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(12) # EUROPEAN PATENT APPLICATION

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(71) Applicant: **BTR plc**
Silvertown House Vincent Square
London SW1P 2PL(GB)

(72) Inventor: **Hawkins, James Mitchell**
19 Harebell Close
Huntington, Chester, CH3 6RT(GB)

(74) Representative: **Funge, Harry et al,**
WILSON, GUNN & ELLIS 41-51 Royal Exchange Cross Street
Manchester M2 7BD(GB)

(54) **Inflatable structure, in particular a lifeboat.**

(57) The invention proposes a liferaft which includes at least one inflatable structure formed by a bladder (14) of an air-impermeable material and an envelope (13) within which the bladder is disposed. The material of the envelope is of woven form, and adjacent warp or weft elements thereof are movable into supporting relationship with corresponding adjacent such elements.

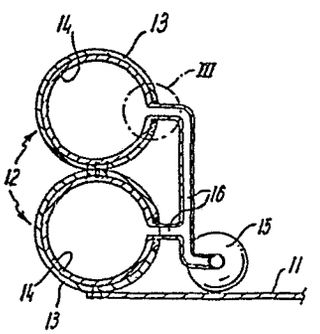


FIG. 2

EP 0 199 514 A1

INFLATABLE EXPANSIBLE STRUCTURE

This invention relates to an inflatable expansible structure, that is a structure made from flexible sheet material and including at least one gas-tight chamber, the structure being initially packed in a deflated condition to form a dense compact package for storage and upon need, is deployed and inflated to form a buoyant functional article such as: a liferaft; an escape chute; a raft; a jetty; an inflatable vessel; and inflatable sail; or a boom or marker.

Heretofore, inflatable expansible structures have been made from composite flexible material consisting of rubber or plastics material reinforced with textile material. Typically, a sheet of woven or non-woven textile material has been impregnated with a fluid plastics or rubber material which is caused to fill the interstices of the fabric and create a flexible, gas-impermeable sheet. It has also been known to produce items from sheets of unreinforced rubber or plastics materials. Specifically cheap air beds and light use articles have been so made. However, the resistance to tearing offerred by unreinforced plastics or rubber sheeting is very low and such articles are very susceptible to damage. Accordingly their use is restricted to situations where failure is unimportant.

In a composite air-impermeable material the reinforcement is often an intrinsically strong textile material; such as canvas, having a very high resistance to tearing and cutting damage. We have found, however, that there is a marked difference between the tear resistance of a reinforcing fabric before and after impregnation with rubber or plastics material. Surprisingly, the resistance of an impregnated composite fabric can often only amount to from 25% to 50% of the tear resistance of the basic fabric.

In a specific example, the tensile strength of the warp of a 41/4 oz fabric of high tenacity nylon, the fabric being unproofed except for a light anti-fray coating, was reduced by 20% on proofing, the tensile strength of the weft being reduced by 22%. The corresponding figures for tear strength were approximately 36% for the warp and 40% for the weft.

We do not know with certainty why this is the case, but research has suggested that when an edge moves into contact with the fabric in a tear-forming way, it first contacts one thread of the fabric and, because the thread has a degree of freedom in the fabric, moves that first thread aside into contact with an adjacent thread. The two threads are then moved together until a small "bundle" of threads are resisting edge movement. Only when the resistance of such a bundle has reached a sufficiently high value is the edge forced to cut to continue its movement. It is now compelled to cut the bundle of threads together

and a quite high force is required, resulting in a high tear strength. It must be appreciated that the degree of movement of the threads in a closely formed fabric will be small, and that the edge will not make any appreciable penetration through the fabric by pushing the threads aside.

Conversely, in a composite material, wherein the fabric interstices are filled with rubber or plastics compound, the individual threads are held in a spaced-apart condition and cannot form such a "bundle". When an edge contacts the composite material it meets a single thread and tensions it to a cutting level individually as it cannot move sideways. Thus the edge cuts the threads successively and individually which clearly requires much less force than is needed to cut a bundle of threads formed as a "bow wave" in advance of the edge.

The consequences of the lowered tear-strength are that an inflatable structure made from composite material is of lower tear-resistance than would be assumed from consideration of the tear strength of the basic fabric. If a particular tear strength is specified for a composite material, a basic fabric of considerably higher basic tear strength must be chosen, with a consequent cost penalty.

It is an object of the present invention therefore, to provide an inflatable expansible structure wherein the aforesaid disadvantage of a composite air-impermeable material is reduced or eliminated.

Accordingly the invention provides an inflatable expansible structure having at least one chamber comprising a bladder of air-impermeable material enclosed within an envelope of textile material.

The bladder can be formed or moulded from unreinforced flexible rubber and/or plastics sheet material. A degree of reinforcement can be incorporated in the bladder to improve its strength during storing and handling, but is not essential. If the bladder is formed from sheet material by cutting, forming and glueing, the adhesive used can be relatively weak, as it needs only to create an airtight joint with only small mechanical strength. Constraint against excessive expansion under the influence of inflation gas is provided by the surrounding envelope and need not be incorporated in the bladder.

