July 25, 1961 R. SWITLIK 2,993,217

LIFE PRESERVING DEVICES

Filed July 18, 1957 2 Sheets-Sheet 1

Fig. 1.

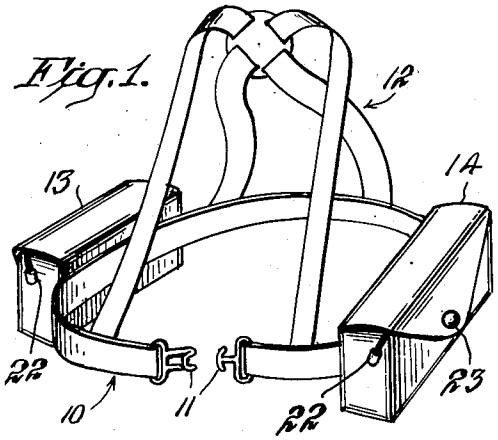


Fig. 3.

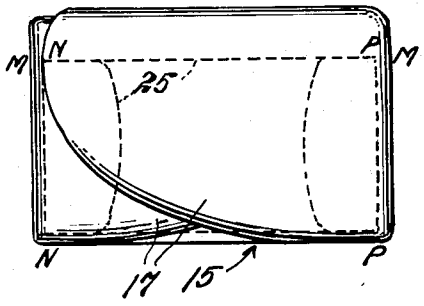


Fig. 2.

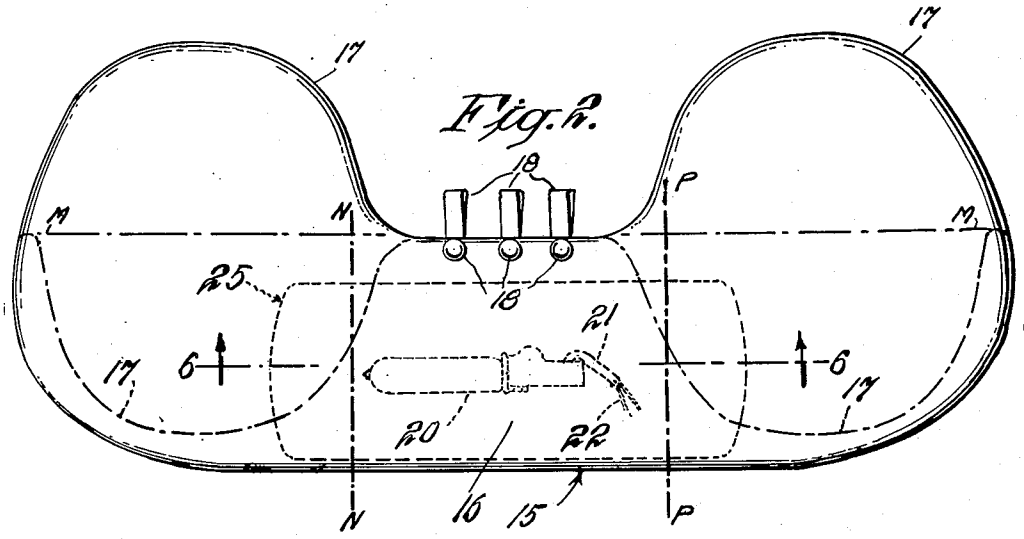


Fig. 5.

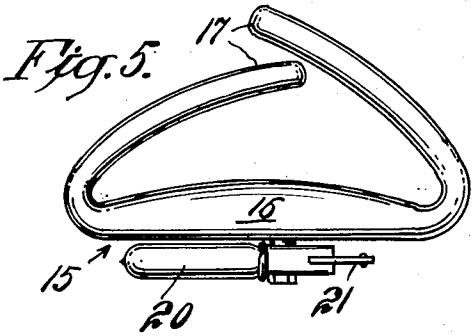
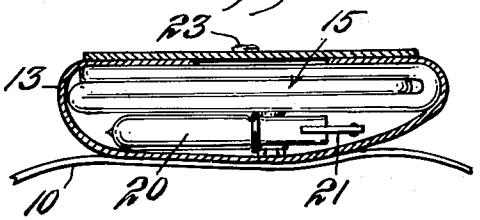


Fig. 4.



