March 14, 1967 R. J. LICHER 3,308,494

INFLATABLE LIFE PRESERVER

Filed Nov. 30, 1964 2 Sheets-Sheet 1

FIG. 1.

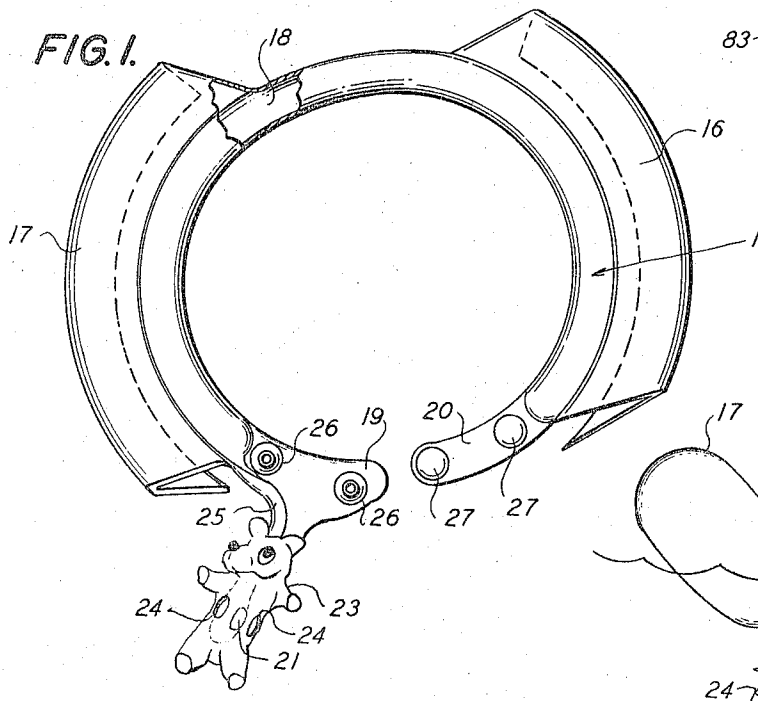


FIG. 7.

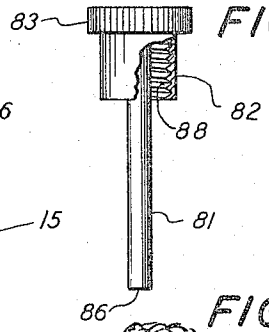


FIG. 2.

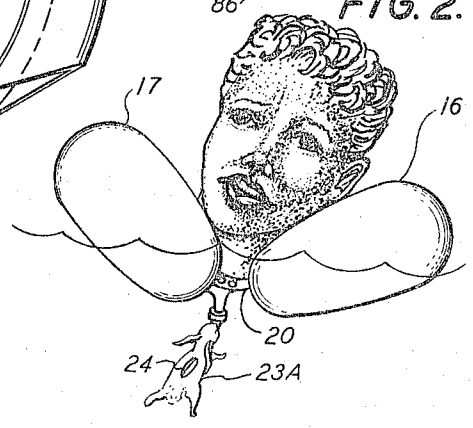


FIG. 3.

