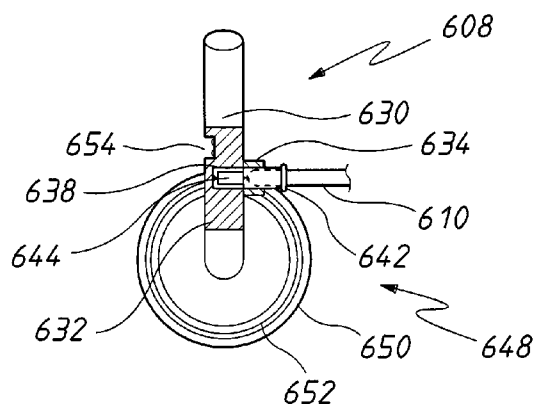


FIG. 8

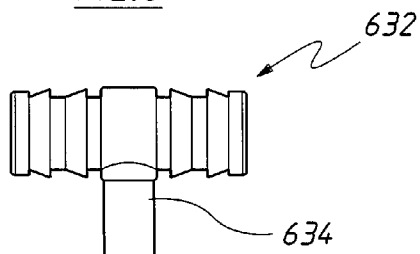


FIG. 9

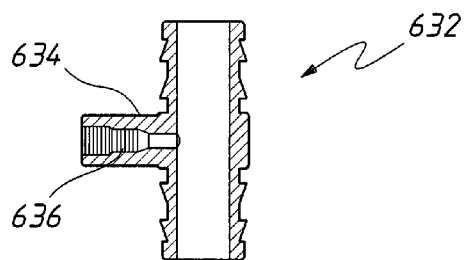


FIG. 10

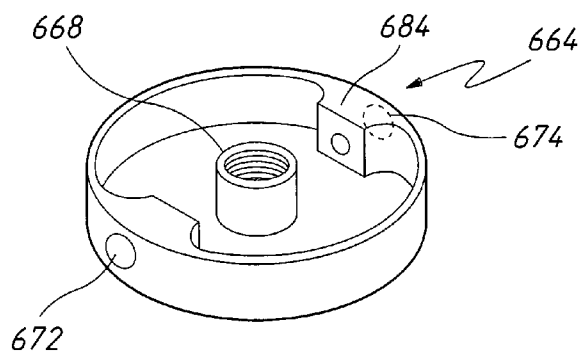


FIG. 11

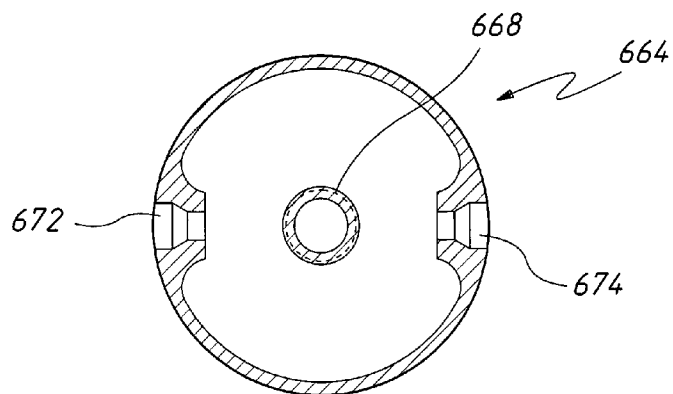


FIG. 12

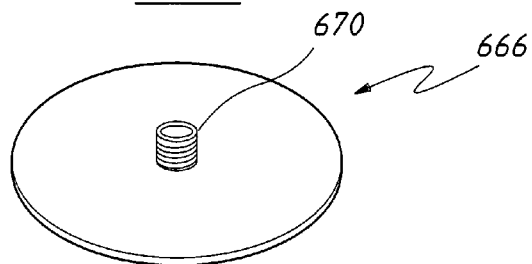


FIG. 13

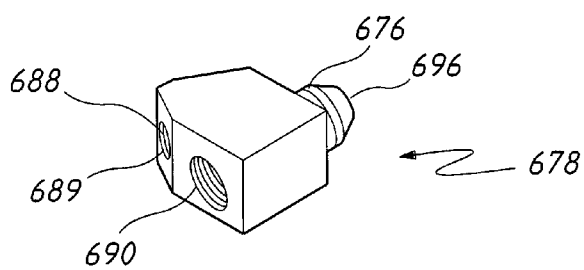


FIG. 14

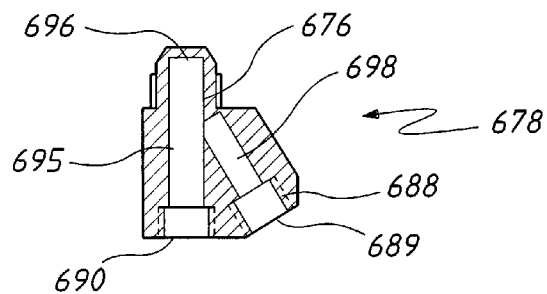


FIG. 15

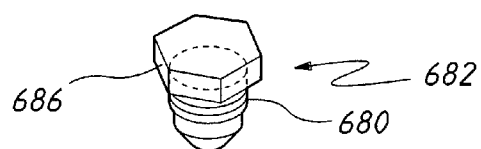


FIG. 16

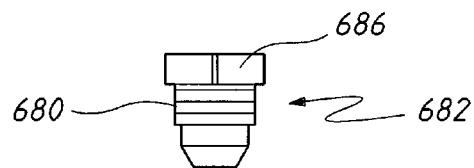


FIG. 17

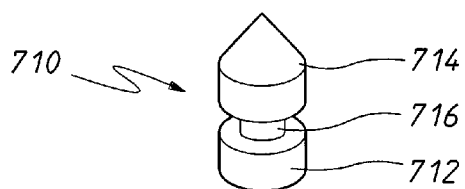


FIG. 18

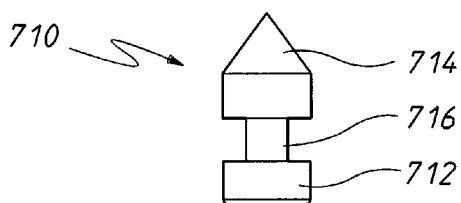


FIG. 19

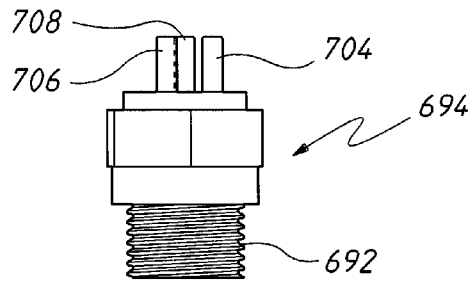


FIG. 20

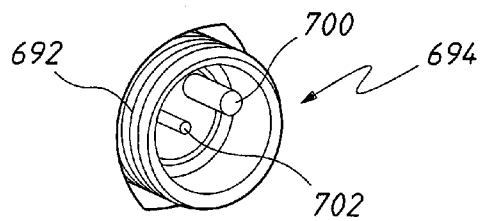


FIG. 21

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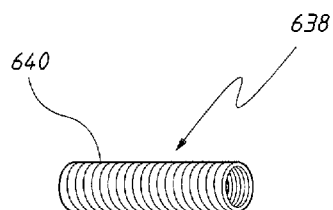


