Nov. 22, 1955

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COMPARTMENTED INFLATABLE ARTICLES AND THE LIKE AND METHOD FOR MAKING THE SAME

Filed March 6, 1953

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This invention relates to improvements in compartmented inflatable articles and the like. More particularly it relates to the air transfer means connecting adjacent compartments of air mattresses, pillows, and similar articles. The invention also relates to a method for making compartmented air cushions and the like and for making air transfer passages therefor.

This invention solves major problems which have arisen in such compartmented inflatable articles as air mattresses and pillows. Recently, a very popular type of air mattress has been made from two sheets of elastic thermoplastic material, such as polyvinyl chloride, and the compartments have been made by fusing linear portions of the sheets together. These plastic air cushions have proven very satisfactory, are lighter in weight than cushions made from rubberized cloth, and are less expensive to manufacture. Difficulties have arisen, however, in connection with the air passages that join adjacent compartments and that transfer air between them when the mattress is being inflated or deflated and when the user shifts his position on an inflated mattress. The weak spot in such a mattress is at the end of the fused seam adjacent each air transfer passage. The pull applied on the end of the fused seam tears the plastic sheets so they leak. Thousands of air mattresses have been returned to the manufacturers because of leakage resulting from this problem. Even when great care was taken by the manufacturer and mattresses were tested out beforehand and were checked out as satisfactory, still the stresses on the end of the seams in the area of the transfer passages continued to cause ruptures that ruined the entire mattress.

The present invention has solved this problem by providing a novel type of air passage between sections. As a result, uniformly satisfactory air mattresses can now be produced from very thin lightweight plastic sheet material. I take advantage of the fact that the side pull on a bonded seam will resist tearing, whereas the end pull on such a seam will tear.

The structure which has solved the problem includes, in addition to the pair of plastic sheets and the fused compartment wall with an opening therethrough, a semi-rigid plastic tube placed crosswise in the opening and preferably an additional lightweight plastic tube interposed between and secured to said semi-rigid tube and said plastic sheets. The invention also includes a novel method for manufacturing the product of this invention.

Other objects and advantages of the invention will appear from the following detailed description presented in accordance with U.S. Revised Statutes, Section 4888. It is not intended that the description of details of structure should limit the invention, because it is obvious that changes may be made in details without departing from the scope of the invention as defined in the claims.

In the drawings:

Fig. 1 is a reduced plan view of an air mattress embodying the principles of the present invention.

Fig. 2 is an enlarged fragmentary plan view of the mattress of Fig. 1 taken in the region of one of the air transfer passages.

Fig. 3 is a view in perspective of a double layer of plastic with no air passage at all, a thin separating strip 45 is inserted inside the tube 43. An
example of material suitable for the strip 45 is silicone-coated glass fiber cloth about 0.004 inch thick. It will not bond to the walls of tube 43 and is later removed.

The prepared sheets 11 and 12 are now ready to be run through a seaming machine (not shown) where they are pressed together and subjected to a temperature which causes them to fuse. The seam 31 actually carries right over the portion of the material where the air passage is to be, so that there is no interruption of the seam and the hollow tube 43 is bonded to the sheets 11 and 12.

The operator has not yet closed the mattress edge and end seams 14, 15, 16 and 17, so he has easy access to the longitudinal seams in the area where the air passages are to be.

Next each separator strip 45 is removed from each tube 43 and a substantially round semi-rigid short plastic tube section 46 is forced inside the thin plastic tube 43. The tube 46 may be made of a vinyl plastic or some similar material, and preferably it is cemented or otherwise bonded to the tube or envelope 43, thereby completing the air transfer device. The tubes 43 plus the continuous longitudinal seams in the sheets 11 and 12 provide the strength needed, but I prefer a construction employing the tubes 46 because they will hold open the ends of the tube 43. If not held open by some spacer means, the ends of the tube 43 tend to act as a valve sealing against the passage of air. As shown in Figs. 3 and 6, the tube or envelope 43 is larger than the tube 46, so that the tubes 43, 46 are preferably cemented together only along a portion 52, 53 of their upper and lower surfaces to hold the tube 46 in place.

As shown in Fig. 6, when the air pressure rises in the mattress compartments, the expansive force at 51 will be resisted by the continuous wall 45a thereby protecting the seam between the sheets 11 and 12. Also at 45b the same protections will be provided by the tube seam 44. What my invention has done is to leave no place in the bonded mattress seams where an end of a seam is exposed to a separative force but instead the strain is all taken on the edges of a shear.

