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INCORPORATION OF AN INFLATED BAG AS A ROOF
INTO A PERMANENT STRUCTURE
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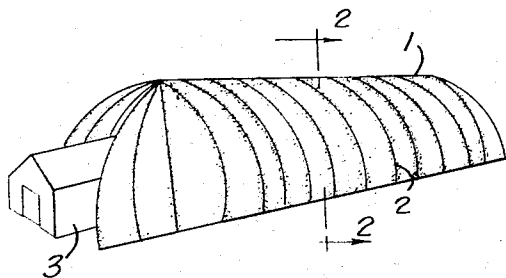


FIG. 1

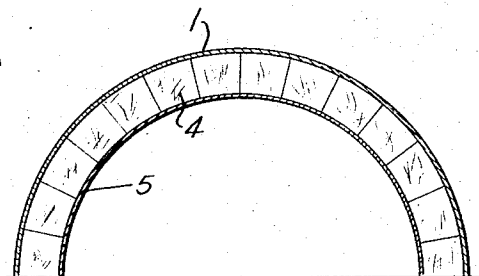


FIG. 2

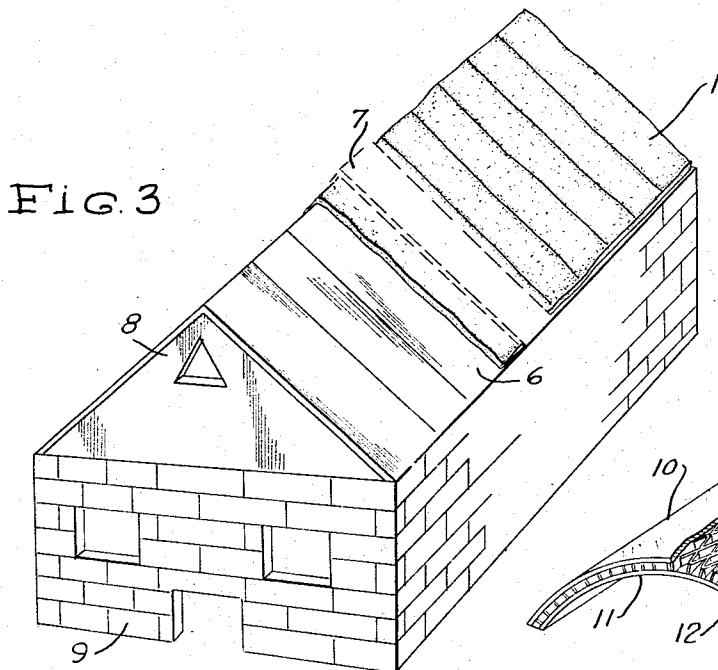
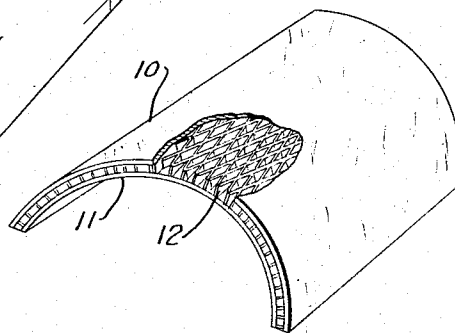


FIG. 3

FIG. 4



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INCORPORATION OF AN INFLATED BAG AS A ROOF INTO A PERMANENT STRUCTURE

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5 Claims. (Cl. 52-746)

The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment to us of any royalty thereon.

This invention relates to the construction of shelters or buildings using an inflatable bag or envelope as a covering during the construction phase and incorporation thereof as a permanent exterior roofing material in the final structure. After inflation of the bag, a core material, which may be composed of blocks of foamed or expanded plastic material or honeycomb structure, is bonded to the underside of the inflated bag and a sheet of synthetic fiber material such as resin impregnated fiber glass cloth bonded to the underside of the core material. This construction provides both rigidity and thermal insulation. Buildings may be either wholly constructed in this manner or only the roof structure, the balance of the building being of conventional materials such as masonry or wood.