FIG. 22

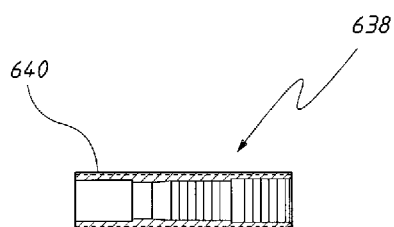


FIG. 23

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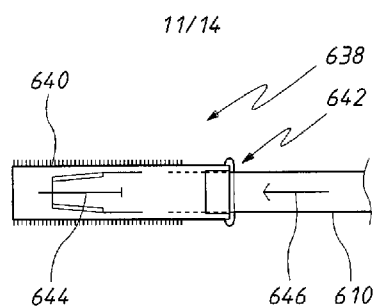


FIG. 24

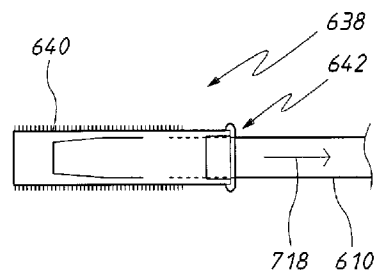


FIG. 25

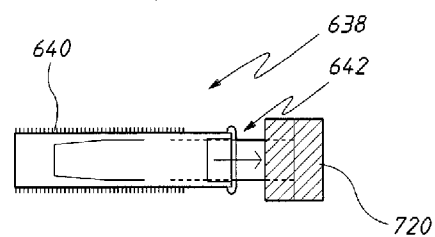


FIG. 26

Substitute Sheet
(Rule 26) RO/AU

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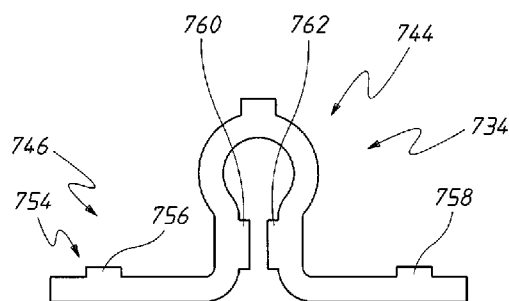
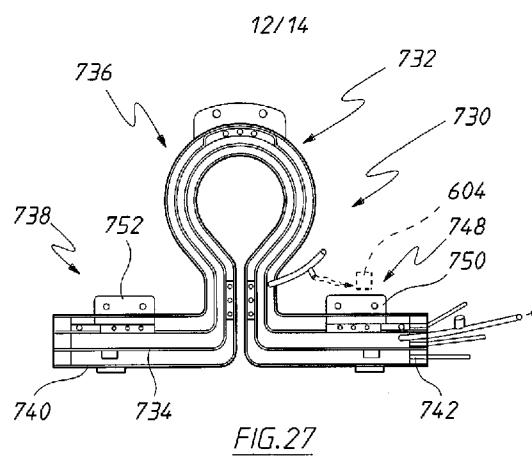


FIG. 28

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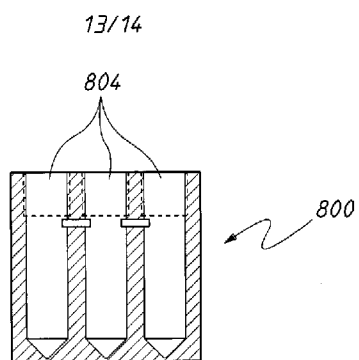


FIG. 29

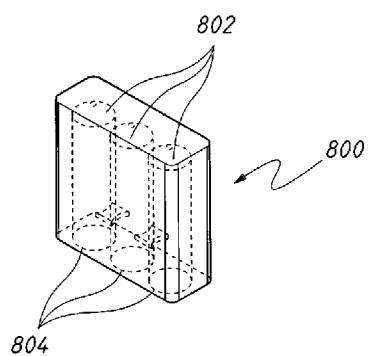


FIG. 30

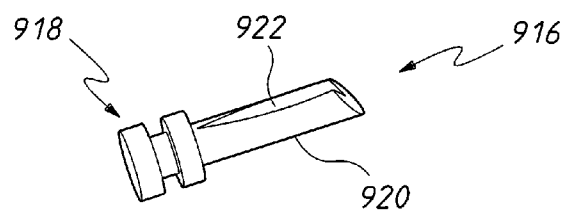


FIG. 31

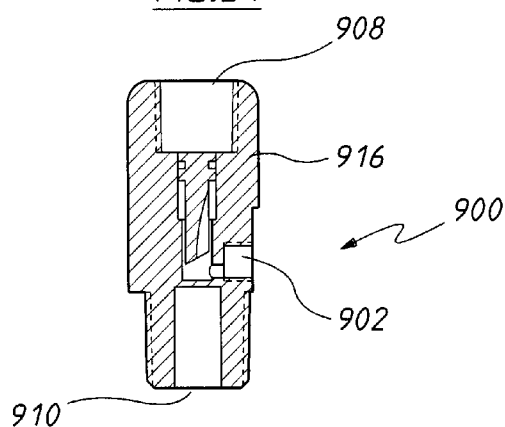


FIG. 32

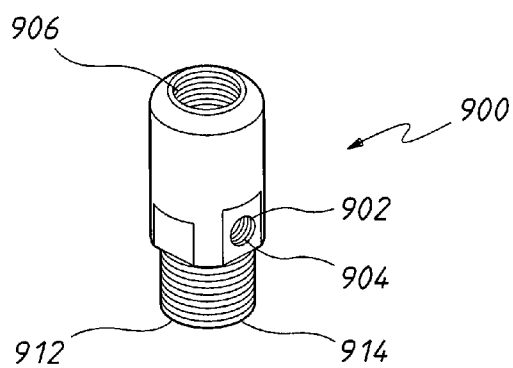


FIG. 33

SAFETY DEVICE AND ADAPTER THEREFOR**FIELD**

[0001] The invention concerns a safety device, particularly a safety device for keeping a user afloat in a body of water during an emergency situation. The invention further concerns an adapter for use in such safety device.

BACKGROUND

[0002] More than a million people die annually as a result of drowning. In the great majority of drowning incidents the victim had no intention of going into the water, but came to be in the water due to an accident, for example being swept from a pier by a large wave.

[0003] As far as water recreational activities are concerned, cruising in small motorised boats rank high in the list of activities drowning victims were engaged in at the time of drowning. Such drowning incidents frequently occur as a result of boats capsizing or victims falling overboard after a collision with other boats or floating objects. Often victims are unable to reach their lifejackets or become exhausted from treading water before help arriving.

[0004] Another factor contributing to the number of drownings at sea is the occurrence of what is referred to as a “rip current” or a “riptide”. A rip current is a strong channel of water which flows seaward from the shore, typically through the surf line. It can occur at any time, causing a swimmer to be taken deep into the ocean. Typically swimmers caught in a rip current will find that they are unable to fight the current, with the result that they have no alternative but to stay afloat for a prolonged period of time while awaiting the arrival of help. Victims of such currents, however, succumb when they become exhausted from treading water before any help can arrive.

[0005] A major danger associated with the sport of rock fishing is that of being swept by an unusually large wave while fishing from a rock platform. The main problem confronting a fisherman swept to sea in such a situation is to stay afloat while searching for a suitable place from which to climb from the water. Many fishermen, however, drown after becoming exhausted from having to tread water for an extended period of time without being able to reach a spot to climb from the water.

[0006] In light of the threat of drowning to persons engaging in water recreational activities, various personal flotation devices (“PFDs”) have been developed. Such devices include, for example, lifejackets having bladders filled with a buoyant material such as foam. Those lifejackets are, however, cumbersome to wear and are not appropriate for recreational bathers swimming in the surf, or for persons engaging in a range of other types of water recreational activities.

