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H. MEYER ET AL
INFLATABLE STRUCTURE

2,939,467

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FIG. 1.

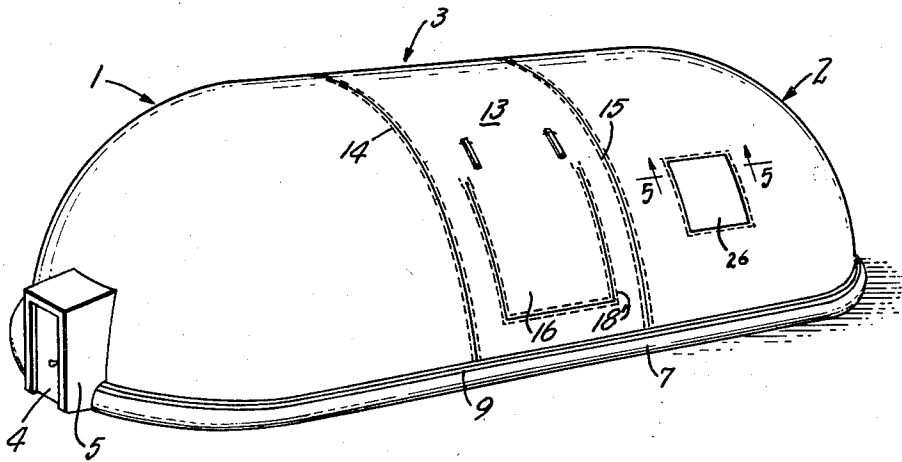


FIG. 2.

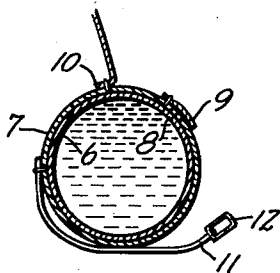


FIG. 3.

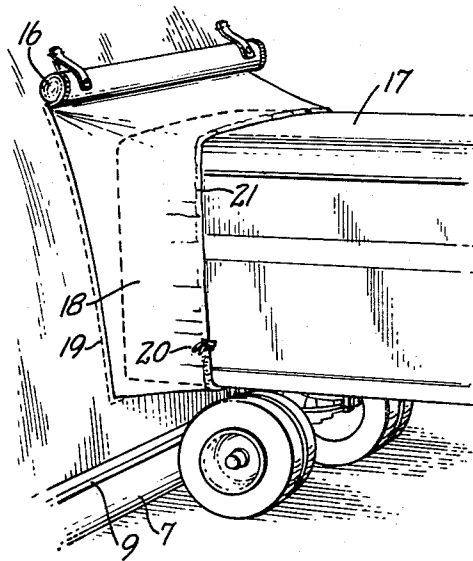


FIG. 4.

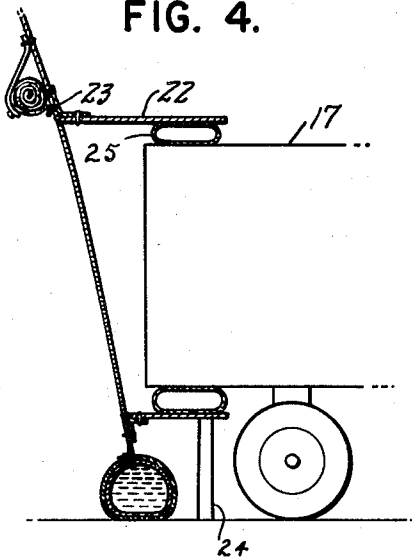
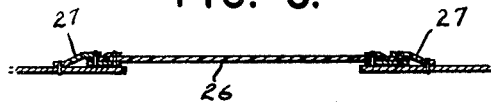


FIG. 5.



INVENTOR
HANS MEYER
KURT MEYER
BY *John M. Calimafde*
ATTORNEY

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INFLATABLE STRUCTURE

Hans Meyer, 779 Riverside Drive, and Kurt Meyer, 330 Haven Ave., both of New York, N.Y.