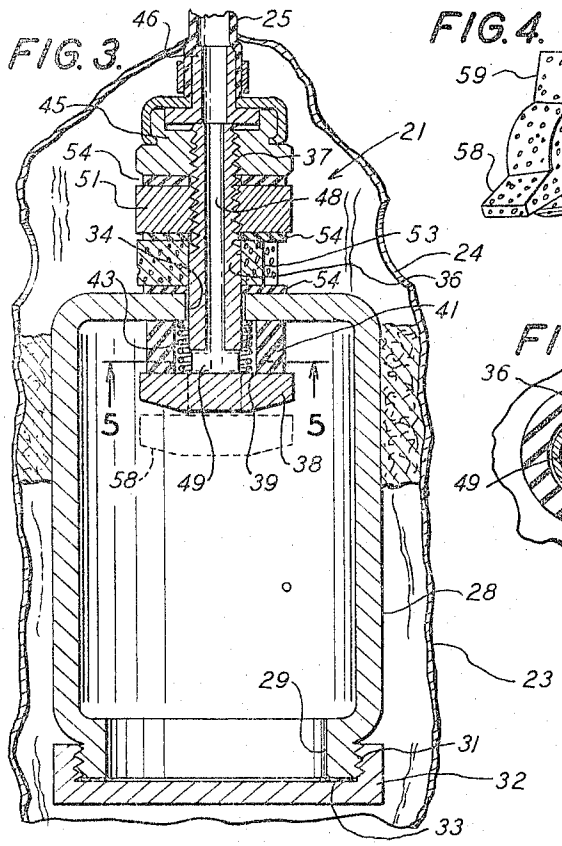


FIG. 4.

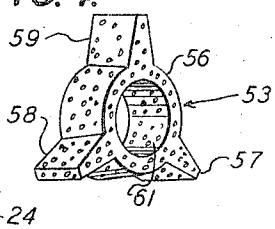


FIG. 5.

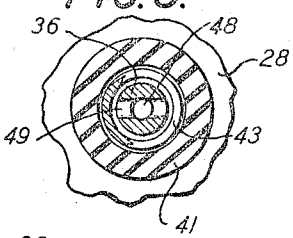
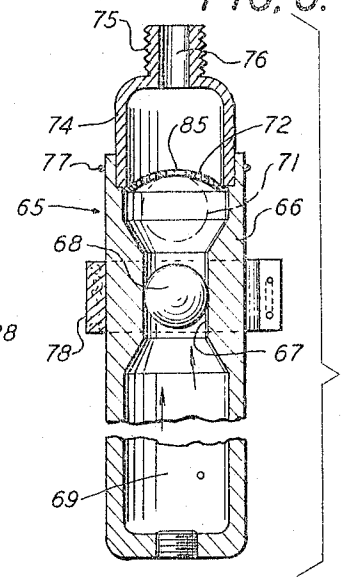


FIG. 6.



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FIG. 8.

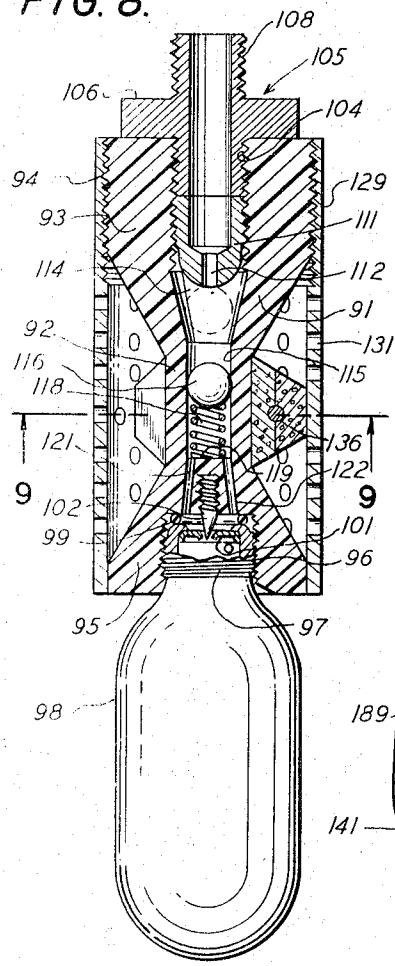


FIG. 9.

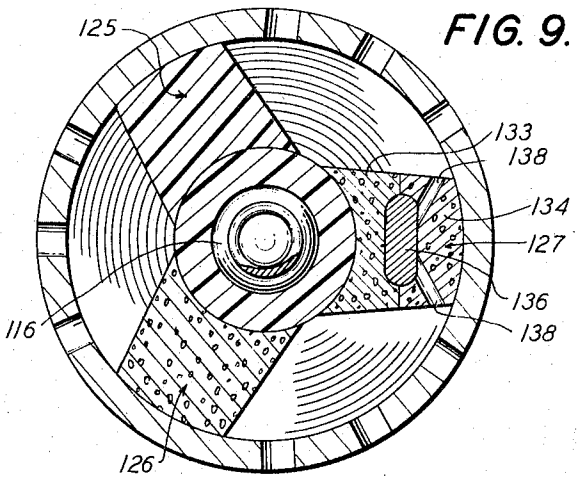


FIG. 11.