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Fig. 6.

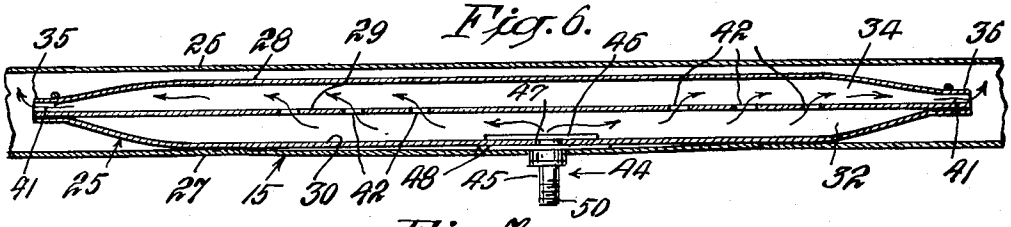


Fig. 7.

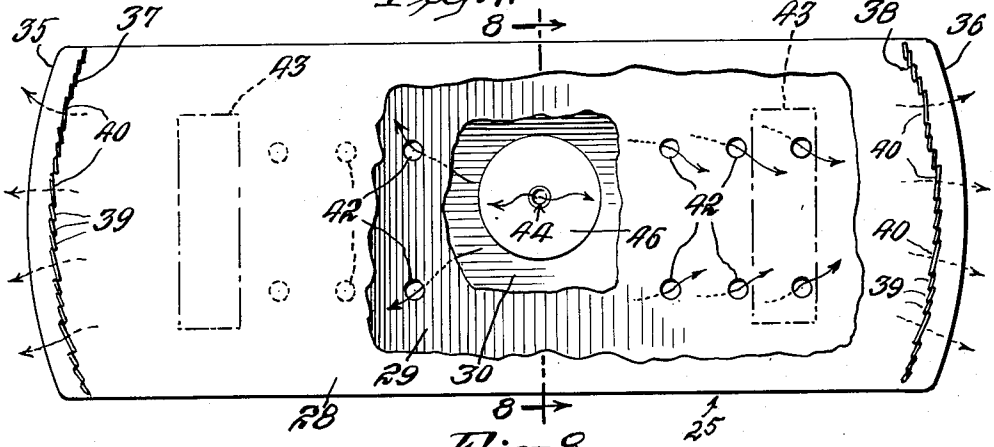
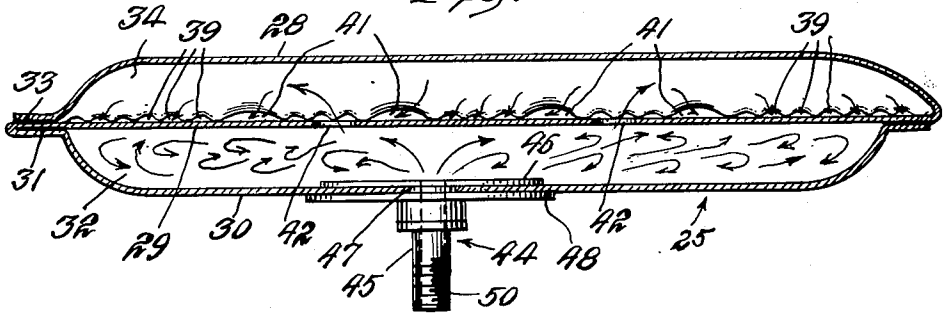


Fig. 8.



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2,993,217

Patented July 25, 1961

2,993,217

LIFE PRESERVING DEVICES

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Filed July 18, 1957, Ser. No. 672,700
9 Claims. (Cl. 9—316)

The present invention relates to life preserving devices such as life belts, life vests, floats, rafts and the like and more particularly to devices of the type having cells adapted to be inflated by a gas.