[0007] An alternative type of PFD employs carbon dioxide to inflate a bladder during an emergency situation. The carbon dioxide is stored in a pressure cylinder which is connected to the bladder. In an emergency situation carbon dioxide is released from the cylinder when a sealed end of the cylinder is pierced by an actuator. The actuator, in turn, will pierce the sealed end when a dissolvable tablet dissolves when it comes into contact with water.

[0008] The drawback of employing a dissolvable tablet is that the bladder can accidentally be inflated when there is no emergency situation. For example, a fisherman may be safely fishing from a rock formation when spray from waves break-

ing against the rock formation comes into contact with the dissolvable tablet. The tablet will as a result dissolve causing the bladder to be inflated. The fisherman will thus have the inconvenience and cost of replacing the spent cylinder. Those types of PFD also are not suitable for persons who engage in water sports as they will be activated as soon as the dissolvable tablet comes into contact with water.

OBJECT

[0009] It is the object of the present invention to substantially overcome or at least ameliorate one or more of the above disadvantages, or to provide a useful alternative.

SUMMARY

[0010] According to a first aspect there is disclosed herein a safety device comprising:

[0011] an inflating product container to hold inflating product, the inflating product container operatively associated with an inflatable bladder to be worn by a user, the inflating product container adapted to be placed in an open condition in which open condition inflating product is allowed to inflate the inflatable bladder;

[0012] an adapter to provide fluid communication between the inflating product container and the inflatable bladder, the adapter including (i) a container coupling formation adapted to secure the adapter to the inflating product container and (ii) an actuator operatively adapted to place the inflating product container in the open condition; and

[0013] a controller operatively associated with the actuator, the controller including a sensor assembly, in use the controller adapted to generate an activation signal responsive to measurements taken by the sensor assembly,

[0014] wherein the actuator is operatively adapted to place the inflating product container in the open condition responsive to the controller generating the activation signal

[0015] According to a second aspect there is disclosed herein an adapter for a safety device, the safety device including an inflatable bladder to be worn by a user, the adapter comprising:

[0016] a container coupling formation operatively adapted to secure the adapter to an inflating product container holding inflating product, the inflating product container operatively adapted to be placed in an open condition in which open condition inflating product is allowed to inflate the inflatable bladder;

[0017] an outlet operatively adapted to place the inflating product container in fluid communication with the inflatable bladder;

[0018] a charge chamber for holding a pyrotechnic composition, the charge chamber operatively associated with the container coupling formation;

[0019] a rupture member operatively locatable in the charge chamber; and

[0020] an igniter coupling formation operatively adapted to secure an igniter proximate the charge chamber, the igniter operatively associated with a controller,

[0021] wherein in use the igniter ignites the pyrotechnic composition responsive to an activation signal generated by the controller, ignition of the pyrotechnic composition causing the rupture member to accelerate across the charge chamber so as to rupture the inflating product container, thereby placing the inflating product container in the open condition.

[0022] According to a further aspect of the present invention there is disclosed herein a safety device, comprising:

[0023] an inflating product container to hold inflating product;

[0024] a conduit operatively associated with the inflating product container;

[0025] an adapter adapted to connect the container with the conduit, the adapter comprising a valve having a closed condition in which inflating product is deterred from moving from the container to the conduit, the valve being adapted to be placed in an open condition in which inflating product is allowed to move from the container to the conduit,

[0026] an actuator operatively associated with the valve;

[0027] a controller operatively associated with the actuator, the controller including a sensor assembly, in use the controller generating an activation signal responsive to measurements taken by the sensor assembly,

[0028] wherein the actuator is adapted to place the valve in the open condition when the activation signal is generated.

[0029] According to another aspect of the present invention there is disclosed herein an adapter for connecting an inflating product container to a conduit, the adapter comprising:

[0030] a container coupling formation adapted to couple to a complimentary coupling formation on the container so as to secure the adapter to the container;

[0031] a conduit coupling formation adapted to couple to the conduit so as to secure the adapter to the conduit;

[0032] a valve operatively located between the container coupling formation and the conduit coupling formation and having a closed condition in which inflating product is deterred from flowing to the conduit from the container, the valve being adapted to be placed in an open condition in which inflating product is allowed to flow from the container to the conduit;

[0033] an actuator operatively associated with the valve and adapted to place the valve in the open condition; and

[0034] a communication assembly adapted to facilitate communication between the actuator and a controller,

[0035] wherein the actuator is adapted to place the valve in the open condition responsive to an activation signal generated by the controller.

[0036] Preferably the valve comprises a valve body adapted to rupture under the influence of the actuator, wherein rupture of the valve body causes the valve to be placed in the open condition so that inflating product flows from the container to the conduit.

[0037] Preferably the valve body is produced from glass, aluminium, ceramic, steel, brass, copper or a plastics material.

[0038] Preferably the actuator comprises a heater adapted to heat the valve body so as to facilitate rupture of the valve body.

[0039] Preferably the heater comprises a heating element.

[0040] Preferably the adapter comprises a rupture member adapted to crack the valve body.

[0041] Preferably the rupture member includes biasing means.

[0042] Preferably the biasing means comprises a spring.

[0043] Preferably the adapter includes a pull cord operatively associated with the rupture member.

[0044] Preferably the rupture member is located in a biased position by locating the spring in a biased condition, the spring being secured in the biased condition with the use of a securing member.

[0045] Preferably the pull cord is secured to the securing member via a curved connector.

[0046] Preferably the container coupling formation comprises a thread adapted to engage a complimentary thread of the coupling formation on the container.

[0047] Preferably the adapter includes a container opening formation adapted to open the container so as to allow inflating product to be dispensed therefrom.

[0048] Preferably the container opening formation comprises a piercing formation adapted to pierce a hole in the container so as to permit inflating product to be dispensed from the container.

[0049] Preferably the sensor assembly includes a water sensor to detect the presence of water, a pressure sensor to sense water pressure when the pressure sensor is immersed in a body of water, or both a water sensor and a pressure sensor.

[0050] Preferably the sensor assembly includes a heart monitor sensor adapted to detect the heartbeat of a user.

[0051] Preferably the sensor assembly includes a breathing sensor adapted to detect breathing of a user.

[0052] Preferably the sensor assembly includes a proximity device.

[0053] Preferably the controller includes signalling means adapted to signal the location of a user during an emergency situation.

[0054] Preferably the signalling means includes an Emergency Position Indicating Radio Beacon (EPIRB).

[0055] Preferably the signalling means includes a GPS unit.

[0056] Preferably the communication assembly includes an electronic socket adapted to hold a plug that is in electronic communication with the controller.

[0057] In an embodiment of the safety device the adapter comprises a valve having a charge chamber adapted to hold an amount of a pyrotechnic composition and the actuator is operatively associated with the charge chamber.

[0058] Preferably the safety device includes an igniter that is adapted to ignite the pyrotechnic composition responsive to the controller generating an activation signal, ignition of the pyrotechnic composition causing the charge chamber to be ruptured so as to place the valve in the open condition.

[0059] Preferably the pyrotechnic composition comprises flash powder.

[0060] Preferably the safety device further includes a manual actuator having a piezoelectric igniter adapted to ignite the pyrotechnic composition.

[0061] Preferably the piezoelectric igniter is attached to a pull cord, the piezoelectric igniter being adapted to ignite the pyrotechnic composition responsive to a force applied to the pull cord by a user.

[0062] According to a further aspect of the invention there is disclosed herein a safety device, comprising:

[0063] an inflating product container to hold inflating product;

[0064] a conduit operatively associated with the inflating product container;

[0065] an adapter adapted to connect the container with the conduit, the adapter comprising a valve having a closed condition in which the valve deters flow of inflating product from the container to the conduit, the valve being adapted to be placed in an open condition in which inflating product flows from the container to the conduit; and

[0066] an actuator operatively associated with the valve;

[0067] wherein the valve holds an amount of a pyrotechnic composition and the actuator is adapted to ignite the composition of the pyrotechnic composition, the valve being adapted to rupture under the influence of ignition of the pyrotechnic composition, such rupture adapted to place the valve in the open condition.

