

[54] **AIR INFLATABLE STRUCTURE**

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[51] Int. Cl. **E04b 1/345**

[58] Field of Search 52/2, 629; 161/121, 161/123, 125, 140

[56] **References Cited**

UNITED STATES PATENTS

2,281,635	5/1942	Strauss	161/123
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FOREIGN PATENTS OR APPLICATIONS

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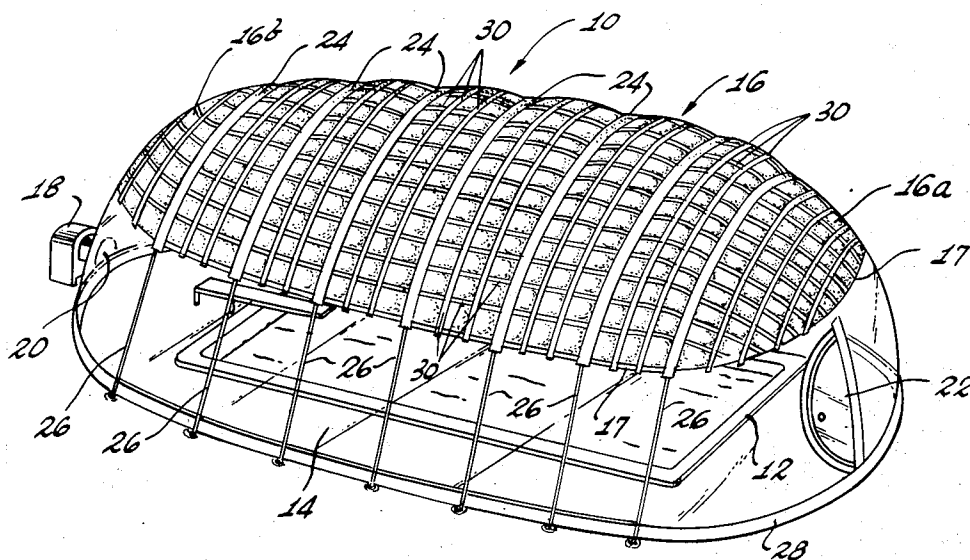
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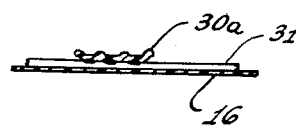
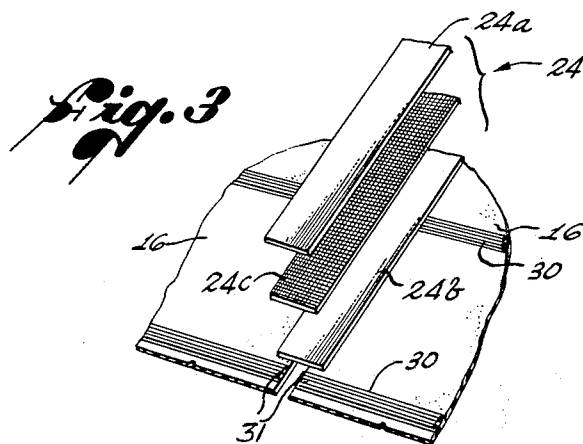
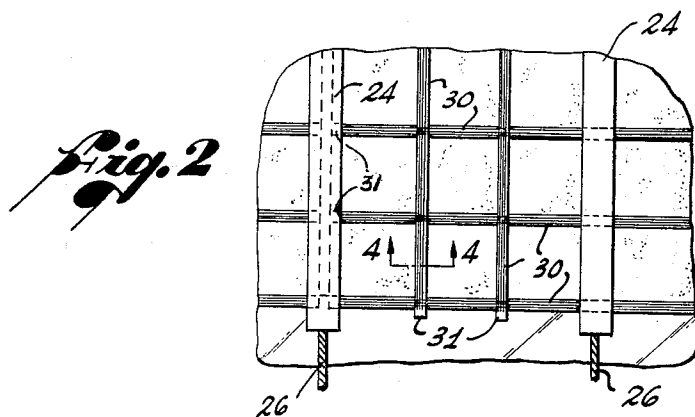
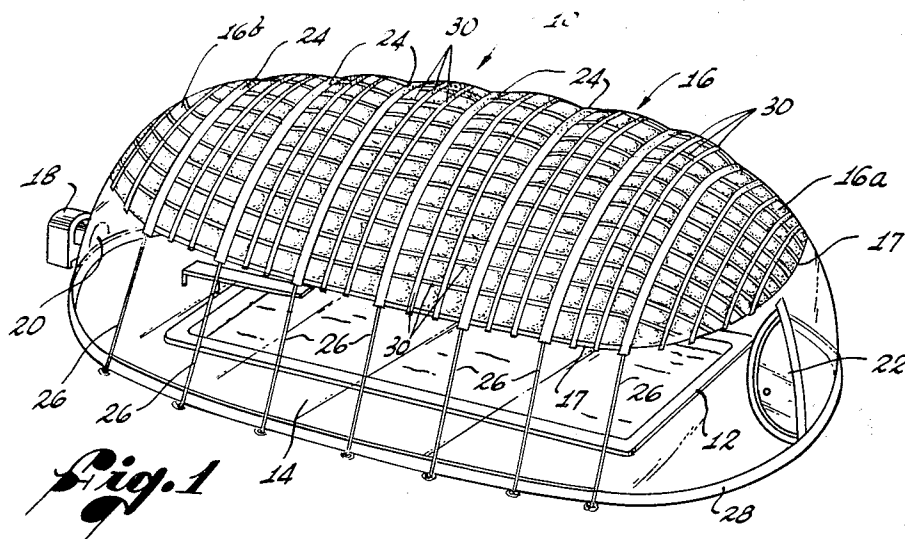
[57] **ABSTRACT**