In life preservers of this type the cells are usually made of a thin, flexible, coated fabric such as nylon impregnated with natural or synthetic rubber or other similar plastic. The cell or cells are then folded into a compact mass and inserted into pockets of a belt or vest adapted to be attached to the body. The gas to inflate the cells is stored at high pressure in a small container either in the form of a gas or as condensed liquid. When such gas or liquid expands from the high pressure in the container to a low pressure in the cell, its temperature is reduced to a degree corresponding to the difference in pressure. Liquid carbon dioxide, commonly used for this purpose, boils at —109° F. at atmospheric pressure. Due to the relatively small quantities of gas required to inflate a cell, the gas is quickly superheated after leaving the container by the transfer of heat from the fabric of the cell which it contacts.

It has been discovered that when the coated fabric material forming the walls of the cell is chilled below a certain temperature it becomes brittle and is apt to crack when flexed as it unfolds. Furthermore, it has been discovered that when the gas expands from the pressure container into the cell the expansion is many times confined to localized areas due to the folding of the fabric. As a result, the gas impinges the fabric at one or a few localized areas over a substantial period of time at the extremely low temperature of the expanding gas and chills the fabric material at those localized areas below the critical temperature at which it is apt to crack. Such cracks in the expanded cell permits the gas to leak therefrom.

One of the objects of the present invention is to provide a diffuser in the inflatable cell for more uniformly distributing the gas throughout the cell when it is released from the container.

Another object is to provide a diffusing baffle for unfolding the material of the cell before the gas is released therein.

Another object is to provide a diffusing baffle in the cell against which the gas initially impinges before it enters the body of the cell so that any cracking will occur in the diffusing baffle instead of in the material of the surrounding cell.

Still another object is to provide a cell of the type indicated which is of simple, light weight and compact construction and one which is reliable in operation and adapted for economical manufacture.

These and other objects will become more apparent from the following description and drawings in which like reference characters denote like parts throughout the several views. It is to be expressly understood, however, that the drawings are for the purpose of illustration only and are not a definition of the limits of the invention, reference being had for this purpose to the appended claims.

In the drawings—

FIGURE 1 is a perspective view of a life belt having inflatable cells incorporating the present invention;

FIGURE 2 is a plan view of one of the cells and showing the location of the diffusing baffle therein and the manner in which the flexible material of the cell is first folded;

FIGURE 3 is a view similar to FIGURE 2 showing the cell folded into a compact mass;

FIGURE 4 is a sectional view showing the folded cell in a pocket on the belt;

FIGURE 5 is an end view of the folded cell illustrated in FIGURE 3 and showing the manner in which the cell is initially unfolded;

FIGURE 6 is a sectional view taken on the line 6—6 of FIGURE 2 to show the separate chambers in the diffusing baffle in the cell and the path of flow of the gas through the baffle from the pressure container to the cell;

FIGURE 7 is a plan view of the diffuser baffle partly in section showing the separate chambers in the baffle and the stitching at the ends to provide a plurality of small outlet openings; and

FIGURE 8 is a transverse sectional view taken on the line 8—8 of FIGURE 7 to show the separate chambers of the diffuser baffle and the plurality of outlet openings between the stitches.

The present invention is shown applied to a life belt but it will be understood that it may be applied to any type of life preserving device having an inflatable cell. The illustrated embodiment shown in FIGURE 1 comprises a belt **10** adapted to be wrapped around the waist of the wearer and attached by a buckle **11** at the ends. A harness **12** is attached to the front and rear of the belt which is adapted to be applied over the shoulders of the wearer. Pockets **13** and **14** are provided at each side of the belt for containing an inflatable cell **15**. As shown in FIGURE 2, each cell **15** is of generally rectangular shape having a narrow central portion **16** and outwardly projecting lobes **17** at each side of the central portion. Thus, the narrow central portion **16** is adapted to underlie the arms of the wearer and the lobes **17** at each end overlie the front and back of the shoulders of the wearer to hold it in place under the arms. The cells **15** are attached to the pockets **13** and through the pockets to the belt **10** by means of fasteners **18** as shown in FIGURE 2.