[0068] According to another aspect of the present invention there is disclosed herein a safety apparatus, comprising:

[0069] a safety device according to either the first, second or third aspects of the invention; and

[0070] an inflatable bladder defining an inner volume,

[0071] wherein the safety device is located within the inner volume of the inflatable bladder.

[0072] Preferably the bladder includes a sealable closure.

[0073] Preferably the sealable closure comprises a pressure zip fastener.

[0074] Preferably the safety device includes a liquid or water sensor located exterior of the inner volume to detect when the bladder is immersed in water or a pressure sensor also located exterior of the bladder to sense water pressure when the bladder is immersed in a body of water, or both such a water sensor and a pressure sensor.

[0075] According to a further aspect of the present invention there is disclosed herein a safety device, comprising:

[0076] a conduit adapted for attachment to an inflatable body;

[0077] an inflating product container adapted to hold inflating product, the inflating product container operatively associated with the conduit so as in use to supply inflating product to the inflatable body, the inflating product container including a valve which (i) has a closed condition in which the valve deters flow of inflating product from the inflating product container and (ii) is adapted to be placed in an open condition in which inflating product flows from the inflating product container;

[0078] an adapter operatively adapted to connect the container with the conduit, the adapter defining a charge chamber; and

[0079] an actuator operatively associated with the valve, the actuator comprising (i) a rupture member located within the charge chamber defined by the adapter and (ii) an igniter operatively associated with the rupture member, the igniter adapted to ignite a pyrotechnic composition operatively located proximate the rupture member, ignition of the pyrotechnic composition causing the rupture member to accelerate across the charge chamber towards the valve so as to rupture the valve thereby placing the valve in the open condition.

[0080] Preferably the safety device includes a controller operatively associated with the actuator, the controller including a sensor assembly, in use the controller generating an activation signal responsive to measurements taken by the sensor assembly, the actuator being adapted to place the valve in the open condition when the activation signal is generated.

[0081] According to yet a further aspect of the present invention there is disclosed herein a safety device, comprising:

[0082] an inflating product container adapted to hold inflating product, the inflating product container operatively associated with an inflatable body so as in use to supply inflating product to the inflatable body, the inflating product container including a valve which (i) has a closed condition in which the valve deters flow of inflating product from the inflating prod-

uct container and (ii) is adapted to be placed in an open condition in which inflating product flows from the inflating product container;

[0083] an adapter operatively adapted to connect to a conduit with the inflating product container; and

[0084] an actuator operatively associated with the valve, the actuator comprising (i) a rupture member located within a charge chamber defined by the adapter and (ii) an igniter operatively associated with the rupture member, the igniter adapted to ignite a pyrotechnic composition operatively located proximate the rupture member, ignition of the pyrotechnic composition causing the rupture member to accelerate across the charge chamber towards the valve so as to rupture the valve thereby placing the valve in the open condition.

BRIEF DESCRIPTION OF THE DRAWINGS

[0085] Preferred embodiments of the invention will be described hereinafter, by way of examples only, with reference to the accompany drawings, in which:

[0086] FIG. 1 is a schematic representation of an inflating product container and an adapter of a safety device in accordance with a first aspect of the invention;

[0087] FIG. 2 is a schematic representation of a controller for use with the inflating product container and the adapter of FIG. 1;

[0088] FIG. 3 is a schematic representation of a second embodiment safety device;

[0089] FIG. 4 is schematic representation of a third embodiment safety device;

[0090] FIG. 5 is a schematic representation of a valve body of the safety device of FIG. 4;

[0091] FIG. 6 is a schematic representation of a first embodiment safety apparatus;

[0092] FIG. 7 is a schematic representation of a second embodiment safety apparatus incorporating an inflatable bladder and a fourth embodiment safety device;

[0093] FIG. 8 is a schematic representation of an oral inflation arrangement of the safety apparatus of FIG. 7;

[0094] FIG. 9 is a front view of a connector of the oral inflation arrangement of FIG. 8;

[0095] FIG. 10 is a cross-sectional view of the connector of FIG. 9;

[0096] FIG. 11 is a perspective view of a base of an inflating product container of the safety device of FIG. 7;

[0097] FIG. 12 is a cross-sectional view of the base of FIG. 11;

[0098] FIG. 13 is a perspective view of a lid for the base of FIG. 11 and FIG. 12;

[0099] FIG. 14 is a perspective view of an adapter of the safety device of FIG. 7;

[0100] FIG. 15 is a cross-sectional view of the adapter of FIG. 14;

[0101] FIG. 16 is a perspective view of a window component of the base of FIG. 11;

[0102] FIG. 17 is a side view of a window component of FIG. 16;

[0103] FIG. 18 is a perspective view of a rupture member of the safety device of FIG. 7;

[0104] FIG. 19 is a side view of the rupture member of FIG. 18;

[0105] FIG. 20 is a side view of an igniter of the safety device of FIG. 7;

[0106] FIG. 21 is a partial perspective bottom view of the igniter of FIG. 20;

[0107] FIG. 22 is a perspective view of a connector of the oral inflation arrangement of FIG. 8;

[0108] FIG. 23 is a cross-sectional view of the connector of FIG. 22;

[0109] FIG. 24 is a schematic representation of a non-return valve of the oral inflation arrangement of FIG. 8;

[0110] FIG. 25 is a schematic representation of a non-return valve of an inflating product container of the safety device of FIG. 7;

[0111] FIG. 26 is a schematic representation of a pressure relief valve for the safety apparatus of FIG. 7;

[0112] FIG. 27 is schematic representation of an inflatable body for use with embodiments of the safety device;

[0113] FIG. 28 is a schematic representation of an inner bladder of the inflatable body of FIG. 27;

[0114] FIG. 29 is schematic representation of further embodiment inflating product container;

[0115] FIG. 30 is schematic representation of the inflating product container of FIG. 29;

[0116] FIG. 31 is a schematic representation of a further embodiment rupture member;

[0117] FIG. 32 is schematic cross-sectional representation of a further embodiment adapter; and

[0118] FIG. 33 is schematic representation of the adapter of FIG. 32.

DESCRIPTION OF PREFERRED EMBODIMENTS

[0119] In the description below like reference numerals will be used to illustrate like components.

[0120] FIG. 1 and FIG. 2 illustrate a first embodiment safety device, generally indicated with the reference numeral 10. In use the safety device 10 will be coupled to a non-illustrated inflatable bladder. During an emergency situation when a user is immersed in a body of water, for example in the case of the user having fallen overboard from a sea vessel, the safety device 10 will cause the bladder to be inflated so as to keep the user afloat until the user is rescued or manages to swim to safety. The safety device 10 will typically in use be attached to an article worn by a user, for example a rash guard.

[0121] The safety device 10 comprises an inflating product container 12 to hold inflating product. In this embodiment the container 12 holds carbon dioxide (CO₂) as the inflating product. The container 12 is tubular in shape. It will, however, be appreciated that the container 12 can have different shapes such as square tubular, rectangular tubular or hexagonal. The container 12 is produced from aluminium. It will of course be understood that the container 12 could be produced from other materials such as steel, plastic, brass or ceramic. The container 12 includes a coupling formation 14 provided in the form of a threaded portion.