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This invention relates to a structure of the warehouse type, and more particularly to an air-inflatable structure.

There recently has been developed an air-inflatable structure of single-wall construction which is especially useful as a warehouse. The body of the structure is essentially in the shape of a semi-circular cylinder and the two opposite ends are in the form of quarter spherical segments. The structure is inflated by introducing air under low pressure into the space defined by the structure and the surface upon which it rests. It is securely anchored to the ground by an encircling tube which is filled with water or sand.

The material from which the structure is made is essentially a vinyl coated nylon fabric which is light in weight, translucent and capable of withstanding both extreme high and low temperatures.

Although the unit is basically extremely useful, it suffers many shortcomings which are eliminated by our invention.

For example, the known structure uses a ballast tube which is designed to hold either water or sand but not both. Therefore, the overall structure must be designed to fulfill a specific purpose and once having been constructed to hold either water or sand, it cannot, practically, be altered to hold the other form of ballast. This lack of versatility is a first shortcoming.

Secondly, units today are constructed to have a given length; however, often the amount of storage space required at some future time is difficult to predict. Therefore, it would be highly desirable to have a structure which is capable of being extended, or contracted, within reasonable limits.

Further, no means other than a door, or doors, are provided for loading the known structure. The frequent opening of doors upsets the equilibrium of air pressure required for inflation. This causes the blower, which produces the required air pressure, to work at a more rapid rate and under certain conditions, the unit may partially deflate.

In the known structure, light in the interior is increased by providing windows on the sides thereof. The windows are made of a thin flexible plastic material which bends in conformity with the sides of the unit. However, the windows are sewn to the sides in order to minimize the escape of air and when it is desired to replace a window, the structure must be taken out of service and returned to the shop. This, obviously, is expensive and impractical.

Accordingly, it is a first object of our invention to provide an inflatable structure including a novel ballast carrier which may be weighted either with water or sand to anchor the structure to the ground.

It is a further object of our invention to provide such a structure which can be easily and simply extended or contracted to accommodate the storage requirements.

It is still a further object of our invention to provide such a structure including novel means to facilitate loading and unloading with a minimum loss of air from the interior of the structure.

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It is also an object of our invention to provide window fastening means which permits easy removal and replacement of the windows.

In accordance with a first aspect of our invention, we provide ballast carrier means for an inflatable structure, comprising outer and inner tubular members, the inner tubular member being made of an expansible watertight material and the outer tubular member being made of a relatively inexpandable material and serving to enclose the inner tube. The outer tubular member, initially in the shape of an elongated sheet, is formed into a tube by fastening together the opposite longitudinal edges, for example, by means of a zipper. Thus, when it is desired to use water as the ballast, both tubes are utilized and when it is desired to use a solid weighting means such as sand, the inner tube is removed and the outer tube is opened for receiving the sand.

In accordance with another aspect of our invention, the structure comprises at least one removable section which extends circumferentially around the structure and which is detachably attached to the adjoining parts of the unit by common fastener means, whereby the unit may be lengthened or shortened, by adding to, or removing from the unit, one or more of the sections.

In accordance with still another aspect of our invention, the structure comprises a partially detachable section of predetermined size and shape; the shape being similar to the shape of a loading portion of a vehicle and the size being slightly greater than the loading portion. Means are provided around the periphery of the section for tightly enclosing the perimeter of the loading portion of the vehicle, after having detached the section from the side of the unit, whereby the amount of air escaping from the interior of the unit during the loading and unloading of the vehicle is insufficient to deflate the unit.

