Aug. 19, 1969 M. H. COCKBILL ET AL 3,461,835

WATER-ACTIVATED BALLOON INFLATING DEVICE

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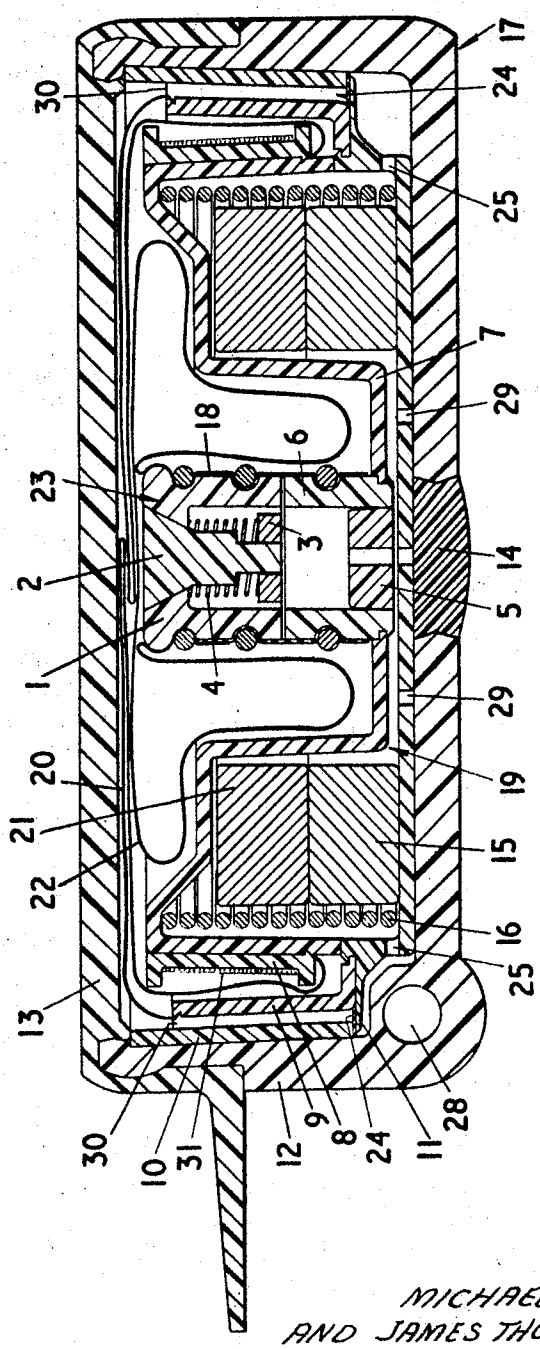


FIG. 1.