[0122] The safety device 10 includes a conduit 16 adapted to be coupled to the non-illustrated inflatable bladder. In an emergency situation the conduit 16 will direct inflating product from the container 12 in the direction of arrow 18 towards the inflatable bladder.

[0123] The safety device 10 further includes an adapter 20 adapted to connect the container 12 with the conduit 16 so as to provide fluid communication between the container 12 and the conduit 16, and as result fluid communication between the container 12 and the inflatable bladder. In this embodiment the conduit 16 includes a conduit coupling formation 22, here

a threaded portion, at one end that is adapted to engage a complimentary threaded portion 24 at an outlet 23 of the adapter 20. At another end the adapter 20 includes a container coupling formation 26, here a threaded portion that is complimentary to the threaded portion of the coupling formation 14.

[0124] The adapter 20 includes a valve 28 having a closed condition, in which the valve is adapted in use to deter flow of inflating product from the container 12 to the conduit 16, and an open condition in which the valve is adapted to allow inflating product to flow from the container 12 to the conduit 16. The operation of the valve 28 is described in detail below.

[0125] The adapter 20 also includes an actuator 30 that is operatively associated with the valve 28 and is adapted to place the valve in the open condition.

[0126] The valve 28 of this embodiment comprises a disc-shaped valve body 29. The valve body 29 is adapted to rupture under the influence of the actuator 30, wherein rupture of the valve body causes the valve to be placed in an open condition so that inflating product can flow from the container 12 to the conduit 16 as discussed below. The valve body 29 is produced from a plastics material. It will, however, be understood that the valve body 29 could be produced from a range of different materials such as glass, aluminium, ceramic, steel, brass and copper.

[0127] The actuator 30 of the adapter 20 comprises a heater having a non-illustrated heating element that is adapted to heat the valve body 29, the valve body in turn being adapted to melt, such melting serving to facilitate rupture of the valve body 29.

[0128] In order to open the container 12 so that inflating product can flow through the adapter 20 towards the conduit 16, the adapter 20 includes a container opening formation 32. In this embodiment the container opening formation 32 comprises a piercing formation adapted to pierce a hole in the container 12. The piercing formation 32 will pierce the container 12 when the adapter 20 is attached to the container 12. This aspect is discussed in further detail below.

[0129] The adapter 20 includes a rupture member 34 adapted to crack/rupture the valve body 29. In order to generate sufficient momentum in the rupture member 34 to rupture the valve body 29, the rupture member 34 is secured to biasing means 36, here a helical spring, for in use preloading the rupture member 34. The rupture member 34 is held in a preloaded/biased position by a securing member 38. The securing member 38 in turn is connected to a pull cord 40 via a curved connector 42. The curved connector 42 nests within a curved portion 44 in an outer surface 46 of the adapter 20. By pulling on the pull cord 40 the securing member 38 can be released from the rupture member 34, thereby allowing the rupture member 34 to accelerate under the influence of the spring 36 to rupture the valve body 29 so as to release inflating product into the conduit 16. By providing that the connector 42 is curved it is possible for a user to remove the securing member 38 by pulling on the pull cord 40 irrespective of the orientation of the pull cord 40 relative to the securing member 38. It is pointed out that the pull cord 40 will typically only be employed to rupture the valve body 29 should the actuator 30 for some reason fail to rupture the valve body 29. The manner in which the actuator 30 functions to open the valve body 29 is discussed in detail below.

[0130] The safety device 10 further comprises a controller 48 that is connectable to the adapter 20 through a communication assembly 50. In this embodiment the communication

assembly 50 comprises an electric cable 52 having plugs at its two ends (not illustrated). The adapter 20 and the controller 48 each include a socket (not illustrated) adapted to receive the respective plugs so as to provide electronic communication between the actuator 30 and the controller 48. It will be understood that the communication assembly could be provided by alternative means, for example by wireless, Bluetooth™ or infrared connectivity. The container 12 and the controller 48 could also be physically coupled to obviate the need for such a communication assembly.

[0131] The controller 48 includes a sensor assembly 53. In use the controller 48 is adapted to generate an activation signal responsive to measurements taken by the sensor assembly 53 indicating that the user is in distress. Upon receipt of the activation signal the actuator 30 will place the valve 28 in the open condition by rupturing the valve body 29. Upon rupture of the valve body 29 inflating product will flow from the container 12 to the conduit 16 in order to be fed to the non-illustrated bladder.

[0132] FIG. 2 diagrammatically illustrate that the sensor assembly 53 includes a proximity sensor 54, signalling means comprising an Emergency Position Indicating Radio Beacon (EPIRB) and a Global Position System (GPS) module 56, an electronic water sensor 58, a mechanical water pressure sensor 60 in communication with a countdown timer 62, a low battery alarm 64, a remote activation module 66, a service alert module 68 to provide indication that the safety device 10 is due for a routine service (typically in 12 month intervals), a sensor activation module function 70, a heart monitor sensor 71 to monitor the heart rate of a user as well as a breathing sensor 73 to monitor the breathing of the user. The controller 48 is powered by a rechargeable main battery 72. A second rechargeable battery 74 is provided to serve as a back-up for the main battery 72 should the latter be rundown or for some reason fail.

[0133] The controller 48 is pre-set to provide a number of modes of operation, those being: (i) a safe mode, (ii) an off-mode, (iii) a remote mode, (iv) a manual mode and (v) a proximity mode.

[0134] In the safe mode the safety device 10 will cause the valve body 29 to be ruptured upon the water sensor 58 detecting the presence of water. In the off-mode a user is able to swim and the water sensor 58 will not trigger rupturing of the valve body 29. However, should the user find himself/herself in distress, the pull cord 40 can be employed to rupture the valve body 29 in order to inflate the bladder.

[0135] In the remote mode a user can also swim without the valve body 29 being ruptured. The remote activation module 66 is adapted to receive signals from a remote signalling means 67. The remote activation mode thus allows, for example, a child to swim and a parent to cause the valve body 29 to be ruptured when the child is in distress. Rupture is achieved by the parent activating a remote signalling means to communicate with the controller via the receiving module. In this embodiment the remote activation module comprises mobile telephony circuitry, such as a subscriber identification module (SIM) card that is adapted to communicate with a mobile telephone 67. In use a parent can rupture the valve body 29 remotely by communicating an activation signal to the remote activation module 66.

[0136] The mobile telephone 67 will typically include application software to operate in conjunction with the safety device 10. The software may be adapted to provide information on the location of the safety device 10 and to generate an

alarm signal to indicate that an emergency situation has arisen indicated by the fact that the valve body 29 has been ruptured. The software further can be adapted to activate the actuator 30. Furthermore the application software may be adapted to control the controller 48 or work with the electronic circuitry of the controller.

[0137] The proximity mode operates via the proximity sensor 54 and serves as signalling means to alert an operator that the user of the safety device 10 has moved beyond a set distance from a remote device, here a mobile telephone, held by the operator. That mode can, for example, be employed to alert parents inside a house that a child playing outside has moved outside a set range. The parent can then take appropriate action to ensure the safety of the child.

[0138] The controller 48 includes an information display module 76, in this embodiment provided in the form of a number of non-illustrated light emitting diodes (LEDs). The LEDs in use serve to indicate (i) the selected mode of the safety device, (ii) a low battery charge, (iii) potential low levels of inflating product within the inflating product compartment and (iv) service due indicator alerting the user that the safety device 10 must undergo a scheduled service. The remote activation module 66 may also include indicating means to alert an operator that the valve body 29 has been ruptured and that the user of the safety device may be in distress. Similarly, the information display module 76 may include an alarm 79 to alert third parties that the user of the safety device 10 is in distress. The alarm 79 can be provided in the form a speaker to generate a siren and/or a light emitting device to generate a flashing light to signify distress.