This disclosure relates to an air inflatable enclosure comprising sheets of unsupported stretchable plasticized polyvinyl chloride or polyvinyl acetate plastic sheet, having a thickness of between about 10 to 20 mils, in combination with (1) a plurality of spaced, parallel non-stretchable reinforcing strips or webs of material fused to at least a portion of the roof surface of the plastic sheet material, the ends of the non-stretchable parallel strips being anchored to decking or to other base material (such as earth and the like) for stability and provided with (2) a reinforcing grid pattern formed, at least between each of said spaced, parallel strips, the grid pattern being constructed of heavier stretchable vinyl strips fused to the vinyl sheet material.

The combination of non-stretchable reinforcing parallel, spaced, strips together with the grid pattern of heavier stretchable vinyl strips, preferably 30 to 120 mils, placed between said non-stretchable strips, all fused to the plastic sheet provide a relatively low cost, highly stable, and highly tear-resistant air inflatable enclosure.

3 Claims, 4 Drawing Figures





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AIR INFLATABLE STRUCTURE

This is a continuation of application Ser. No. 60,038, filed July 31, 1970, now abandoned.

BACKGROUND OF THE INVENTION

The present invention relates to air inflatable enclosures for a variety of uses, e.g., for the enclosure of swimming pools, tennis courts, plants, vegetable crops, and for outdoor storage shelter, display, or entertainment. The invention has particular reference to a novel portable structure, which is unusually strong and tear-resistant, has high impact resistance, is extremely stable under high wind load conditions, while being low in cost.

The use of flexible plastic sheet materials for building construction and for enclosures in general have met with some degree of success over the past decade or so because of their low cost, ease of assembly and disassembly in comparison with rigid structures. One of the major problems, however, in the use of such materials is that of durability. Flexible plastics, such as plasticized polyvinyl chloride or polyvinyl acetate usually with various fillers and additives (these materials being referred to hereinafter simply, as vinyl materials), tend to tear quite easily and therefore for most construction applications, the sheet plastic use must either be relatively thick and/or highly reinforced to prevent tear propagation. Other plastic materials, such as nylon are utilized rather than vinyl materials; however, the nylon enclosures have disadvantages, the major ones being that of their high cost and their lack of light transmittance.

In the past, inflatable structures have been made of vinyl plastic sheet material and have sought to avoid the disadvantages mentioned heretofore. One such structure that has been patented is shown in U. S. Pat. No. 3,353,309 issued to me on Nov. 21, 1967. This patent discloses substantial improvements in the stability and tear resistances of vinyl sheet enclosures. The advantages of inflatable structures over rigid structures in general are further described in the said U. S. Pat. No. 3,353,309, especially with reference to the enclosure of swimming pools, and the teachings of this earlier patent are incorporated herein by reference.

SUMMARY OF THE INVENTION

This invention is directed towards a novel form of construction of reinforced sheet plastic material, especially suitable for use in the fabrication of enclosures of the air inflatable type, but is not limited thereto. More particularly, this invention is concerned with the utilization of vinyl sheet plastic material as the basic element of an enclosure — which sheet vinyl material is reinforced along particular discrete areas of the sheet plastic, the reinforcement comprising both non-stretchable, flexible plastic materials in combination with stretchable plastic materials.