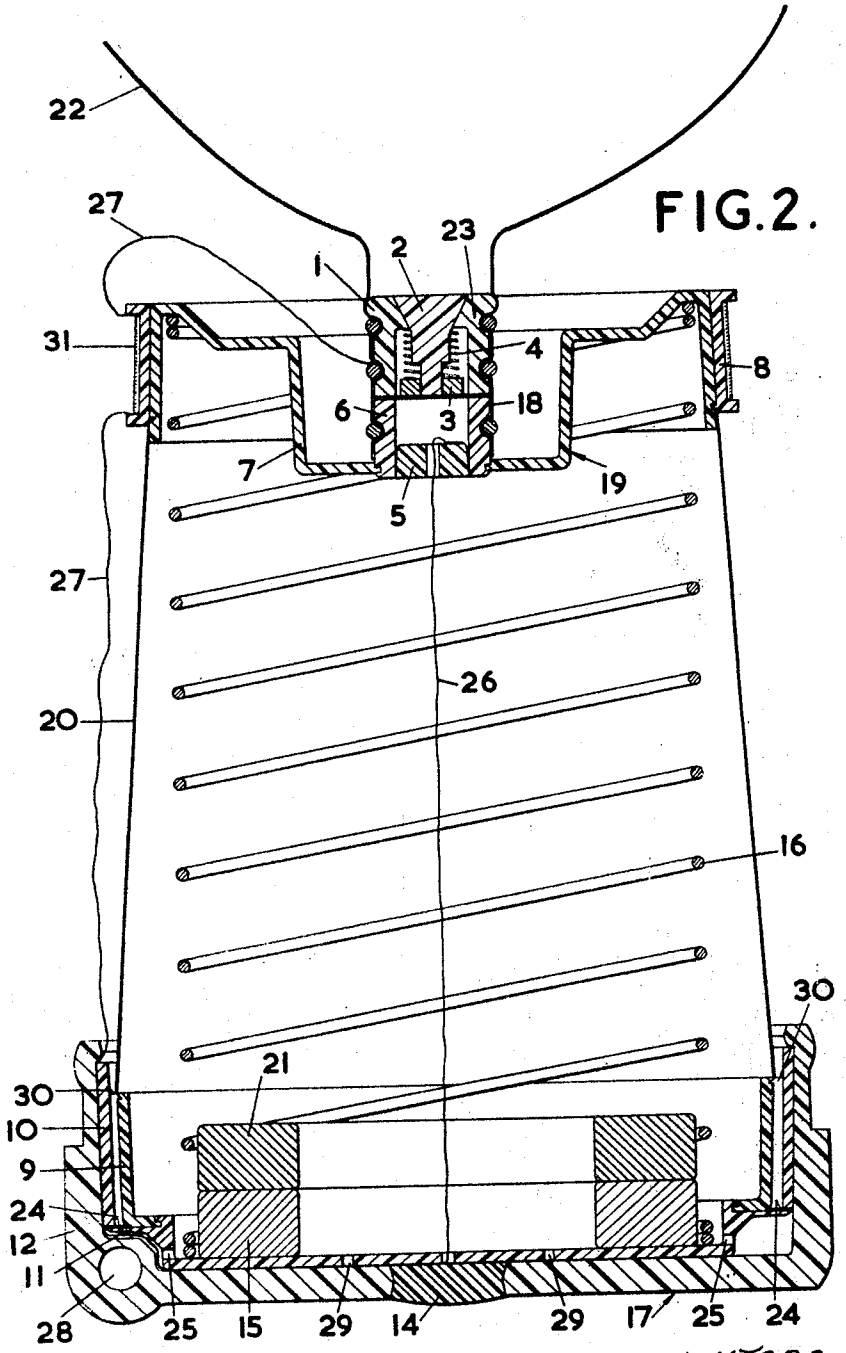
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FIG.2.



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WATER-ACTIVATED BALLOON INFLATING DEVICE

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U.S. Cl. 116—124 9 Claims

ABSTRACT OF THE DISCLOSURE

A device for inflating a balloon having a receptacle containing a chemical which reacts with water to release hydrogen into a balloon so that the balloon can ascend and mark the position of the operator for use in rescue work at sea.

This invention relates to a water activated balloon inflating device.

The device is especially suitable for use in rescue work at sea. The device is preferably attached to a life-saving garment or boat so that a person in difficulties may inflate and release a balloon to attract the attention of rescue workers. The device may alternatively form an integral part of a life-saving garment so that it is inflated as the garment is inflated or it may be carried on a lanyard attached to the user if he is not wearing a life-saving garment.

The invention consists in a water-activated balloon inflating device comprising a receptacle having at least one water inlet and containing a substance capable of generating gas by reaction with water and a balloon having an inlet such that gas generated in the receptacle is able to enter the balloon and is retained therein.

Preferably, the gas generated is lighter than air so that the inflated balloon can ascend to an appreciable height while remaining attached to the device by a cord.

Conveniently, the water inlet of the receptacle is controlled by a one-way valve and the gas inlet of the balloon comprises a one-way valve fitted in the neck of the balloon.

The preferred substance for generating gas by reaction with water is sodium borohydride together with a catalyst such as anhydrous cobalt chloride. The gas generated in this case is hydrogen. The speed of the reaction may be increased with the use of other catalysts.