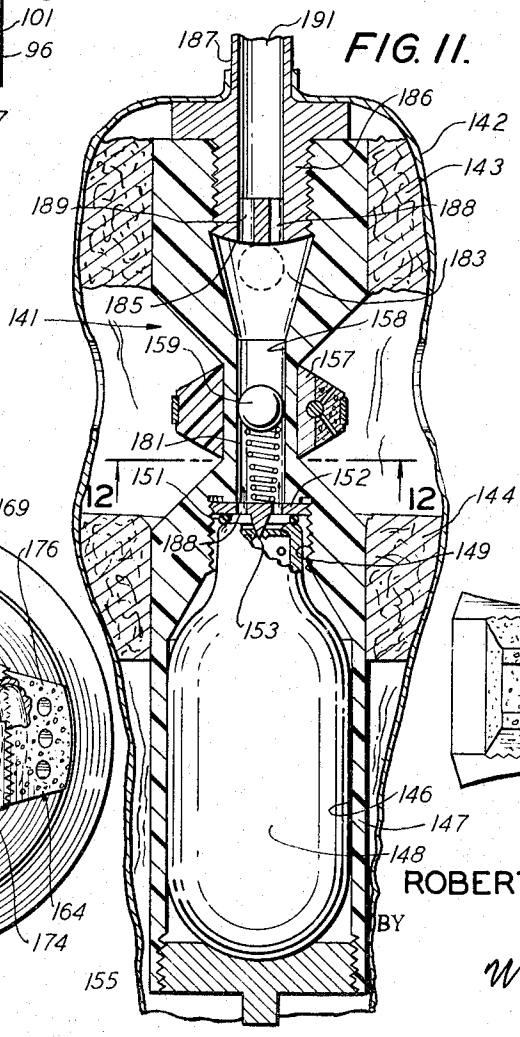


FIG. 12.

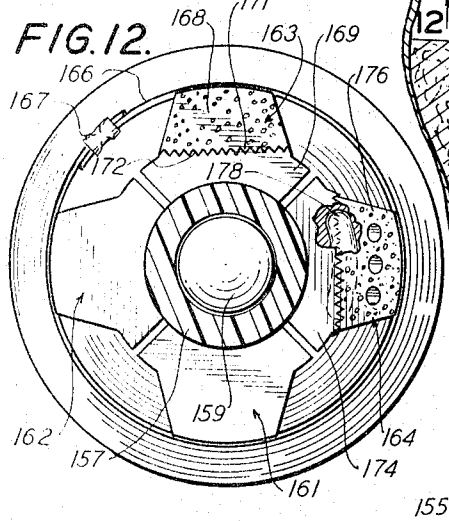
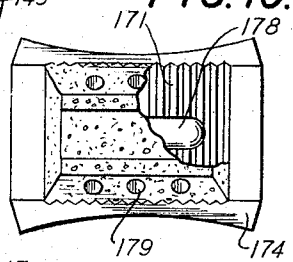


FIG. 10.



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3,308,494

INFLATABLE LIFE PRESERVER

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4 Claims. (Cl. 9—317)

The invention relates to life preservers, and more particularly to inflatable life preservers which inflate automatically when immersed.

Because of bulkiness, the conventional inflatable life preserver is maintained in uninflated condition except when needed. A common conventional life preserver comprises one or more inflatable chambers connected to conventional compressed gas cartridges which normally contain carbon dioxide. A trigger mechanism perforates the gas container so that the compressed gas flows into the inflatable chambers from the cartridge. Operation of the trigger mechanism requires a conscious, deliberate effort on the part of the wearer. Often, as in the case of small children and of accident victims who are unconscious, there is insufficient awareness by the wearer to effectuate inflation of the life jacket.