The non-stretchable reinforcing webs are fused in spaced parallel relationship, to the vinyl sheet material forming the enclosure, along a substantial portion of the roof section of the enclosure. Both ends of each of the non-stretchable webs are anchored to the ground or other base material adjacent the structure or area enclosed. A reinforcing grid of heavy stretchable vinyl plastic strips are fused to the surface of the vinyl sheet material between the non-stretchable, stabilizing strips.

The final enclosure material is thus formed of sheet plastic material reinforced with spaced, parallel, non-stretchable reinforcing webs in combination with stretchable reinforcing strips fused to the sheet plastic, between the webs. The grid pattern provides a highly stable, highly impact resistant and tear resistant structure, at substantially lower cost than the all nylon air-inflatable enclosures presently on the market, and is a substantial improvement, as well, with respect to unsupported vinyl enclosures.

Other features and advantages of the present invention will be apparent from the following detailed description taken in conjunction with the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of an air-inflatable enclosure showing a presently preferred embodiment thereof enclosing a swimming pool;

FIG. 2 is an enlargement of one portion of the roof area of the enclosure of FIG. 1;

FIG. 3 is an exploded view showing the structure of the non-stretchable reinforcing strips utilized in this invention; and

FIG. 4 is a section along the line 4—4 of FIG. 2.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawing and especially to FIG. 1, an air inflated enclosure, generally designated by the numeral 10, is there shown enclosing an in-the-ground swimming pool 12. The enclosure 10 is composed of sheet vinyl material which preferably has a gauge thickness of between 10 mils and 20 mils and which may have transparent as well as opaque portions. In the particular embodiment shown in FIG. 1, a continuous transparent section of sheet vinyl is shown in the lower portion of the enclosure and is designated by the numeral 14, while the remainder of the enclosure 10 is preferably an opaque sheet vinyl. The opaque section, roughly corresponding to the roof portion of the enclosure, and designated by the numeral 16, is fused to the transparent section by conventional high frequencies welding techniques along the circumferential line, generally designated by the numeral 17, to thereby form, with a base water-containing tube 28, the complete enclosure 10.

A blower 18 communicates with the interior of the enclosure 10 through a port or opening designated by the numeral 20 and when turned on, maintains the enclosure in inflated condition. At the other end of the enclosure, there is formed a door opening for a door 22. Door 22 is located in the transparent portion 14 of the enclosure 10.

Fused to the roof portion 16 of the enclosure 10 are a plurality of non-stretchable strips or webs of reinforced plastic material 24. The distance between the parallel webs 24 varies between about 3 feet to as much as 10 feet, depending upon the size of the enclosure and the weather conditions which predominate in the particular location in which it is to be placed. To each of the ends of the reinforcing strips 24 there is attached, by any conventional means, nylon stabilizing ropes 26 which ropes are, in turn, anchored to the ground or other base material adjacent the structure (in this case the swimming pool 12) to be enclosed.

There is also provided a substantially continuous tube 28 of plastic sheet welded to the bottom edge of

the transparent portion 14 of the enclosure 10 which tube is adapted to be filled with water. The water-filled tube 28 provides an air-tight seal for the enclosure 10 with the base surrounding the swimming pool 12.

To this point, the enclosure 10 comprises an anchoring water tube 28, a blower 18, a door 22, transparent and opaque sheet vinyl portions 14 and 16, respectively, together with the stabilizing strips 24, 26. All of these elements are described in substantially greater detail in my earlier U.S. Pat. No. 3,353,309 issued Nov. 21, 1967.

As mentioned earlier, these provide substantially greater tear-resistance, combined with low cost than was hitherto the case when the application for this U.S. Pat. (No. 3,353,309) was filed. However, by means of the present invention, the tear resistance of my earlier invention is further substantially improved with relatively little increase in overall cost of manufacture of the enclosure 10.

In order to achieve this, I have fused to the roof portion 16 of the enclosure 10, between stabilizing strips 24, a plurality of parallel strips 30 of stretchable vinyl material running at right-angles to each other to form a grid pattern. In addition, strips 30, in the form of a grid, are preferably fused to the opposite ends of the roof portion 16, these ends 16a and 16b not being bounded by stabilizing strips 24. It will be understood that the grid pattern formed by the vinyl strips 30 may be added to any part of the enclosure, not only the roof portion 16. It is found, however, to be of greater advantage to utilize the strips 30 in the roof portions, than in the side wall sections 14, because it is the roof area or portion 16 which takes the greater load under high wind or other severe weather conditions.

Those vinyl strips 30 running at right angles to the stabilizing strips 24 have their ends 31 welded to strips 24 as shown in FIG. 2 and also to the transparent portion of the enclosure 10. These strips 30, running parallel to the stabilizing strips 24, are also fused to the surface of the roof portion 16 of the enclosure, have their ends 31 fused to the transparent portion 14 of the enclosure and are also welded to those strips 30 running at right angles to it — by conventional high frequency welding techniques.