The above-mentioned and other features and objects of this invention and the manner of attaining them will become more apparent and the invention itself will be best understood by reference to the following description of an embodiment of the invention taken in conjunction with the accompanying drawings: wherein:

Fig. 1 is a perspective view of an inflatable structure illustrating several aspects of our invention;

Fig. 2 is a cross-sectional view of the novel ballast carrying means of our invention;

Figs. 3 and 4 are two embodiments of means for tightly enclosing a vehicle while the vehicle is loading and unloading through a section provided therefor in the side of the unit; and

Fig. 5 is a cross-sectional view of a window fastened to the unit.

Referring first to Fig. 1, there is illustrated in perspective view an inflatable structure which will be referred to as a housing or unit.

The housing may be considered as comprising three sections, although it actually is constructed of a plurality of panels sewn together. The housing may be considered as comprising forward and rear sections 1 and 2 respectively, and an intermediate section 3. The sections 1, 2 are each in the shape of a quarter of a sphere and the intermediate section 3 is a semi-circular cylinder. Therefore, the body of the house is twice as wide as it is high.

At the front end 1 of the house, a door 4 is provided, preferably aluminum, mounted to an aluminum frame. The frame is attached by any suitable means to a compartmental extension 5 of the forward end 1. The compartment 5 may be integral with the forward end, or preferably, is sewn to the housing.

If desired the door frame may be recessed into the forward end; however, we have found it preferable, from the viewpoint of maintaining the air pressure within the

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housing, to provide the extended compartment 5 and include a partition between the interior of the housing and the compartment. In this manner opening the door 4 does not materially affect the air pressure within the unit.

The walls of the housing are single thickness and preferably made of a vinyl coated nylon. The unit is inflated by applying air under low pressure into the housing, preferably by means of a ventilating blower. This pressurized air supports the entire structure, no rigid framework of any kind is required. The blower, of course, may be gasoline or electrically operated.

The housing is securely anchored to the ground by ballast carrying means (Figs. 1 and 2) comprising inner and outer tubular members 6 and 7 respectively. The inner tubular member 6 is watertight and made of an expansible material. A valve is provided at one or more places (not shown) for the purpose of adding water to, and emptying water from the inner tubular member. The outer tubular member 7 is relatively inexpandible and serves to enclose securely the inner tube 6. The outer tube 7 is initially in the form of an elongated sheet and the longitudinal edges thereof are brought together and fastened, preferably zippered together as shown at 8. The outer tube serves the dual function of supporting the inner tube when water is used as the ballast, or if a solid such as sand is used for ballasting, then the inner tube is removed and the sand is placed directly into the outer tube.

The zipper 8 is protected by a flap 9, sewn to the outer tube 7 along one edge thereof, and the outer tube is sewn, as shown in Fig. 2, to the bottom 10 of the housing.

A plurality of straps 11 having rings 12 at one end and sewn to the outer tube 7 at the other end, are adapted to serve two functions. The rings, preferably spaced every 5-10 feet along the tube 7, may be staked to the ground in the event of wind storms, to steady the housing. In addition, if it is desired to collapse the unit on the articles stored therein so that the housing acts merely as a cover for the articles, the blower is removed and the deflation of the house is permitted. After the unit is deflated, it is advisable to secure the sides of the unit, otherwise the sides are subject to severe flapping in the event of wind. The sides and top of the unit are secured by passing rope or other suitable means through the rings from side-to-side and tied to the opposite end rings.

Referring again to Fig. 1, it is seen that the intermediate portion 3 comprises a removable section 13, extending circumferentially around the unit. The section 13 is detachably attached by means of zippers 14, 15 to the adjoining portion of the housing. Thus, if it is desired to remove the section 13, the two zippers are simply opened, the separated ends brought together and zippered closed. Conversely, additional sections may be added to increase the length of the housing. Thus, by providing common fastener means, for example, zippers, at the opposite ends of the section, or sections, the unit may easily be lengthened or shortened.

Since the unit is primarily useful as a warehouse, means must be provided for loading and unloading the unit. Heretofore, loading was accomplished through the front door by means of a fork-lift truck. Of course, when the door was opened, the air-pressure inside dropped and the operation had to be effected rapidly, or the unit would partially collapse.