I have invented life preserver apparatus in which inflation of the support chambers or bladders of the life preserver is effected when the life preserver is immersed. Contact with water triggers a mechanism which releases compressed gas to the life preserver support bladder or bladders. The invention contemplates a life preserver comprising an inflatable support bladder with a gas inlet and a compressed gas container connected to a valve body. The gas container may be a conventional "CO_2 cartridge" commonly used for carbonating drinks or for a propellant in pellet guns. A valve port within the body is associated with a valve adapted to seat in sealing relationship against the port to shut off flow of gas between the container and the gas inlet of the life preserver. Restrictive means on the valve body are adapted to hold the valve in sealing relationship with the valve port. Bias means urge the valve out of sealing contact with the valve port in opposition to the restrictive means. The latter means is water sensitive such that contact with water relaxes the restriction on the valve. In the preferred embodiment a valve body chamber is adapted to receive the valve when the bias means overcomes the relaxed restrictive means and urges the valve out of sealing relationship with the valve port. The chamber conducts compressed gas from the container to the gas inlet to the inflatable bladder.

The restrictive means may be a water-soluble compression segment which is forced into restrictive contact with the valve port such that a valve ball is bound within the port. The compression segment may be held in place by a tension ring or by a restrictive casing forming part of the valve body. In either instance the contact with water dissolves the compression segment and releases the restriction upon the valve ball.

A compression segment may be interposed between a stop and a spring and in this position hold a valve closed against a port. When the segment dissolves, the spring is then free to move the valve away from the port. The stop, segment and spring may be coaxially aligned along a central stem of the valve.

The compression segment may be composed of one of many solids which dissolve readily in water. Preferably a segment contains a central pellet of metallic sodium and the segment is perforated so that water quickly contacts the sodium. The violent disintegration of the sodium exerts pressures against the compression segment which hasten its disintegration and thus makes the valving action extremely quick.

The life preserver of the invention may be economically fabricated from conventional components and materials. The valving mechanism is small in size, and may easily be covered both to prevent its damage and to make it more attractive. A preferred embodiment of the invention includes a water-permeable sheath surrounding the valve body and gas container. The sheath has the outer configuration of an animate figure in miniature. A child's favorite animal, for instance, may thus be associated with the life preserver and make more desirable the continuous wearing of the life preserver when the child is proximate a swimming pool or on a boat.

These and other advantages of the invention are apparent in the following detailed description and drawing in which:

FIG. 1 is a plan view of a life preserver in accordance with the invention;

FIG. 2 is a fragmentary elevational view of the embodiment of FIG. 1 in use by a wearer;

FIG. 3 is a sectional elevation of a preferred embodiment of the invention;

FIG. 4 is a detailed perspective view of a dissolvable segment;

FIG. 5 is a sectional view taken along line 5—5 of FIG. 3;

FIG. 6 is a sectional elevation illustrating an alternate embodiment of the invention;

FIG. 7 is an elevation, partly in section, of a reloading tool;

FIG. 8 is a sectional elevation of a further alternate embodiment of the invention;

FIG. 9 is a transverse sectional view taken along line 9—9 of FIG. 8;

FIG. 10 is a plan view, partly broken away, of a preferred compression segment in accordance with the invention;

FIG. 11 is a fragmentary sectional elevation of another alternate embodiment of the invention; and

FIG. 12 is a transverse section taken along line 12—12 of FIG. 11.

FIGS. 1–5 illustrate a preferred embodiment of the invention. Life preserver apparatus comprising a separable inflatable ring **15** having folded diametrically opposed support bladders **16** and **17** has a distribution duct **18** that terminates in disconnected tab ends **19** and **20**. A gas container and valve assembly **21** is covered by a sheath **23** of water permeable material. Permeability is aided by a plurality of apertures **24** through the sheath. The container and valving assembly is connected to the distributing ring **18** by an inlet connector **25**.