Construction of buildings or shelters such as barracks, radoms, missile shelters, warehouses, garages, etc., can pose many problems especially when they must be erected in remote locations such as in arctic regions or in relatively inaccessible locations such as may be encountered in military operations. Conventional construction methods and materials require the transportation of bulky materials, use of heavy equipment and skilled labor. The construction as herein described overcomes many of these difficulties and permits construction operations to proceed despite the weather.

Accordingly, it is a principal object of the invention to provide a construction for buildings affording structural strength and thermal insulation which may be quickly erected from materials having minimum initial volume which may be expanded to a final predetermined size and shape by a minimum number of skilled personnel with a minimum of construction aids.

It is a further object of the invention to provide construction for buildings employing elements which may be quickly erected to provide protection during erection and which may be incorporated as a part of the final structure.

It is a further object of the invention to provide a construction for buildings which may be readily adapted to site conditions.

It is another object of the invention to provide a construction for buildings including an inflatable member which may be used in combination with conventional structural materials or alone and which may support additional rigid elements and a sheet membrane to provide a self-supporting building or portion thereof having structural strength and thermal insulating properties.

These and other objects will become apparent as the description proceeds in which:

FIG. 1 is a perspective view of a building constructed with an inflatable bag exterior;

FIG. 2 is a cross sectional view taken on the line 2-2 of FIG. 1 showing how the inflatable bag, the building modules, and the interior liner cooperate to give a permanent building structure;

FIG. 3 is a perspective view of a roof structure of A-shape showing the inflatable bag and form means; and

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FIG. 4 is a perspective view, partly in section, of a modification of the invention employing a honeycomb structure as the core material.

Referring now to FIG. 1, where the outside layer or inflatable bag 1 is shown, it is noted that a free blown bag 1 forms a Quonset-type building. The base portion of the bag is anchored and the bag is then inflated by air pressure sufficient to overcome the atmospheric air pressure on the structure and such pressure maintained until the plastic blocks are adhered to the underside of the bag at which time the pressure producing source is disconnected and the blocks maintain the rigidity of the structure. Strips of airtight material are sewn together at seams 2 to form this configuration of the building. Entrance 3 provides means to enter and exit from the building and also provides an air lock to keep the bag inflated while the building is being constructed.

The cross sectional view in FIG. 2 shows the various elements of the structure. First an inflatable bag 1, as shown in FIG. 1, is inflated to give both a form for the building to take and also a shelter for workmen constructing the building to work in. To this inflated bag are attached by means of an adhesive the blocks or modules 4 that will form the main structural strength of the building. The blocks are joined by suitable adhesive at their meeting surfaces to form a monolithic structure. These blocks 4 can be foamed resin blocks which are extremely suitable because they can be carried to the construction site in powder form and then foamed at the site. Alternatively, the foamed core material may be applied by spraying. This procedure will eliminate much of the bulk and crating problems in transporting building materials such as bricks and lumber. After the blocks 4 are all in place and adhering to the bag 1, internal lining 5 is put on the inside of blocks to provide an interior surface. This lining can be applied with conventional adhesives. When the interior lining is completed, the air lock is disassembled and the building structure is complete. With this method of construction, the inflated bag that was used as a shelter and form in the construction of the building has now also become the outer waterproof covering for the building and has in fact become a permanent part of the building.

The resulting building is in the form of a sandwich with the plastic foamed blocks being sandwiched between the inflated bag on the outside and the interior lining on the inside. A suitable lining is a resin impregnated glass fiber sheet which will give both structural strength to the building by firmly holding all the blocks in place and also provide a tough interior surface much more suited than exposed foamed plastic blocks.