An automated method for producing the grid pattern, along with the apparatus therefor, is described in detail in an application entitled "METHOD AND APPARATUS FOR FORMING A REINFORCED ELONGATED SHEET AND THE PRODUCT PRODUCED THEREBY," this application bearing Ser. No. 60,039, filed July 31, 1970, now abandoned and being filed by me concurrently with the present patent application. The subject matter of my method and apparatus for producing the grid structure 30, in a continuous and automatic fashion, as incorporated herein by reference.

Manufacturers of vinyl sheet generally make them in widths no larger than 5 feet. Therefore, in order to make large sheets for enclosure purposes, the 5 foot widths must be welded or fused together and this is most conveniently done in the construction of my invention by fusing the edges of two grid reinforced sheets together, by means of stabilizing strips 24, as is shown in FIG. 3.

Stabilizing strips 24 each comprise a lamination of two outer pieces of sheet vinyl 24a and 24b, between which is placed nylon mesh 24c, so that the stabilizing strip 24 becomes non-elastic and substantially non-

stretchable, while at the same time being flexible and readily fusible to the vinyl sheet of the enclosure 10 by conventional techniques. Normally, strips 24 are performed so that only welding of the lower piece of vinyl 24a to the sheet vinyl of the enclosure is required.

The rectangles formed by the grid of strips 30 generally confine an area of between about 0.5 to about 2 square feet so that if a puncture should occur within a unit of the grid pattern, due to high impact or rocks being thrown or the like, any tear propagation will be effectively prohibited from continuing beyond a single unit of the grid. Normally, this means that even if there should be a large hole made as a result of some high impact, the opening will not be sufficiently large to result in any significant degree of deflation of the enclosure — for the blower 18 can operate at some substantially greater capacity to maintain a well inflated condition until the puncture or opening can be fixed.

The combination of non-stretchable but flexible stabilizing strips 24 together with vinyl reinforcing strips 30 in a criss-cross or grid pattern imparts to the enclosure 10 a high degree of stability, while at the same time allowing the larger areas between the stabilizing strips 24 to inflate or deflate, under the influence of high winds or temperature changes, and to thereby compensate for such changes readily. If the strips 30 were also made of a non-stretchable material or a non-stretchable lamination, such as strips 24, the roof portion of the enclosure 16 would be so rigid that it would not readily compensate for high impact loads such as occasioned by high velocity gusts of winds of the order of 70 to 80 miles per hour. Strips 30 might then crack under such high impact loadings where there is no give or stretchability.

The extreme outer edges 30a of the strips 30 are, preferably, not welded to the vinyl sheet 16 of the enclosure 10 because it is found that there is greater tear resistance occasioned by this form of construction than if the very outer or extreme edges of the strips 30 were, themselves, welded to the vinyl sheet. The structure shown in FIG. 4 is then the presently preferred structure. However, it will be understood that the edges of strips 30 could also be themselves welded directly to the sheet vinyl enclosure and still effect great advantages with respect to the presently known prior art.

From the foregoing discussion, it will be apparent that a low-cost air inflated enclosure is provided which is both stabilized against movement while being substantially more tear-resistant than that presently existing, which structure is economical to manufacture. While particular forms of the enclosure have been illustrated and described, various modifications can be made without departing from the spirit and scope of the invention.

I claim:

1. An inflatable enclosure, which comprises, in combination, an inflatable sheet plastic structure, having a gauge thickness of between about 10 to 20 mils, inflatable by gaseous fluid from a fluid supply source; stabilizing means extending over said inflatable structure when inflated to substantially prevent said inflatable structure from moving generally upwardly from a desired fully inflated position, said stabilizing means including a plurality of spaced reinforcing substantially non-stretchable webs of material, each affixed to at least a portion of the surface of

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said inflatable structure and held to a base adjacent said body member; and
a plurality of stretchable plastic strips, having a thickness of at least 30 mils, fused to at least a portion of the surface of said inflatable structure between said spaced reinforcing substantially non-stretchable webs of material and arranged in the form of a grid pattern, the outer edges of said plastic strips not being fused to said surface of said in-

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flatable structure.

2. The inflatable enclosure of claim 1 wherein said reinforcing webs are flexible to follow the curvature of said inflatable structure.

3. The inflatable enclosure of claim 1 wherein the unit of grid pattern confines an area between about 0.5 square feet to about 2 square feet.

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