[0139] An additional pull cord 78 is attached to a pin 80 as shown. The pin 80 is adapted to co-operate with non-illustrated circuitry of the controller 48 in such a manner that removal of the pin 80 from the controller 48 by a user pulling on the pull cord 78 will short-circuit circuitry to cause an activation signal to be generated so that the actuator 30 will rupture the valve body 29. Alternatively, the circuitry could include a switch which is arranged such that pulling on the cord will close the switch, thereby causing an activation signal to be generated.

[0140] It will be understood that coupling between the container 12 and the adapter 20 could be achieved in a number of ways and need not be by way of complimentary threaded portions. For example, coupling could be through a clip-lock formation.

[0141] To recharge the batteries 72 and 74, the controller 48 includes a recharge socket, not illustrated, which is adapted to be coupled to a charging unit connectable to an electricity supply.

[0142] FIG. 3 shows a second embodiment safety device 82. The safety device 82 comprises a container 12 that is connectable to a controller 48. The controller 48 is housed within a circular housing 84 as opposed to the square shaped housing of the controller 48 of the safety device 10. The controller 48 includes a communication cable 50 having a plug 86 adapted to be plugged into a socket 88. The container 12 of the safety device is located within a protective casing 90. The safety device 82 operates in a manner similar to the safety device 10.

[0143] FIG. 4 and FIG. 5 show a third embodiment safety device, generally indicated with the reference numeral 200. The safety device 200 is similar to the safety device 10 in that it includes an inflating product container 12 and an adapter 20 for facilitating coupling between the container 12 and a con-

duit 16. The conduit 16 is in fluid communication with a non-illustrated inflatable bladder. The adapter 20 includes a hollow valve 28. The valve 28 at one end includes a charge chamber 202 to hold an amount of a pyrotechnic composition. In this embodiment the pyrotechnic composition is flash powder.

[0144] The adapter 20 includes a container opening formation 32 adapted to pierce the container 12 so that inflating product is allowed to flow into the hollow valve 28. The inflating product is, however, prevented from flowing to the conduit 16 by the charge chamber 202 sealing the bottom of the valve 28.

[0145] To deter leakage of inflating product between the container 12 and the adapter 20 O-rings 210 are provided.

[0146] The adapter 20 includes an actuator 30. The actuator 30 is in electronic communication with the controller 48 via an electric cable 52. The actuator 30 includes an electric igniter 204 that in use is adapted to ignite the pyrotechnic composition of the charge chamber 202.

[0147] During an emergency situation the controller 48 will generate an activation signal responsive to measurements taken by a sensor assembly 53 as discussed above. The igniter 204 is hereafter supplied with electric current so as to ignite the pyrotechnic composition. Upon ignition of the pyrotechnic composition the charge chamber 202 will be ruptured so as to place the valve 28 in an open condition. Inflating product can now flow from the container 12 through the adapter 20, through outlet 23 to the conduit 16 so as to be fed to the inflatable bladder.

[0148] The safety device 200 includes a manual actuator 206. The manual actuator 206 can be employed by a user to ignite the pyrotechnic composition should the controller 48 for some reason fail to generate an activation signal during an emergency situation. The manual actuator 206 comprises a pull cord 40 that is attached to a piezoelectric igniter 208. The piezoelectric igniter 208 is adapted to ignite the pyrotechnic composition responsive to a force applied to the pull cord 40 by a user.

[0149] It will be understood that the safety device may be produced with either just the manual actuator or just an actuator in communication with a controller.

[0150] FIG. 26 shows a first embodiment safety apparatus, generally indicated with the reference numeral 300. The safety apparatus 300 includes an inflatable bladder 302, here in the form of an inflatable vest. The bladder 302 defines an inner volume 304. Located within the inner volume 304 is a safety device 10. To provide access to the inner volume 304, for example to replace the safety device 10, the bladder 302 includes sealable closures 306. In this embodiment the sealable closures comprise pressure zip fasteners.

[0151] The safety device 10 further includes a non-illustrated water sensor exterior of the inner volume 304 to detect when the bladder 302 is immersed in water as well as a non-illustrated pressure sensor, also exterior of the inner volume 304, to sense water pressure when the bladder 302 is immersed in a body of water. The safety device 10 operates in a manner as described above and will cause the bladder 302 to be inflated with inflating product responsive to measurements taken by the water sensor and the pressure sensors.

[0152] The safety apparatus 300 further includes an oral inflator 308 whereby a user can supplement inflating product in the bladder 302 with breath as well as a non-illustrated on/off switch for activating and deactivating the safety device

10. To charge a battery 310 of the safety device 10 a non-illustrated external charge port is provided.

[0153] By enclosing the safety device 10 and its electronic circuitry within the bladder 302 as discussed above they are protected against the corrosive effects of water, particularly salt water.

[0154] FIG. 7 shows a second embodiment safety apparatus 600 comprising a bladder 602 and a fourth embodiment safety device 604 located exterior of the bladder 602. The safety device 604 includes an inflating product container 606 which is in fluid communication with an oral inflation arrangement 608 of the bladder 602, via a conduit 610. The conduit 610 is secured to the inflating product container 606 by way of an adapter 612 as is described below. The inflating product container 606 is connected by electric wiring 613 to a housing 614 holding electronic circuitry of a controller 48 of the safety device 604. An external battery 616 is connected by electric wiring 618 to the electronic circuitry held by the housing 614. In use the electronic circuitry of the controller 48 is driven by the external battery 616.

[0155] The oral inflation valve arrangement 608 includes a conventional oral inflation tube 630 having a non-illustrated non-return valve. The oral inflation valve arrangement 608 is adapted to facilitate oral inflation of the bladder 602 with a user's breath and prevents escape of fluid from the bladder 602.

[0156] The oral inflation tube 630 has retrofitted thereto a connector 632. The connector 632 in turn is connected to the conduit 610. The conduit 610 provides fluid communication between the oral inflation tube 630 and the inflating product container 606.

[0157] Referring to FIGS. 8 to 10, it is shown that the connector 632 is in the form of a T-piece which is sized for retro-fitment to the conventional oral inflation tube 630. The connector 632 includes a side portion 634. The side portion 634 has a threaded interior 636 for threadingly engaging a connector 638. As shown in FIG. 22 and FIG. 23, the connector 638 includes an outer threaded portion 640. The outer threaded portion 640 is complimentary to the threaded interior 636 of the side portion 634. To secure the conduit 610 to the side portion 634, the connector 638 is threadingly secured to the side portion 634. The conduit 610 is thereafter secured to the connector 638 with a fitting 642, here a John Guest™ fitting. The connector 638 includes a non-return valve 644, in this embodiment provided in the form of a Schrader™ valve. This is further illustrated in FIG. 24 where the arrow 646 indicates the direction of inflating product flow from the inflating product container 606.

[0158] In an emergency situation the product container 606 will release an inflating product, here carbon dioxide. The inflating product will be fed via the conduit 610 to the non-return valve 644. The pressure of the inflating product will cause the non-return valve 644 to open allowing inflating product to enter the oral inflation tube 630. The inflating product will now be directed to travel along the oral inflation tube 630 towards the bladder 602. The pressure of the inflating product will cause the non-illustrated inflating product non-return valve to open allowing inflating product to enter the outer bladder 602. Once the inflating product container 606 has expended its inflating product, the inflating product non-return valve is allowed to return to a closed position as will the non-return valve 644 of the connector 638.

[0159] Should a user wish to add buoyancy to the bladder 602 the user can blow breath down the oral inflation tube 630.