Other substances which may be used to generate hydrogen are lithium hydride, sodium hydride, calcium hydride and lithium borohydride.

In one embodiment of the invention, the receptacle comprises an expandable collapsed envelope enclosed in a container such that when the container is opened under water the envelope expands and draws in water.

When gas generation commences, it is possible that the increase in pressure within the receptacle will prevent sufficient water entering the reaction chamber. It is therefore preferable to have the reaction slightly delayed by enclosing the reactants in a water soluble membrane or in water soluble capsules.

The reaction may be phased by enclosing the reactants in water soluble capsules having walls of varying thicknesses so that the substances are released gradually and excess heat generated by the reaction is dissipated. In this case, the capsules may be arranged in fixed positions about a rod within the receptacle so that water reaches the capsules with the thinnest walls first.

An additional hazard in the operation of the device is that a violent foaming action may take place in the early

stages of the reaction. This foaming action can cause some of the liquid present in the receptacle to be forced through the gas inlet into the balloon.

To overcome this disadvantage, a connecting nozzle leading from the envelope to the gas inlet of the balloon is conveniently sealed with a plug, the plug being removable from the nozzle by expansion of the envelope after hydrogen generation has commenced.

The collapsed envelope is preferably fitted with an expandable spring and the neck of the balloon is conveniently joined to the connecting nozzle by a water-soluble seal such that the seal will not dissolve until after the balloon has been inflated.

A filter may also be provided in the connecting nozzle to prevent liquid or foam entering the balloon.

In another embodiment of the invention, the receptacle has a water inlet and a water outlet, each fitted with a one-way valve, and a gas outlet leading to the neck of the balloon and fitted with a valve, with the operation of each valve being dependent on the gas pressure within the receptacle such that when the receptacle is immersed in water, water is periodically circulated through the receptacle and gas is released into the balloon.

Preferably, in this embodiment of the invention, the receptacle is divided into two compartments by a perforated plate, with the gas generating substance and gas outlet being continued in one compartment and the water inlet and water outlet valves being fitted in the other compartment.

The gas outlet valve is held in its open position by a spring or resilient material such as foam rubber.

The water inlet and outlet valves are each closed by a water-soluble seal and the receptacle is preferably partially evacuated before use.

When the receptacle is immersed in water, the water soluble seals on the inlet and outlet valves dissolve. Water passes into the receptacle through the one-way inlet valves.

As described above, an alkali metal hydride or borohydride with or without an appropriate catalyst is preferably used as the gas generating substance.

The water reacts with the hydride to generate hydrogen which passes through the gas outlet into a tube leading to the neck of the balloon. This tube is preferably narrow or formed with a restriction so that the pressure within the receptacle increases as the hydrogen is generated.

When the gas pressure reaches a certain level the spring valve closes and there is a further increase of pressure within the receptacle.

This increase in pressure causes the water outlet valve to open and water is expelled from the receptacle until the pressure drops sufficiently to cause the water outlet valve to close and the gas outlet to open.

The drop in pressure inside the receptacle causes the water inlet valve to open so that more water enters the receptacle and the cycle is repeated.

Before use, the receptacle is preferably sealed in a container, conveniently made of plastic or metal. The container is divided into two parts by a plate. The receptacle is placed in one part of the cotnainer and the collapsed balloon is placed in the other part. The tube connecting the gas output to the neck of the balloon passes through a hole in the plate.

A cord of suitable length is fitted within the part of the container enclosing the balloon and connects the balloon to the container so that when the inflated balloon is released the balloon remains attached to the device.

The receptacle has a rip-cord or handle which extends from the container so that when the device is to be used the sealed container can be opened and the receptacle allowed to fall away from the container.

The receptacle preferably has a weight so that it remains substantially vertically immersed in the water.

The rip-cord or handle also opens the end of the container through which the inflated balloon is eventually released.

The gas generating substance is conveniently enclosed in a water-soluble bag, a suitable material for the bag being a water-soluble polyvinylalcohol.