Sheath **23** preferably has the outer configuration of an animate object or figure, such as the bear-like figure shown in FIG. 1, or the rabbit-like figure shown at **23A** in FIG. 2. As previously set forth, the object of the sheath configuration is to make more desirable continuous wearing of the life preserver apparatus. The configuration may be achieved by padding the figure from the inside, with care being taken to leave room for the container and valving assembly.

Tab ends **19** and **20** have pairs of male and female snaps **26**, **27**, respectively, which mesh when overlapped to hold the life preserver in a generally circular configuration. The ring of small diameter may be placed about the neck of a wearer such that the bladder **16** and **17**, when inflated, tends to hold the head of a wearer upright, as shown in FIG. 2. Use of two sets of snap components allows adjustment of ring diameter.

In FIG. 3 the details of the container and valving assembly are apparent. A carbon dioxide container **28** has a large opening **29** at one of its ends. External threads **31** on the container receive a container cap **32** which com-

presses a gasket 33 between the cap and the end of the container for a gasproof seal.

A smaller opening 34 in the opposite end of the gas container is occupied by a valve body 36. The valve body extends exteriorly of the gas container in a hollow threaded shank 37. Interiorly of the container the valve body has a valve head 38, which, in FIG. 3, is seated against a valve port 39. The valve port is defined by a resilient rubber or plastic ring 41 fixed concentrically with respect to opening 34. A compression spring 43 within the ring thrusts against the underside of the valve head 38, biasing it away from valve port 39 and ring 41.

The threaded shank of the valve body receives a coupling member 45 from which a bushing 46 extends to which gas inlet connection 25 is clamped. Connector 45 acts as a conduit between gas inlet 25 of the inflatable life preserver and an elongate chamber 48 within the valve body. The chamber terminates within the gas container in a bypass 49 immediately adjacent valve head 38.

A nut 51 engaged with the threads of shank 37 of the valve body retains a valve restrictive means or compression segment 53 about the shank of the valve body. Washers 54 may be used between the various components on the valve body to space those components.

The preferred configuration of segment 53 is seen in FIG. 4. The segment has a substantially cylindrical central body 56, from which thick ribs 57, 58, 59 radiate. An axial aperture 61 fits over shank 37 of the valve body.

Preferably the restrictive means or compression segment 53 is composed of a water-soluble solid. The shape may be achieved by molding or other conventional means. A prime consideration in selecting the material for the compression segment is its ability to dissolve quickly in water. Time lag can result in prolonged underwater periods for the wearer of the life preserver. Materials which have proved to have sufficient compressive strength, yet which dissolve quickly on contact with water are substances like monocalcium phosphate, acidified sodium bicarbonate or potassium hydrogen tartrate. The ribs and exposed cylindrical surface provide greater absorption area for the compression segment. If the material is cast in porous form, additional absorbing surface is afforded.

When segment 53 dissolves, the valve body is free to move inwardly in the container 28 under the urging of biasing spring 43. Valve head 38 moves away from ring 41, opening port 39 so that a gas transfer may take place from the container through bypass 49 and chamber 48 into gas inlet 25 to inflate the support bladder.

The connection of the bypass to chamber 48 is shown in FIG. 5 wherein the dual inlet aspect of the bypass is clear. The dotted lines 58 show the extent of displacement of the valve head from valve port 39 under the urging of spring 43.

The water-permeable sheath 23 does not interfere with rapid contact of the surface of segment 53 by water into which the life preserver and wearer may be plunged. The sheath may, under normal circumstances, afford some protection to the gas container and valving mechanism during conventional wear.

The gas container may be reloaded and reused after initial use. The connector 45 and locking nut 51 may be quickly unthreaded from valve body shank 37 and a new segment 53 replaced about the valve body. The gas container may be recharged either through the threaded valve shank or by means of the cap 32. If it is recharged by valve shank 37 locking nut 51 must be loosened during charging and then tightened quickly to close the valve.