Because the envelope is not itself gas-tight, it can be formed from sheet material and secured in shape by sewing or by adhesive. Adhesive must be used with composite material, because sewing produces perforations which need to be subsequently sealed by coating or taping at some expense. However, sewing is a preferred method of uniting textile material as it can produce a very strong joint simply and easily without the use of chemicals and solvents and without the need for a dwell after adhesion to allow setting or curing. Thus the dual nature of the

new structure does necessitate two forming and joining operations, but each is easier in itself, thus there is not a doubling of the work and expenditure involved.

The invention will be described further, by way of example, with reference to the accompanying drawings, wherein:-

Fig. 1 is a perspective view of a liferaft conforming to the invention;

Fig. 2 is a fragmentary cross-sectional view on line II-II of Fig. 1; and

Fig. 3 is a further enlarged fragmentary cross-sectional view of the part ringed III in Fig. 2.

A preferred inflatable expansible structure conforming to the invention is a liferaft 10 of generally conventional overall form comprising a floor 11 of fluid-impermeable sheet material and a pair of superposed annular buoyancy chambers 12. Each chamber 12 is of dual construction having an annular outer envelope 13 of a strong woven textile material such, as for example, cotton duck or canvas, which is unproofed, except for a light anti-fray coating, and which retains the whole or substantially the whole of its strength and flexibility. The envelopes 13 are formed by cutting and sewing together one or more sheets of fabric. Sewing provides a mechanically very strong bond at minimal cost, rapidly and with little complication. The two annular-envelopes 13 can be sewn together and to the floor 11 to form a mechanically strong structure.

Within each envelope 13 is an annular bladder 14 moulded, for example, from polyurethane or other flexible rubber or plastics material without (or with minimal) reinforcement. If made by cutting, forming and glueing sheet material, the adhesive can be a cheaper sealing adhesive rather than a mechanically strong adhesive.

The bladders 14 are each connected to a gas source such as a cylinder 15 by conventional pipes 16. Non-return valves (not shown) can be incorporated to maintain the chambers separate, so that failure of one cannot allow deflation of the other.

In a typical construction, the bladder comprises a 0.3mm unsupported liner material, whilst the envelope is a 4 1/4oz. fabric woven from high tenacity nylon.

Fig. 3 illustrates an additional advantage of the dual construction. It is well known that the juntion between an inflation tube and the body of an inflatable item is a weak point at which failure often occurs. In an inflatable made from composite material such junction must be both mechanically strong and completely gas impermeable. In the present dual construction these two properties are separated. Strength and protection can be afforded by reinforcing the material of the envelope 14 by an annular patch 17. sewn and/or adhered to the envelope 14 without attention being paid to sealing. The moulding-in or adhesion

of a flanged pipe-to-body junction can be effected with reference only so the need for gas impermeability, mechanical strength and protection being essentially disregarded as such properties are primarily provided by the envelope.

The structure of the invention has resistance to damage by tearing and impact which is concomitant with the tear resistance of the envelope material and a much more rugged and robust structure is provided than using a composite material of comparable basic strength.

Of course, the dual, bladder/envelope construction has been previously applied to such items as gameballs (a rubber bladder within a leather sheath) and a vehicle tyre structure (inner tube within a reinforced casing). However, in neither of these cases was the envelope solely of a textile material whose tear strength determined the ruggedness of the structure. Further, neither of these structures was an expansible structure, normally collapsed in a dense, compact package for storage and transport, and subsequently inflated for use from a gas source.

The invention can be applied to escape chutes, buoys, jetties, boats and similar inflatable expansible structures.

CLAIMS

1. An inflatable expansible structure including a chamber comprising a bladder (14) of an air-impermeable material enclosed within an envelope (13) of textile material.

2. An inflatable expansible structure as claimed in claim 1, wherein the envelope (13) comprises a woven textile material.

3. An inflatable expansible structure as claimed in claim 1 or 2, wherein the envelope (13) comprises a textile material having a protective coating applied thereto of a form and in an amount not materially to reduce the tear strength thereof.

4. An inflatable expansible structure as claimed in claim 3, wherein the protective coating comprises a light anti-fray coating.

5. An inflatable expansible structure as claimed in any one of the preceding claims, wherein the envelope (13) is secured in shape by sewing.

6. An inflatable expansible structure as claimed in any one of the preceding claims, wherein the bladder (14) includes light reinforcement.