The invention will be further described with reference to the accompanying drawings in which:

FIGURE 1 is a sectional view of one embodiment of the invention showing the balloon inflating device ready for use, and

FIGURE 2 is a sectional view of the same embodiment of the invention with the envelope partially expanded.

As shown in FIGURE 1, the device comprises a receptacle **19**, comprising an expandable collapsed envelope **20** containing tablets, **15** and **21**, each tablet comprising a mixture of sodium borohydride and anhydrous cobalt chloride and a balloon **22** having a gas inlet valve **23**. The sodium borohydride and catalyst may alternatively be provided in separate tablets.

The collapsed envelope **20** is enclosed in a container **17** and is fitted with an expandable spring **16**.

The receptacle **19** is fitted with a connecting nozzle **6** leading to the gas inlet valve **23** of the balloon, with the nozzle being sealed with a plug **5** before hydrogen generation has commenced. The neck of the balloon is joined to the connecting nozzle **6** by a water soluble seal **18**.

The container **17** comprises a bottom outer casing **12** sealed with a disposable lid **13** and a securing ring **10**, fitted around the inner periphery of the bottom outer casing **12**, with a plurality of water entry channels **30** passing through the securing ring.

The receptacle **19** comprises the envelope **20** attached to a top securing ring **8** and a bottom collar **9**. The envelope is also provided with a base plate **11**, with the base plate and the bottom collar **9** being formed with recesses and projections such that they engage one another in a gas tight fit. The bottom collar **9** fits into the container so that it engages the securing ring **10**.

The base plate **11** is formed with an annular flexible flap **24** which extends below the securing ring **10** so as to be flexible in one direction. Water entry channels **25** are formed in the side walls of the base plate **11**, below the flexible flap **24**, so that water passing through the first stage water entry channels is sucked into the envelope **20** as the envelope expands.

The envelope **20** is fitted with a cover **7** supported by the top securing ring **8**. The connecting nozzle **6**, leading to the gas inlet valve in the neck of the balloon, is fitted in the cover **7**. The plug **5** is attached by a cord **26** to the base plate **11**.

The length of the cord **26** is such that when the container is opened and the envelope is partially expanded by the force of the spring **16**, as shown in FIGURE 2, the plug **5** remains in the connecting nozzle **6**.

The cord **26** is slightly shorter than the length of the fully expanded envelope so that when the pressure within the envelope increases due to hydrogen generation, the envelope is further expanded and the plug **5** is pulled out of the connecting nozzle **6**.

The purpose of the plug is to contain hydrogen in the envelope until it builds up a back pressure. This pressure serves to push down the foam which is generated by the initial reaction and ensures that none of it passes into the balloon. The back pressure also closes the one way valve formed by the flexible flap **24**.

The one-way valve **23**, in the neck of the balloon comprises a valve stop **3**, a valve return spring **4** and a molded plastic valve needle **2**. This one-way valve is enclosed in a molded plastic tube **1** fitted in the neck of the balloon.

The balloon is connected to the lower outer casing **12** by a nylon cord **27**. The cord **27** is coiled around the top securing ring **8** and is held in place by a water soluble membrane **31** so that it does not uncoil until required.

A hole **28** is formed in the bottom outer casing **12** for

attaching the device to a person, life-saving garment or boat.

The device is preferably small enough to be easily held in the hand.

In order to use the device, the lid **13** of the container is ripped off. The spring **16** expands and the required amount of water is drawn into the envelope **20** via the water inlet valves **30** and **25**, and hydrogen generation commences. The pressure within the envelope increases so that it expands further and the plug **5** is withdrawn from the connecting nozzle **6**. Hydrogen then enters the balloon via the one-way gas inlet valve **23** and the balloon is inflated.

The quantities of reactants are water and preferably chosen so that the balloon will be inflated in about 5 minutes after the reaction commences. The water soluble seal joining the balloon to the connecting nozzle is designed to release the balloon by the time it is inflated.

As the balloon rises the cord **27** uncoils from the top securing ring **8**.

The water soluble seals and membranes used in the device are preferably polyvinyl alcohol.