The pressure exerted by the user will cause the inflating product non-return valve (not shown) to open so that the user's expended breath may enter the bladder 602. When the user ceases to blow down the oral inflation tube 630 the inflating product non-return valve will return to its closed position.

[0160] The bladder 602 includes a sealable closure 648, here of nylon, whereby access can be gained to the interior of the bladder 602. The sealable closure 648 comprises a press-seal (clip-lock). The press-seal closure 648 comprises male and female engagement portions 650 and 652 which sealingly engage when pressed together. To locate the sealable closure 648 in an open condition a user may pull on the oral inflation tube 630 whereby the male and female engagement portions 650 and 652 are peeled apart. In order to re-seal the press-seal closure 648, the male and female portions 650 and 652 are simply pressed together so as to be sealingly engaged. The press-seal sealable closure 648 is produced from nylon. It will, however, be understood that the press-seal could be produced from other materials. The sealable closure 648 will normally be welded in position at a hole in the bladder 602. In this embodiment sensors 654, which are operatively associated with the controller 48, are mounted to the oral inflation tube 630. The oral inflation tube 630 may also include a non-illustrated socket to accommodate an auxiliary battery for the controller.

[0161] It is pointed out that the safety device 604 can be located on the interior of the bladder 602 as indicated by the reference numeral 604A. Access to the interior of the bladder 602 is in such case effected by way of the sealable closure 648.

[0162] The bladder 602 includes a second press-seal sealable closure 656 as shown. The press-seal closure 656 operates in a manner similar to the sealable closure 648. However, in the case of the sealable closure 656, a pull-tab 658 is provided for peeling the male and female portions apart when opening of the sealable closure 656 is required. Opening of the sealable closure 656 may, for example, be required to access the interior of the bladder to install a satellite phone 660 in position. The face of the satellite phone 660 includes a waterproof touch pad exterior of the bladder 602 so as to be operated when the safety apparatus is in use.

[0163] As shown the safety apparatus 600 includes light emitting diodes (LEDs) 662. The LEDs are in communication with the controller 48 and will be activated in an emergency situation. In use the LEDs 662 can glow, flash and/or flash in a controlled manner so as to generate SOS sequences.

[0164] The inflating product container 606 is discussed with specific reference to FIGS. 11 to 13 of the drawings. The inflating product container 606 comprises a base 664 and a lid 666. The base 664 includes a threaded female portion 668 adapted for engaging a threaded male portion 670 of the lid 666. The base 664 includes two diagonally opposed inner threaded portions 672 and 674 which are respectively sized for threadingly engaging a threaded portion 676 of an adapter 678, shown in FIG. 14 and FIG. 15, and a threaded portion 680 of a window component 682, the purpose of which is discussed below.

[0165] To fill the inflating product container 606 with carbon dioxide inflating product, a frozen carbon dioxide material is placed inside the base 664. The lid 666 is hereafter secured to the base 664 via engagement of the female and male portions 668 and 670 whereafter the lid 666 is sealed to the base 664 by way of welding. The inflating product con-

tainer 606 will be filled with an inflating gas product once the carbon dioxide material has melted. In an alternative method carbon dioxide is pressure fed into the inflating product container through the inner threaded portions 672 and 674. In this method the base 664 and lid 666 will have been secured in position prior to the inflating product container 606 being charged with carbon dioxide.

[0166] The base 664 includes a valve 684 which can be placed in an open condition as discussed below so as to allow inflating product to flow from the inflating product container 606 to inflate the bladder 602.

[0167] Referring to FIG. 16 and FIG. 17 the window component 682 includes a transparent window member 686 produced from a plastics material, typically a polycarbonate. The window component 682 is secured to the base 664 of the inflating product container 606 by having the threaded portion 680 engage the corresponding threaded portion 672. In use an operator may visually inspect the interior of the inflating product container 606 through the window member 686 of the window component 682. In an alternative arrangement the window member 686 can be replaced with a non-illustrated filling valve.

[0168] The adapter 678 is discussed with reference to FIGS. 14 and 15 as well as FIGS. 18 to 21. The adapter 678 includes a conduit threaded portion 688 at outlet 689 for engagement with a corresponding threaded portion 640 located on a connector 638 placed on an end portion of the conduit 610, as shown in FIG. 24. The adapter 678 further includes an igniter threaded portion 690 for engagement with a corresponding threaded portion on an igniter 694, shown in FIG. 20 and FIG. 21.

[0169] The adapter 678 defines an elongate charge chamber 695 extending from the igniter threaded portion 690 across the length of the adapter 678 through the threaded portion 676 to an inlet 696. An inflating product outlet 698 branches off from the charge chamber 695.

[0170] The igniter 694 in use serves to ignite a pyrotechnic composition located in the charge chamber 695. The pyrotechnic composition will generally be placed inside the charge chamber in the form of a water-based paste and thereafter sealed with a glue seal. The igniter 694 includes a first and a second ignite element 700 and 702. The first ignite element is in the form of a nichrome wire and is in electronic communication with the controller 48 via wiring connected to a first connecting prong 704. In an emergency situation the controller 48 will cause the nichrome wire to become heated, causing the pyrotechnic composition to be ignited. In an alternative arrangement the igniter 694 may include a single glow plug element.

[0171] The second ignite element 702 is a nichrome separated wire. The second ignite element 702 is in electric communication with a piezoelectric component, not shown, located in a manual actuator, also not shown. The piezoelectric component is electrically connected to the second ignite element 702 via wiring connected to a second connecting prong 706. Responsive to a force applied to the manual actuator an electric current will flow to the second ignite element 702 which in turn will cause a spark between portions of the nichrome separated wire. Such spark will ignite the pyrotechnic composition.

[0172] The third prong 708 of the igniter 694 is to be grounded.

[0173] A rupture member 710 is shown in FIG. 18 and FIG. 19. The rupture member 710 includes a base 712, a tapering

head **714** and a neck **716** for connecting the base and the head. The rupture member **710** is sized for location within the charge chamber **695** and is adapted to move across the length of the charge chamber **695**.

[0174] The igniter **694** and the rupture member **710** provide an actuator for locating the valve **684** of the inflating product container **606** in an open condition. Specifically, when the pyrotechnic composition is caused to be ignited, the expanding gases resulting from the ignition will impact on the base **712** of the rupture member **710** causing the rupture member to accelerate across the length of the charge chamber **695** and to impact the valve **684**. Such impact will cause the head **714** of the rupture member **710** to rupture the valve **684**. Inflating product will thereafter push the rupture member **710** back along the charge chamber **684** so that inflating product can follow through the inflating product outlet **698** and into the conduit **610**.

[0175] Referring to FIG. 25, the arrow **718** indicates the direction of inflating product flow from the inflating product container **606**.

[0176] FIG. 26 depicts a connector **638** having attached to it a relief cap **720**. This arrangement may be employed as a pressure relief valve in the safety apparatus **600**.

[0177] FIG. 27 and FIG. 28 show an alternative inflatable body **730** comprising an outer inflatable bladder **732** and an inner inflatable bladder **734**. The outer bladder **732** includes a curved neck support portion **736**, operatively configured to support the neck of a user floating in a body of water. The outer bladder **732** further includes a torso support portion **738** operatively configured to extend around the torso and under the arms of the user. The torso support portion **738** comprises a first and a second end portion **740** and **742** which are connected via the neck support portion **736**.

[0178] The inner bladder **734** is complimentary shaped to the outer bladder **732** and includes a curved inner neck support portion **744** and an inner torso support portion **746**. The inner neck support portion **744** is sized for location within the neck support portion **736** of the outer bladder **732**. The inner torso support portion **746** is similarly sized for location within the torso support portion **738** of the outer bladder **732**.