The embodiment illustrated in FIG. 6 comprises a container and valving assembly 65 in which a valve body 66, preferably of Teflon or nylon, contains a cylindrical valve port 67 in which a valve ball 68 normally lodges. A compressed gas containing chamber 69 may be a part of the valving body as shown, or may be a separate unit connected thereto. The valve body has a ball-receiving cavity 71 which is larger than valve ball 68. A perforated screen 72 defines one end of the cavity. A connector unit 74 having an external thread 75 concentric with an inner passage 76 is secured as by binding wire 77 to the valve body. A restrictive means 78 is bound about the central portion of valve body 66, compressing the cylindrical port 67 against the valve ball 68. If a quarter-inch valve ball is used, the diameter of the cylindrical port should be approximately 0.001" greater than the ball. Nylon or Teflon has been found sufficiently resilient to compress about the ball and hold it in place against the pressure of the compressed gas within chamber 69. Restrictive means 78 may be a band or thong of a fibrous material, such as rawhide, which tends to stretch when wetted. The diameter of the band about the valve body will thus increase, relieving the compressive force against the ball and permitting the gases within the chamber to impel the ball into chamber 71 against the perforated screen. The compressed gas from the container 69 is then free to pass through the screen and through passage 76 into a connector (not shown) threadably engaged with threads 75.

The biasing means of the embodiment of FIG. 3 is a spring. In the embodiment of FIG. 6 the force of the compressed gas is used to bias the valve ball away from sealing configuration with the valve port.

FIG. 7 illustrates a reloading tool which serves to thrust the valving ball back into sealing position within cylindrical port 67. The tool comprises a thrusting rod 81 about which an internally threaded collar 82 is concentrically positioned. A knurled knob 83 serves as a base for the threaded collar and the rod. In use rod 81 is inserted into passage 76 and through a central hole 85 in screen 72. The end of rod 81 engages ball 68 and moves it toward port 67. The internal threads 88 of the collar may then be engaged with threads 75 and the knob 83 turned to force the ball back into position in the port. Once restrictive means 78 dries the nylon or Teflon valve body is again compressed about the valve ball, restricting it in sealed position. Chamber or container 69 may then be recharged with compressed gas.

Like the embodiment of FIG. 6, the alternative embodiment shown in FIGS. 8 and 9 may be covered by a water-permeable sheath having the outer characteristics of an animate figure. In each of FIGS. 6 and 8 the sheath is not shown to simplify the disclosure.

In FIG. 8 a valve body 91 has a reduced diameter central section 92. A first enlarged end 93 has external threads 94. A second enlarged end 95 has internal threads 96. The internal threads receive a threaded neck 97 of a conventional carbon dioxide cartridge or container 98. When screwed into compressive relationship to an O-ring 99, a cap 101 of the CO_2 cartridge is pierced by a point 102 threadably mounted axially in the valve body.

First enlarged end 93 also has internal threads 104. A threaded bushing 105 having a central flange 106 is engaged within the first enlarged end. External threads 108 on the bushing are adapted to receive a connector (not shown) by means of which the gas inlet of a life preserver similar to the preserver shown in FIGS. 1–5 may be connected.

Inwardly of bushing 105 is a valve ball stop member 111. One end of the stop is engaged with internal threads 104. The opposite end of the stop is rounded and has a diametrical slot 112. The rounded end protrudes into a frusto-conical valve body cavity 114 which connects with a cylindrical valve port 115. A valve ball 116 is lodged in sealing relationship within valve port 115. A biasing spring 118 is compressed between the valve ball and an inner transverse wall 119 of the valve body. The spring is urging the valve ball in the direction of contact with ball stop 111. When the ball is in contact with the stop, compressed gas is free to flow in turn through inlet

ports **121**, **122**, conical cavity **114**, slot **112**, the bushing and into the gas inlet of the life preserver.