FIG. 3 shows an embodiment of the invention where the roof is of the A-shape type. Here a wall enclosure 9 is built on a foundation and the inflatable bag 1 is secured to the top of wall enclosure 9. Inflation of the bag will cause it to go into a free blown shape, hence the need for a form 7 to hold the bag in an A-shape. The form 7 would be on the exterior of the bag and be moved as the blocks are secured to the interior surface of the bag. This type of construction may also be used when the entire building is to be formed by the inflatable bag and to have an A-shape or other desired configuration. The completed roof 6, where only the roof is formed of the inflatable bag, is a rigid structure that is firmly attached to the wall 9. Gable 8 is formed by a flat form held against the inflated bag and the plastic blocks are stacked vertically on wall 9 and caused to adhere to the plastic bag.

The construction illustrated in FIG. 4 embodies an outer and inner resin impregnated fiber glass cloth mat, 10 and 11 respectively, and a core 12 of expanded paper honey-

comb structure in place of the expanded, foamed resin plastic material. The inflatable bag may be rigidized after inflation by being constructed of pre-impregnated fiber glass mat which is heated or activated as by spraying with a catalyst and rolling. A stress resisting skin may also be obtained by spraying the underside of the inflated bag with a mixture of chopped glass fiber and resin or by hand lay-up methods using resin impregnated fiber glass cloth.

Fixed windows may be incorporated into the structure by omitting the core material at the point desired and bonding a transparent sheet to the adjoining core area. Movable windows can be located in the structure by bonding a hinge to the window and the structure. Doors may be installed in the same manner. Structures of various configurations can thus be either wholly or partially constructed by means of the inflatable bag and method herein described by a minimum of skilled personnel from material of small bulk and without the aid of heavy construction equipment ordinarily required in the construction of conventional structures.

We claim:

1. A method for constructing a structure comprising the steps of:

- (a) impregnating a fiber glass cloth material of predetermined bag configuration with a resin plastic material;
- (b) securing said resin impregnated, bag configured fiber glass cloth material to a base in air-tight relation;
- (c) applying air pressure supply means and inflating said bag;
- (d) securing by adhesive means a plurality of modular structural units to the underside of said inflated bag to form a continuous surface;
- (e) securing a liner material to the under surface of said plurality of modular structural units to be coextensive therewith;
- (f) curing said resin plastic impregnated material to a rigidized state; and
- (g) removing said air pressure supply means.

2. A method for constructing a structure comprising the steps of:

- (a) impregnating a fiber glass cloth material of predetermined bag configuration with a resin plastic material;
- (b) securing said resin impregnated, bag configured fiber glass cloth material to a base in air-tight relation;
- (c) applying air pressure supply means and inflating said bag;
- (d) securing by adhesive means an expanded honeycomb material to the underside of said inflated bag to form a continuous surface;
- (e) securing a liner material to the under surface of said expanded honeycomb material to be coextensive therewith;

(f) curing said resin impregnated material to a rigidized state; and

(g) removing said air pressure supply means.

3. A method of constructing a structure as recited in claim 11 including the steps of impregnating said liner material with a resin plastic material and curing said liner material to a rigidized state prior to removal of the air pressure supply means.

4. A method for constructing a structure comprising the steps of:

- (a) securing an inflatable bag of non-porous material of predetermined configuration to a base in air-tight relation;
- (b) applying air pressure supply means and inflating said bag;
- (c) positioning a movable forming member supported on said base and exterior of said inflated bag at a terminal end of said inflatable bag for movement along said inflated bag, in predetermined intervals;
- (d) securing by adhesive means an expanded core material to the under surface of said inflated bag to form a continuous surface therewith and successively moving said forming member in predetermined intervals as said core material is applied to the under surface of said inflated bag;
- (e) securing a liner material to the exposed surface of said expanded core material to be coextensive therewith; and
- (f) removing said air pressure supply means and said forming member.

5. The method as recited in claim 4 including the steps of impregnating said inflatable bag material and said liner with a resin plastic and curing said inflatable bag and said liner to a rigidized state prior to removal of said air pressure supply means.

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