[0179] The outer bladder **732** includes a fastening formation **748** adapted to secure the torso support portion **738** around the torso of the user. The fastening formation **748** comprises a first fastener **750** which is adapted for releasable attachment to a second fastener **752**.

[0180] The inflatable body **730** is particularly suitable for use by an adult in that it includes two bladders for providing buoyancy. In the case of a toddler, for example, the buoyancy provided by the inner bladder **734** will be sufficient to keep a toddler afloat. The inner bladder **734** can accordingly be employed on its own. The inner bladder **734** for this reason is also provided with a fastening formation **754**. The fastening formation **754** comprises a first fastener **756** which is adapted for releasable attachment to a second fastener **758** as well as a third fastener **760** which is adapted for releasable attachment to a fourth fastener **762**.

[0181] The inner bladder **734** is adapted in use to be placed in fluid communication with a safety device **604** as discussed above. The outer bladder **732** can either be orally inflated or inflated employing a safety device **604** as discussed above.

[0182] Persons familiar with the operation of conventional electric water sensors will appreciate that a water sensor includes two elements which define an open switch which is closed when those elements are immersed in water. The water

sensor **58** employed by the controller **48** includes two such elements. In an embodiment safety device the controller **48** is adapted such that a user touching the two elements will short circuit the water sensor **58** thereby switching on the controller **48** to conduct a self-test of electronic circuitry of the controller **48**. The controller **48** is further configured such that a second touch will prompt the controller to test battery function and strength. An LED on the display module **76** will be caused to flash if the batteries of the safety device are sufficiently charged to operate thereby signalling this fact to a user.

[0183] The controller **48** is further configured that upon a third touch of the sensor elements the controller **48** will conduct a barometric pressure test and equalise the pressure of the pressure sensor and set the controller **48** to zero pressure. The controller **48** is configured that should the necessary LEDs fail to light up while conducting the pressure test this will indicate to a user that the safety device is not in a proper working condition and should not be used.

[0184] FIG. 29 and FIG. 30 show an embodiment container **800**. The container **800** includes three inflating product storage modules **802** that are adapted to store inflating product. Each inflating product storage module **802** includes a threaded coupling formation **804** that is adapted to couple to a complimentary threaded container coupling formation on an adapter of an embodiment safety device. An example of a suitable adapter is discussed below with reference to FIG. 32 and FIG. 33.

[0185] FIGS. 32 and 33 show an alternative embodiment adapter **900**. The adapter **900** includes an outlet **902** having a conduit threaded portion **904** adapted for engagement with a corresponding threaded portion on a connector of a conduit in fluid communication with an inflatable bladder. The adapter **900** includes an igniter threaded portion **906** for engagement with a corresponding threaded portion on an igniter, not shown.

[0186] The adapter **900** defines an elongate charge chamber **908** extending from the igniter threaded portion **906** across the length of the adapter **900** through the threaded portion **912** to an inflating product inlet **914**.

[0187] The adapter **900** includes a rupture member **916**, shown in FIG. 31. The rupture member **916** includes a base **918** and an elongate stem **920**. A groove **922**, the purpose of which is discussed below, is provided in the stem **920**. The rupture member **916** is sized for location within the charge chamber **908** and is adapted to move across the length of the charge chamber.

[0188] In use a non-illustrated igniter and the rupture member **916** provide an actuator for opening a non-illustrated inflating product container. Specifically, when a pyrotechnic composition located inside a charge chamber **924** is caused to be ignited, the expanding gases resulting from the ignition will impact on the base **918** of the rupture member **916** causing the rupture member to accelerate across the length of the charge chamber and to impact the inflating product container. Such impact will cause the stem **920** of the rupture member **916** to create an opening in the inflating product container. Inflating product will thereafter push the rupture member **916** back along the charge chamber **908** so that inflating product can follow through the inflating product outlet **902** towards a non-illustrated inflatable bladder. In this regard the groove **922** will serve to enhance the speed with which the rupture member **916** can be pushed back by inflating product escaping the open container.

[0189] In a non-illustrated embodiment the safety device is adapted so that its recharge socket may be coupled to a mobile device so as to be recharged.

[0190] In a further non-illustrated embodiment the safety device includes a shark repelling device adapted to generate a sound signal to repel sharks when the safety device is used at sea.

[0191] In the specification rupture includes within its meaning to pierce, break, break open, cleave, destroy completely, break open, burst, crack, fracture, open, puncture, shatter, split or tear.

[0192] Although the invention has been described with reference to specific examples, it will be appreciated by those skilled in the art that the invention may be embodied in many other forms.

1. A safety device comprising:
 - an inflating product container to hold inflating product, the inflating product container operatively associated with an inflatable bladder to be worn by a user, the inflating product container adapted to be placed in an open condition in which an open condition inflating product is allowed to inflate the inflatable bladder;
 - an adapter to provide fluid communication between the inflating product container and the inflatable bladder, the adapter including:
 - (i) a container coupling formation adapted to secure the adapter to the inflating product container and;
 - (ii) an actuator operatively adapted to place the inflating product container in the open condition; and
 - a controller operatively associated with the actuator, the controller including a sensor assembly, in use the controller adapted to generate an activation signal responsive to measurements taken by the sensor assembly, wherein the actuator is operatively adapted to place the inflating product container in the open condition responsive to the controller generating the activation signal.
2. A safety device according to claim 1, wherein the sensor assembly includes a water sensor to detect the presence of water or a pressure sensor to sense water pressure when the pressure sensor is immersed in a body of water, or both a water sensor and a pressure sensor.
3. A safety device according to claim 1, wherein the adapter defines a charge chamber to hold a pyrotechnic composition, the charge chamber operatively associated with the inflating product container.
4. A safety device according to claim 3, wherein the actuator comprises:
 - (i) a rupture member locatable within the charge chamber defined by the adapter; and

- (ii) an igniter operatively associated with the rupture member and adapted to ignite the pyrotechnic composition, the rupture member being adapted such that ignition of the pyrotechnic composition will cause the rupture member to accelerate across the charge chamber so as to rupture the inflating product container, thereby placing the inflating product container in the open condition.

5. A safety device according to claim 4, wherein the pyrotechnic composition comprises flash powder.

6. A safety device according to claim 1, wherein the adapter includes an outlet operatively adapted to couple with a conduit in fluid communication with the inflatable bladder.

7. A safety device according to claim 6, wherein the inflatable bladder includes an oral inflation tube.

8. A safety device according to claim 7, including a connector adapted for attachment to the oral inflation tube.

9. A safety device according to claim 8, wherein the connector is adapted for operative attachment to the conduit in fluid communication with the adapter.

10. An adapter for a safety device, the safety device including an inflatable bladder to be worn by a user, the adapter comprising:

- a container coupling formation operatively adapted to secure the adapter to an inflating product container holding inflating product, the inflating product container operatively adapted to be placed in an open condition in which an open condition inflating product is allowed to inflate the inflatable bladder;
- an outlet operatively adapted to place the inflating product container in fluid communication with the inflatable bladder;
- a charge chamber for holding a pyrotechnic composition, the charge chamber operatively associated with the container coupling formation;
- a rupture member operatively locatable in the charge chamber; and
- an igniter coupling formation operatively adapted to secure an igniter proximate the charge chamber, the igniter operatively associated with a controller,

wherein in use, the igniter ignites the pyrotechnic composition responsive to an activation signal generated by the controller, ignition of the pyrotechnic composition causing the rupture member to accelerate across the charge chamber so as to rupture the inflating product container, thereby placing the inflating product container in the open condition.

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