As positioned in FIG. 8, no gas flow takes place because restricted portion **92** of the valve body is held compressed against valve ball **116** by compression segments **125**, **126** and **127**. These compression segments have generally pyramidal shapes and are urged into compression relationship with shank **92** by a cylindrical sleeve **129**. The sleeve threadably engages first enlarged body portion **93** and covers substantially the entire valve body. A plurality of perforations **131** in the sleeve act as water conduits to conduct water from the exterior of the sleeve into contact with compression segments **125**, **126**, **127**. One or more of the compression segments may be dissolvable in water. Segment **125** is illustrated as being of a plastic material, such as polystyrene. Segment **126** may be a porous segment of a material such as magnesium sulfide or the other quickly soluble materials named heretofore.

Compression segment **127** differs from segment **126** in being divided into a base **133** (which may be of a plastic material or of a soluble material as shown) and a soluble cap **134**. The cap is thrust against base **133** by sleeve **129**. The mating surfaces of each of the cap and the base are hollowed to receive an activating pellet **136**. Preferably the cap has water passages **138** communicating from the exterior of the cap to the pellet. The cap itself may also be cast in porous fashion.

The pellet is preferably of a water-reactive material, such as metallic sodium or potassium or sodium oxide. The violent reaction of any of these materials on contact with water aids the disintegration of the cap and base such that the valving mechanism responds very quickly to the presence of water.

In operation, the water soluble compression segments dissolve and disintegrate upon contact with water, which signals the necessity for inflating the life preserver support bladders. The disintegration of the compression segments on one or two sides of the cylindrical port **115** relieves the compressive loading upon the valve ball. Biasing spring **118** is then able to urge the ball from the valve port, opening a path between the gas container and the bushing **105**, which connects to the gas inlet.

Recharging the container and valving assembly of the embodiment of FIGS. 8 and 9 is simple. The cartridge **98** is easily replaceable. The valve ball **116** may be thrust back into the cylindrical port by a tool such as that illustrated in FIG. 7. The cylindrical sleeve **129** may be disengaged from the body and the compression segments replaced about shank **92** in the orientation shown in FIG. 8. With the replacement of the sleeve to urge the compressive segments against a shank the container and valving mechanism is again ready for attachment to a life preserver.

FIGS. 10, 11 and 12 illustrate a further alternate embodiment of the invention wherein dissolvable segments like that shown in FIG. 10 are combined with a compressed gas container and valving assembly **141**. The assembly is contained within a water-permeable sheath **142**. Pads **143** and **144** intervening between the interior of the sheath and the exterior of the assembly help to shape the sheath into an outer configuration of an animate figure.

Assembly **141** comprises a gas container chamber **146** which is at one end of a valve body **147**. A conventional carbon dioxide cartridge **148** resides within chamber **146**. The chamber tapers at its upper end in FIG. 11 to juncture with an internally threaded bore **149**. The exit end of the cartridge is seated against an O-ring seal **151** which abuts the surface of a puncture plate **152**. The puncture plate has at its center a needle point **153** adapted to pierce the cap of the compressed gas cartridge so that the gas may exit therefrom.

The cartridge is urged into piercing contact with the needle by a cap **155** threadably engaged with the bottom end of the valve body.

The valve body narrows near its middle to a thin cylindrical wall **157**. The inner surface of the wall defines a cylindrical port **158** in which a valve ball **159** normally lodges. Restrictive means such as compression segments **161**, **162**, **163** and **164** bear against the outer wall of thin wall **157**. Compression segments **161** and **162** are preferably of plastic, such as polystyrene. Segments **163** and **164** are preferably of water soluble materials that tend to disintegrate quickly in water.

A restrictive metallic band **166** surrounds the compression segments. The band is drawn tight and its overlapping ends secured by a crimped metal collar **167** which is crimped into notches (not shown) located in the sides of the band ends.

Compression segment **163** may comprise an outer soluble element **168** and an inner base **169**. The inner base may be of polystyrene or other suitable material. For better orientation and gripping, the upper surface of base **169** has a series of serrations **171**. Serrations **171** mesh with like serrations **172** in the bottom of compression segment **168**.