In accordance with our invention, we provide a partially detachable section 16 of given size and shape. Although we have shown the section 16 centrally located, it, of course, may be located at any convenient position.

The shape of the section 16 is designed to conform with the loading portion 17 (Fig. 3) of a vehicle, and the size of the section 16 is slightly larger than the loading portion 17.

The section 16 is partially detachably attached, pref-

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erably along three sides only, so that it may be rolled up and secured as shown in Fig. 3. Zipper means 18' fasten the section 16 to the adjoining portion of the housing.

A flap 18, in the shape of a box-frame, is sewn to the housing at 19 and is normally folded in the interior of the unit when not in use. During loading and unloading, when the section 16 is opened and the vehicle is backed-up to the opening, the flap 18 is adjusted to surround the vehicle, as shown. A draw-string 20 is mounted in a folded loop portion 21 at the peripheral end of the flap 18, whereby the flap may be tightly secured around the vehicle. Since the opposite end of the flap is attached to the peripheral area surrounding the section 16, very little air is permitted to escape during the loading and unloading operations.

An alternative embodiment of enclosing the loading portion of the vehicle is illustrated in Fig. 4. In this embodiment the section 16 is rolled-up and secured to the inside of the housing. Mounted to the outside of the housing is a rigid framework 22, attached to the housing by any suitable means. As shown, the framework is stitched to a piece of fabric 23 along one edge thereof, and the fabric is stitched (or sewn) along the opposite edge to the housing. The framework 22 is made of a light metal, such as aluminum or a magnesium alloy. Leg supports 24 are utilized to support the framework 22; the legs rest on the ground and extend to the underside of the frame 22. By using the leg supports, the weight is removed from the housing and this, of course, is desirable.

Attached to the inside of the frame 22 and extending along the four sides thereof is a pneumatic tubular member 25 which is normally deflated. The tube 25 is inflated when a vehicle is backed into the framework 22, as shown in Fig. 4. The pneumatic tube is made of such expansible material that the tube encloses tightly the loading portion of the vehicle minimizing any loss of air.

Referring for a moment to Fig. 1, it is seen that the door is provided on a compartment which extends from the housing. In the conventional unit a portion is cut-out of the front end of the housing and the door is mounted in the cut-out area. As a result, each time the door is opened, some air escapes which affects the air-pressure in the interior of the unit. By providing the door at the end of a partitioned compartment, we have materially minimized the variation in air-pressure in the interior of the unit resulting from opening the door.

Referring now to Figs. 1 and 5, a window 26 is shown fastened to the housing. The window is made of a flexible plastic material, less durable than the housing. Therefore, it is necessary to change the window from time-to-time. We solve this problem by fastening the window to the housing with one or more zippers 27. The carrier for the zipper is sewn along one edge to the window 27 and along the other edge to the housing. Thus, a defective window may easily be removed and a new one substituted in its place.

While I have described above the principles of my invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of my invention as set forth in the objects thereof and in the accompanying claims.

What is claimed is:

1. An inflatable structure comprising a housing ballast carrying means comprising outer and inner tubular members, the inner tubular member being made of an expansible watertight material and including valve means for filling and emptying said inner tubular member with water, said outer tubular member being made of a relatively inexpandible material and serving to enclose securely the inner tubular member, means attaching said outer tubular member to the bottom of said housing, fastener means extending longitudinally of the outer tubular mem-

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ber which may be opened to remove the inner tubular member, whereby other forms of ballast may be placed in the opened outer tubular member, the space between the housing and the surface on which the outer tubular member rests being filled with air under low pressure sufficient to inflate said housing.

2. The structure according to claim 1, wherein said housing comprises forward, rear and intermediate portions, said intermediate portion being a removable section detachably attached to adjoining parts of said forward and rear portions respectively by common fastener means.