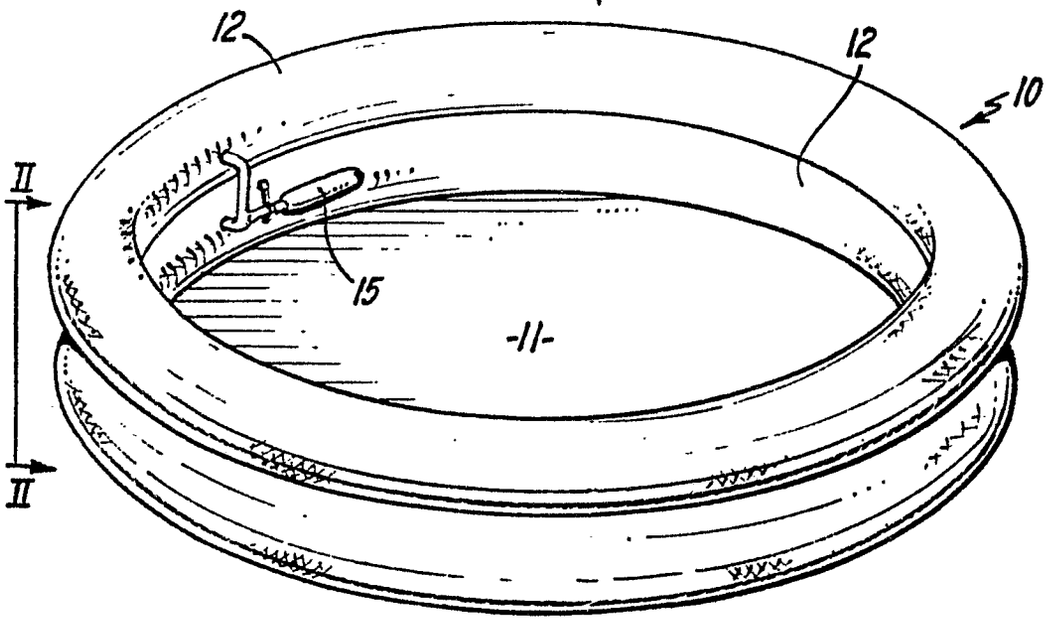
7. An inflatable expansible structure as claimed in any one of the preceding claims, wherein the envelope (13) includes an aperture therein in register with and to provide passage for an inflation tube (16) extending from the bladder (14).

8. An inflatable expansible structure as claimed in claim 7, further including reinforcement of the

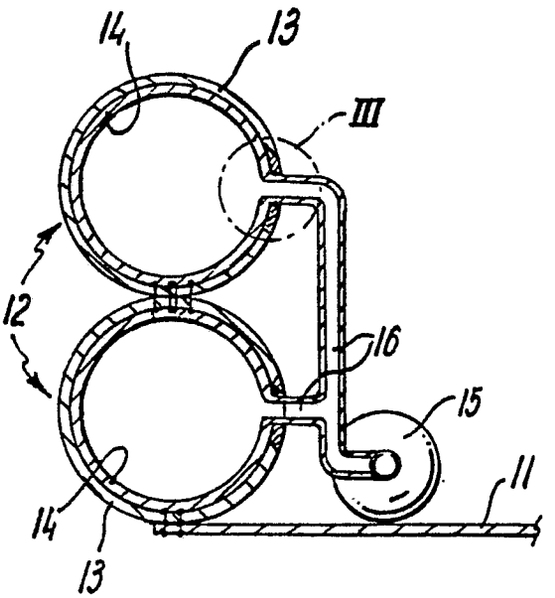
envelope about the periphery of the aperture therein.

9. An inflatable expansible structure as claimed in claim 8, wherein the reinforcement comprises an annular patch (17) applied to the envelope (13) in register with the aperture therein.

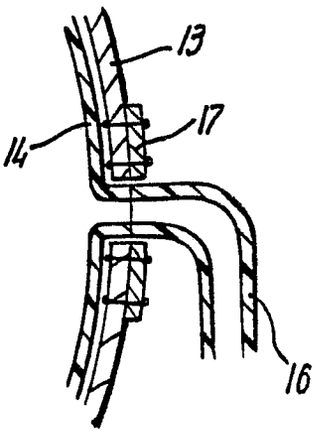
10. A liferaft comprising an inflatable expansible structure as claimed in any one of the preceding claims.



ФИГ. 1



ФИГ. 2



ФИГ. 3

0199514

Application number

EP 86 30 2728

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EUROPEAN SEARCH REPORT

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	US-A-3 871 042 (FARMER) * Whole document *	1-3,5, 6,10	B 63 B 7/08
X	US-A-2 876 467 (LUND) * Whole document *	1	
X	GB-A- 238 417 (SCHEIBERT) * Page 1, lines 70-78; figure 3 *	1-10	
X	BE-A- 569 521 (KLEPPER-WERKE) * Whole document *	1	
A	GB-A- 895 253 (JABLONSKY)		
A	GB-A-1 313 850 (PANTER et al.)		TECHNICAL FIELDS SEARCHED (Int Cl.4) B 63 B B 63 C A 62 B
A	GB-A- 328 524 (WINKLER)		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	26-06-1986	BENZE W.E.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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