The cells **15** are composed of a non-porous flexible material to form an airtight compartment. Preferably, the cells **15** are composed of a coated fabric such as nylon impregnated with a suitable material such as natural or synthetic rubber. Each cell **15** is sealed by cementing two layers of the coated fabric around their marginal edge. As shown in FIGS. 2 and 5 a cylinder **20** containing an expansible liquid, such as carbon dioxide, is connected to the interior of the cell. An actuating lever **21** is mounted on the cylinder **20** for breaking a seal in the cylinder to permit the carbon dioxide contained therein to flow into the interior of the cell **15**. A lanyard **22** is attached to the lever **21** for manual actuation.

The deflated cell **15** with the cylinder **20** attached thereto is folded and packed in a pocket **13** or **14**. To this end, the lobes **17** of the cell **15** are first folded on the dot-and-dash lines MM to the position indicated in FIGURE 2. The partially folded cell **15** is then folded on the lines NN and PP of FIGURE 2 to form the packet illustrated in FIGURE 3. The folded packet of FIGURE 3 is then inserted into the pocket **13** or **14** as illustrated in FIGURE 4. Each of the pockets **13** and **14** are formed by sides which are held in overlapping relationship by a detachable snap fastener **23** adapted to automatically release to open the pocket when the cell is expanded.

In accordance with the present invention a diffuser baffle **25** is provided in each cell **15**. As shown in FIGURE 2, the diffuser baffle **25** is of generally rectangular

shape with curved ends and of less width than the relatively narrow central portion 16 and a length to extend beyond the fold lines NN and PP. As shown in FIGURE 6, the diffuser baffle 25 is enclosed within the sides 26 and 27 of the cell envelope 15. Baffle 25 comprises three superimposed sheets or layers 28, 29 and 30 of a thin flexible material such as a rubberized fabric. Preferably a thin nylon fabric is used having a rubber coating on each side.

Referring to Figure 8, the three layers 28, 29 and 30 are formed by folding a single sheet of the coated fabric back on itself. The overlapping edge portions of the folds or layers 29 and 30 are cemented around the entire periphery of the baffle by a rubber cement as indicated at 31 to form a chamber 32. The layers 28 and 29 are also cemented at the overlapping free edge as indicated at 33 to form a superimposed chamber 34 open at its opposite ends. The open ends 35 and 36 are, in turn, partially closed by stitching as illustrated at 37 and 38 which form a plurality of outlet port openings 39 between each stitch. As shown in FIG. 7, the stitching 37 and 38 may have interrupted portions to provide long stitches 40 at spaced intervals to provide larger port openings 41.

The intermediate layer 29 between the chambers 32 and 34 has a plurality of port openings 42 therein. In the illustrated embodiment as shown in FIGURES 6 to 8, three pairs of such openings 42 are provided in the intermediate layer or wall 29 through which gas must flow from the chamber 32 to the chamber 34 and then from the chamber 32 through the port openings 39 and 41 at the ends of the diffuser baffle. The diffuser baffle 25 is attached to one wall of the cell envelope by means of cement applied at the areas 43 as illustrated in FIGURE 7.

As shown in FIGURES 6 and 8 the diffuser baffle 25 has a fitting 44 with a nipple 45 extending to the wall 30. To this end, the fitting 44 has a disc 46 at its inner end overlying the inside surface of the wall 30 of the diffuser baffle with the nipple 45 projecting through a hole 47. A similar disc 48 overlies the outside of the wall 30 of the diffuser baffle 25 and over the inside of the wall 27 of the cell envelope. The wall 27 of the cell envelope and the wall 30 of the diffuser baffle 25 are then joined to the discs 46 and 48 with cement to form an hermetic seal. The outwardly projecting end of the nipple 45 is threaded at 50 to receive the pressure container 20 in the form of a cylinder which is screwed thereon. One form of the invention having now been described in detail the mode of operation is next explained.