To those skilled in the art to which this invention relates, many changes in construction and widely differing embodiments and applications of the invention will suggest themselves without departing from the spirit and scope of the invention. The disclosures and the description herein are purely illustrative and are not intended to be in any sense limiting.

I claim:
1. The improvement in the construction of inflatable objects made of sheet material having at least two compartments, with each compartment separated from its adjacent compartment by a seam made by bonding said sheets to each other, which consists in having in each seam air passage means comprising a tube-like member extending generally crosswise to said seam between said sheets, and bonded on its complete outer periphery to said sheets in the area of said seam, whereby the seam areas between said sheets are bonded to each other and to said member in an unbroken bond and the wall of said tube-like member will take the principal strain off the seam in that area when said object is inflated and subjected to internal air pressure; and a separate semi-rigid tube member inserted in the opening provided by said tube-like member.

2. A compartmented inflatable article, including in combination two facing sheets sealed together around their edges by a valve, an enclosed inflatable space between them and sealed together along at least one seam in between said edges to divide said space into a plurality of adjacent compartments communicating with each other, the communication comprising an envelope extending across each said seam and to which said sheets are bonded, whereby all said compartments are walled in by said seams adapted to withstand the loads imposed by inflation and any weight resting on it; and a semi-rigid tube inserted in said envelope to hold it open throughout its length.

3. A compartmented inflatable article, including in combination two facing sheets bonded together around the edges to define an enclosed inflatable space between them and having at least one bonded seam in between said edges to divide said space into a plurality of adjacent compartments communicating with each other, the communication comprising a self-supporting tube and a flexible envelope around said tube extending across said seam and bonded between said facing sheets along said seam.

4. A compartmented inflatable article, including in combination two facing sheets of thermoplastic material joined around the edges to define an enclosed inflatable space between them and bonded together along a plurality of seams in between said edges to divide said space into a multiplicity of compartments, adjacent compartments communicating with each other, via air passages across said seams, each air passage including a flexible tubular member sealed across said seam between said facing sheets and bonded to both said sheets, and a semi-rigid tube inserted in the opening provided by the said flexible tubular member.

5. A method of manufacturing a compartment wall for an inflatable article of the type comprising two facing sheets sealed to each other and having communicating compartments, said method comprising the steps of inserting a flattened tube so that its axis lies generally perpendicularly across where the compartment walls are to be formed at the place where air transfer is desired; inserting inside said flattened tube a strip of material not bondable to said tube; fusible said sheets together and to the outer surface of said flattened tube, said strip preventing said tube walls from bonding to each other; withdrawing said strip from said tube; and inserting therein a substantially round self-supporting tube of semi-rigid material.

6. A method of manufacturing an air transfer passage in a compartment wall made from two sheets of thermoplastic material for an inflatable article of the type having communicating compartments, comprising the steps of inserting a double thickness of material that is bondable by heat to the wall; forming said wall by heat that fuses together the inner faces of the wall to each other and to the outer surface of said double thickness of material, by separating a portion of the latter to prevent them from sticking together; and inserting in the space between said double thickness a self-supporting tube.

7. A method of manufacturing a compartment wall for an inflatable article of the type made from two facing sheets of thermoplastic material and having communicating compartments, comprising the steps of inserting a doubled strip of thermoplastic material where air transfer is desired generally crosswise to the compartment wall where it is to be formed; separating a portion of the facing walls of said strip to prevent bonding during heating; heating said sheets to fuse together and to the outer surface of said strip to form said wall; and inserting between the opposite sides of said double strip a substantially round self-supporting tube of semi-rigid material.

8. A method of manufacturing a compartment wall for an inflatable article of the type made from two facing sheets of thermoplastic material and having communicating compartments, comprising the steps of inserting a double thickness of thermoplastic material perpendicularly across where the compartment wall is to be formed at the place where air transfer is desired; inserting between said thickness a strip of silicone-coated fiber-glass cloth narrower than said thicknesses; fusing said sheets together and to the outer surfaces of said double thickness, while said cloth prevents said thicknesses from bonding together except at an outer edge to form thereof a tube bonded between said sheets; withdrawing said cloth from the interior of said tube; and cementing therein a substan-
tially round self-supporting tube of semi-rigid plastic material.

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