3. The structure according to claim 2 wherein said intermediate portion is in the shape of a semi-circular cylinder and said forward and rear portions are quarter sections of a sphere extending from the ends of the semi-cylindrical portion to the surface which supports the structure.

4. The structure according to claim 1, wherein said housing comprises forward, rear and intermediate portions, one of said portions comprising at least one window made of flexible material, and fastener means for detachably attaching said window to said one of said portions, whereby said window may be easily removed from said structure and a new one substituted in its place.

5. The structure according to claim 1, wherein said housing includes a section of predetermined size and shape partially detachably attached to adjoining portion of the housing, the shape of said section being similar to the shape of a loading portion of a vehicle and the size of said section being slightly greater than the loading portion and means surrounding the periphery of said section and attached thereto, for tightly enclosing the perimeter of the loading portion of the vehicle after partially detaching said section from said housing, whereby the amount of pressurized air escaping from said housing during the loading and unloading of the vehicle is insufficient to deflate said housing.

6. The structure according to claim 5, wherein said means for tightly enclosing the loading vehicle comprises a box-shaped flap extending from said housing, and means connected to said flap for drawing it tightly around the vehicle.

7. The structure according to claim 5, wherein said means for tightly enclosing the loading vehicle comprises a box-shaped rigid frame attached on the exterior surface of said housing, pneumatic tubular means attached to the inside of said frame and valve means for applying compressed air to said tubular means whereby the space between the loading vehicle and frame is closed-off by suitably inflating said tubular means.

8. An inflatable structure comprising a housing having forward, rear and intermediate portions, the intermediate portion having a semi-circular cylindrical shape and the forward and rear portions being in the shape of quarter sections of a sphere, said intermediate portion comprising at least one removable section extending completely around the circumference thereof, common fastener means attaching the opposite ends of said section to the adjoining ends of said intermediate portion, whereby said housing may be lengthened or shortened by adding to, or removing from said intermediate portion, one or more of said sections; ballast carrier means comprising outer and inner tubular members, the inner tubular member being made of an expansible watertight material, said outer tubular member being made of a

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relatively inexpandible material and serving to enclose securely the inner tubular member, means attaching said outer tubular member to the bottom of said housing, fastener means extending longitudinally of the outer tubular member which may be opened to remove the inner tubular member, whereby other forms of ballast may be placed in the opened outer member; said intermediate portion further comprising a second section of predetermined size and shape, fastener means partially detachably attaching said second section to the adjoining portion of said housing, the shape of said second section being similar to the shape of a loading portion of a vehicle and the size of said second section being slightly greater than the loading portion, and means surrounding the periphery of said second section and attached thereto, for tightly enclosing the perimeter of the loading portion of the vehicle when said second section is partially detached from said housing, whereby the amount of pressurized air escaping from said housing during the loading and unloading of the vehicle is insufficient to deflate said housing.

9. The structure according to claim 8, wherein said means for tightly enclosing the loading vehicle comprises a box-shaped flap extending from said housing, and means connected to said flap for drawing it tightly around the vehicle.

10. The structure according to claim 8, wherein said means for tightly enclosing the loading vehicle comprises a box-shaped rigid frame attached on the exterior surface of said housing, and pneumatic tubular means attached to the inside of said frame and adapted to be inflated by compressed air whereby the space between the loading vehicle and frame is closed-off.

11. An air inflatable structure, comprising a housing including a section of predetermined size and shape partially detachably attached to the adjoining portion of the housing, the shape of said section being similar to the shape of a loading portion of a vehicle and the size of said section being slightly greater than the loading portion, means surrounding the periphery of said section and attached thereto, comprising a box-shaped flap extending from said housing, means connected to said flap for drawing it tightly around the vehicle, the interior of said housing adapted to receive air under sufficient pressure to inflate said housing, and means for securely anchoring said housing to the surface on which it is mounted.

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