Compression segment **164**, like segment **163**, may have a plastic base. Preferably the base **174** of the compression segment is of a water-soluble material. As can be seen in FIGS. 10 and 12, both the base and the soluble compression cap portion **176** are serrated along their mutually abutting surfaces for better orientation. Also, each of the abutting surfaces is hollowed to receive a pellet **178** of a water-reacting material, such as metallic sodium. Apertures **179** communicate from the exterior of the water-soluble outer cap of the segment to the pellet **178**.

With the segments held in place against thin wall **157** by restrictive band **166**, the thin wall is compressed inwardly against valve ball **159**, holding it in sealing relationship within port **158** against the biasing pressure of a compression spring **181**. When the gas container valving apparatus is in contact with water the soluble compression segments quickly disintegrate, and the pressure against the thin wall **157** is relaxed. Spring **181** is then able to impel valve ball **159** out of sealing relationship with chamber **158** and into an oversize conical chamber **183**. There the ball, under the pressure of the escaping compressed gas from cartridge **148**, is impelled into contact with a curving end **185** of a threaded connector **186**. The connector has an outer stem **187** to which may be attached the gas inlet of a life preserver such as that shown with respect to the embodiment of FIGS. 1–5. The gas path from the cartridge is through the perforations **188** of the piercing disc **152**, cylindrical valve port **158** and conical chamber **183**, and through perforations **188**, **189** of the connector element into the passage **191** of the element.

The embodiments shown and described above are to be regarded as illustrative only. Many other variations within the scope of the invention will occur to those skilled in this particular art. Therefore, the scope of the invention is to be measured by the appended claims rather than by the purely illustrative embodiments described herein.

I claim:

1. A life preserver comprising an inflatable support bladder, a gas inlet on the bladder, a compressed gas container, a valve body adapted to connect to the gas container, a valve port within the body, a valve member adapted to seat in sealing relationship with the port so as to preclude flow between the container and the gas inlet, bias means urging the valve member out of contact with the valve port, peripherally restrictive means adapted to hold the valve member in sealing relationship with the valve port, said restrictive means being water sensitive such that contact with water relaxes the re-

striction on the valve member, and a chamber adapted to receive the valve member when the bias means urges the valve out of sealing relationship with the valve port, said chamber conducting compressed gas from the container to the gas inlet of the inflatable bladder.

2. A life preserver in accordance with claim 1 wherein a water-permeable sheath having the outer appearance of an animate figure encloses the gas container and valve body.

3. A life preserver comprising an inflatable support bladder, a gas inlet on the bladder, a compressed gas container, a valve body volumetrically connecting between the gas container and the gas inlet, a valve port within the body, a ball valve adapted to seat in sealing relationship with the port so as to preclude flow between the container and the gas inlet, spring means within the valve body urging the valve ball out of contact with the valve port, peripherally restrictive means adapted to hold the valve ball in sealing relationship with the valve port, said peripherally restrictive means comprising a peripheral segment soluble in water such that dissolution of the segment relaxes the peripheral restriction on the valve ball, and a chamber within the valve body adapted to receive the valve ball when the spring means urges the valve ball out of sealing relationship with the valve port, said chamber conducting compressed gas from the container to the gas inlet of the inflatable bladder.

4. A water-sensitive compressed gas unit for use with a gas-inflatable life preserver and a compressed gas container and comprising a valve body, means adapted to connect the valve body to the gas container, means adapted to connect the valve body to the life preserver, head-supporting bladder segments on the life preserver, a water-permeable sheath about the valve body, said sheath having the outer appearance of an animate figure, a valve port in the valve body, a valve member adapted to seat in sealing relationship with the port so as to preclude flow between the container and the life preserver, peripherally restrictive means adapted to hold the valve member in sealing relationship with the valve port, said restrictive means being water-sensitive such that contact with water relaxes the restriction on the valve member, bias means urging the valve member from sealing contact with the valve port when the restricting means is relaxed, and means adapted to pass compressed gas about the valve member when the valve member is displaced from the valve port.

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