The life belt 10 with a folded cell 15 contained in each pocket 13 and 14 is applied around the waist of the wearer. In applying the belt 10, the wearer inserts his arms through the harness 12 and fastens the buckle 11 at the front of the waist. The pockets 13 and 14 containing the cells 15 then underlie the arms of the wearer.

When the cells 15 are to be inflated, the lanyards 22 are pulled to release the liquid carbon dioxide in each of the cylindrical containers 20. Upon release and a reduction in pressure, the liquid carbon dioxide immediately evaporated at a low temperature, corresponding to the low pressure in the cell, at approximately —110° F. In evaporating the liquid carbon dioxide absorbs the latent heat of vaporization from the material which it contacts. Furthermore, the release of the high pressure gas causes it to flow at high velocity.

As the gas flows from the cylindrical container 20 it first enters the chamber 32 of the diffuser baffle 25 at high velocity and directly impinges the intermediate wall 29. The gas then flows in all directions in the chamber 32 with considerable turbulence as indicated by the arrows in the chamber in FIGURE 8. The port openings 42 in the wall 29 between the chambers 32 and 34 restrict the flow of the gas from one chamber to the other which causes the folded over ends of the diffuser baffle 25 to unfold and thereby unfold the overlapping portions of the cell envelope in the manner as shown in FIGURE 5. As soon as the diffuser baffle 25 unfolds the gas flows from the upper chamber 34 through the port openings 39 and 41 between the stitches 37, 38 and 40 at the opposite ends of the chamber. Thus, the flow of gas from the diffuser baffle 25 into the cell 15 is produced through a large number of small port openings to diffuse the gas over a large area and prevent localized impingement of the relatively cold gas with any particular area of the cell envelope 15.

Furthermore, the relatively cold gas leaving the cylinder 20 is heated by its contact with the walls 28, 29 and 30 of the diffuser baffle 25 before it enters the cell 15 so that its temperature is raised above the minimum at which damage is caused to the impermeable coating on the cell envelope. In other words, the cold gas leaving the cylindrical container 20 at substantially —110° F. immediately contacts the relatively warm walls 28, 29 and 30 of the diffuser baffle 25 before entering the cell 15 which heats the gas to some temperature such as —50° F. before it leaves the diffuser baffle. Also, the diffuser baffle 25 reduces the velocity of the gas and discharges it over a large area so that large quantities of gas will not impinge localized spots of the envelope of the cell at a high velocity. Thus, cracking of the material of the cell envelope is avoided. Furthermore, any cracking of the plastic coated fabric, due to low temperature gas, will occur in the walls of the diffuser baffle 25 which is entirely enclosed and hermetically sealed in the envelope of the cell 15. Thus, cracking of the walls of the diffuser baffle 25 will have no effect on the hermetic seal of the cell envelope.

While a single embodiment of the invention is herein illustrated and described, it will be understood that changes may be made in the construction and arrangement of elements without departing from the spirit or scope of the invention. Therefore, without limitations in this respect the invention is defined by the following claims.

I claim:

1. In a life preserver, an inflatable cell having overlying walls of a thin, flexible and impervious material adapted to be folded into a compact mass, a container for storing gas at high pressure and connected to the cell, a control element for releasing the gas in the container which flows to and inflates the cell, a diffusing baffle in said cell connected to receive the gas from the container, and said diffusing baffle being composed of an impervious material and forming a chamber between the overlying walls of the cell and having a plurality of relatively small outlet openings at its edges to diffuse the gas over a relatively large area as it enters the cell.