The expandable envelope is preferably Melinex polyester film bonded to polythene and anti-foaming agents may be provided in the envelope together with reactants.

When sodium borohydride and anhydrous cobalt chloride are used for gas generation, the catalyst preferably comprises 20% or more by weight of the hydride. The receptacle is preferably designed so that the ratio of water to sodium borohydride is between 10:1 and 20:1.

We claim:

1. A water activated balloon inflating device comprising an expandable collapsed envelope located in a container which is openable under water, a substance contained in said envelope and which generates, by reaction with water, a gas which is lighter than air, means for expanding the envelope to cause entry of water therein through an inlet valve after opening of said container and an inflatable balloon which is fitted with a one-way inlet valve and detachably connected to the envelope.

2. A water activated balloon inflating device according to claim **1** wherein said container comprises a bottom outer casing sealed with a disposable lid.

3. A water activated balloon inflating device according to claim **1** wherein the substance capable of generating gas by reaction with water is selected from the group consisting of sodium borohydride and a catalyst such as anhydrous cobalt chloride, lithium hydride, sodium hydride in oil, calcium hydride or lithium borohydride.

4. A device according to claim **1** wherein said envelope has a water inlet and a water outlet each fitted with a one-way valve, and connection means leading to the neck of the balloon is fitted with a valve, the operation of each of said valves being dependent on the gas pressure within the envelope such when the envelope is immersed in water, water is periodically circulated through the receptacle and gas is released into the balloon.

5. A device according to claim **1** wherein the envelope contains a perforated plate which divides the envelope into two compartments, said gas generating substance and a gas outlet being contained in one compartment and water inlet and water outlet valves being fitted in the other compartment, the envelope being sealed in a container having a plate which divides the container into two parts, the envelope being positioned in one part of the container and the collapsed balloon being positioned in the other part, the connection means leading from the envelope to the balloon passing through a hole in the plate.

6. A water activated balloon inflating device comprising a container which is openable under water, an expandable collapsed envelope located in the container and containing a substance which generates, by reaction with water, a gas which is lighter than air, spring means for expanding the envelope to cause entry of water therein

through an inlet valve after opening of said container and an inflatable balloon, which is fetted with a one-way inlet valve, detachably connected to the envelope and tethered to the container by means of a cord, and automatically operating means for releasing the balloon from the envelope after the balloon has been inflated.

7. A water activated balloon inflating device comprising a container which is operable under water, an expandable collapsed envelope located in the container and containing a substance which generates by reaction with water a gas which is lighter than air, means for expanding the envelope to cause entry of water therein through an inlet valve after opening of said container, an inflatable balloon fitted with a one-way inlet valve and detachably connected to the envelope, connection means leading from the envelope to the neck of said balloon and sealed with a plug, said plug being attached to the envelope by joining means such that expansion of the envelope after gas generation has commenced causes the plug to be withdrawn from the connection means, said balloon being detachably connected to the envelope and tethered to the container by means of a cord, and automatically operating means for releasing the balloon from the envelope after the balloon has been inflated.

8. A water activated balloon inflating device according to claim 7 wherein said connection means comprises a connecting nozzle fitted in the envelope and a water soluble seal joining said connecting nozzle to the neck of the balloon.

9. A water activated balloon inflating device comprising an expandable collapsed envelope located in a container having a bottom outer casing sealed with a disposable lid, a substance contained in said envelope and which generates, by reaction with water, a gas which is lighter than air, means for expanding the envelope to cause entry of water therein through an inlet valve after opening of said container and an inflatable balloon which is fitted with a one-way inlet valve and detachably connected to the envelope, said bottom outer casing having a securing ring fitted around its inner periphery, the securing ring having water entry channels therethrough, said expandable collapsed envelope having a base plate engageable with said bottom outer casing and having a flexible peripheral flap which engages the base of the securing ring to form a plurality of one-way valves and having water entry channels leading to the interior of the envelope, the base of the envelope being supported by a collar adapted to engage both the securing ring and the base plate.

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