2. In a life preserver, an inflatable cell having overlying walls of a thin, flexible and impervious material adapted to be folded into a compact mass, a diffusing baffle sleeve of a thin flexible material forming a chamber within said cell between the overlying walls and adapted to be folded with said cell, said diffusing baffle sleeve having peripheral openings at its ends, a container for storing gas at high pressure at the exterior of the cell and having a nipple connected to the interior of said diffusing baffle sleeve, a control element for releasing gas from the container at high pressure which flows to the chamber of the diffusing baffle and then through the peripheral openings in the chamber to the cell, and said gas first inflating the chamber of the diffusing baffle to unfold the walls of the cell before the gas is delivered thereto.

3. In a life preserving device, an inflatable cell of a thin flexible material, a container at the exterior of said cell and having a nipple connected to the interior of said cell, said container storing a substance at high pressure having a gaseous phase at atmospheric pressure and temperature, and a baffle in said cell and located at the outlet end of said nipple against which the high pressure gas from said container initially impinges before contacting the ma-

terial of said cell, said baffle having gas-impervious walls positioned between the outlet end of the nipple and walls of the cell and forming a passageway for the gas opening into the cell at a point remote from the nipple, and said baffle comprising a plurality of walls of a flexible impervious material so joined as to provide a plurality of adjacent chambers, and port openings so arranged in said chambers as to cause the gas to successively change its direction of movement as it flows from the container through successive chambers and into the cell.

4. In a life preserving device, an inflatable cell of a thin flexible material, a container at the exterior of said cell and having a nipple connected to the interior of said cell, said container storing a substance at high pressure having a gaseous phase at atmospheric pressure and temperature, and a baffle in said cell and located at the outlet end of said nipple against which the high pressure gas from said container initially impinges before contacting the material of said cell, said baffle having gas-impervious walls positioned between the outlet end of the nipple and walls of the cell and forming a passageway for the gas opening into the cell at a point remote from the nipple, and said baffle comprising a plurality of super-imposed walls of a flexible impervious material so joined at their periphery as to provide a plurality of adjacent chambers through which the gas must flow from one chamber to another, and a plurality of outlet openings at the periphery of the last chamber.

5. In a life preserving device, an inflatable cell of a thin flexible material, a container at the exterior of said cell and having a nipple connected to the interior of said cell, said container storing a substance at high pressure having a gaseous phase at atmospheric pressure and temperature, and a baffle in said cell and located at the outlet end of said nipple against which the high pressure gas from said container initially impinges before contacting the material of said cell, said baffle having-impervious walls positioned between the outlet end of the nipple

and walls of the cell and forming a passageway for the gas opening into the cell at a point remote from the nipple, and said baffle comprising a plurality of super-imposed walls of a flexible impervious material, two of said walls being joined around their entire periphery to form a chamber therebetween, another of said superimposed walls being joined to an adjacent one of said last mentioned walls at two opposite edges, the other two opposite edges of said last named wall being joined to the adjacent wall to form a second chamber with a plurality of outlet openings therebetween, and the intermediate wall between the chambers having a plurality of restrictive openings therein whereby gas is caused to flow from the first mentioned chamber to the second mentioned chamber and then through the outlet openings in successively changing directions in its path of flow.

6. A life preserving device in accordance with claim 5 in which the last named wall is joined to the adjacent intermediate wall by stitching to provide a plurality of outlet openings between stitches.

7. A life preserving device in accordance with claim 6 in which the last named wall is joined to the adjacent intermediate wall by alternate series of short and long stitches.

8. A life preserving device in accordance with claim 5 in which the plurality of walls are formed by a single sheet of material reversely folded with the free edges joined to the folds.

9. A life preserving device in accordance with claim 8 in which the adjacent walls are joined at their periphery by cement.

References Cited in the file of this patent

UNITED STATES PATENTS

2,118,165	Christopher et al.	May 24, 1938
2,580,639	Baker	Jan. 1, 1952
2,675,143	Seemann	Apr. 13, 1954
2,710,978	Alderfer	June 21, 1955

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,993,217 July 25, 1961

Richard Switlik

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 5, lines 37 and 38, for "having-impervious" read -- having gas-impervious --.

Signed and sealed this 23rd day of January 1962.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents