

[54] **ROOF STRUCTURE**
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[21] Appl. No.: **40,922**
[52] U.S. Cl.52/747, 52/2, 52/80, 52/86, 52/89, 264/32
[51] Int. Cl.E04b 1/345
[58] Field of Search.....52/741, 747, 2, 80, 81; 264/32

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[57] **ABSTRACT**
An arcuate roof structure formed by interlocking building units, subassemblies, modules, components, blocks and the like together including the method of raising of the roof structure to a usable position.
16 Claims, 20 Drawing Figures

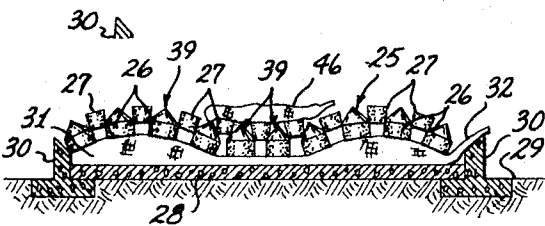




FIG. 1



FIG. 2

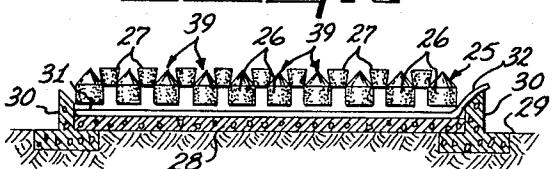


FIG. 3

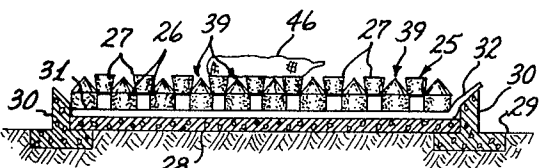


FIG. 4

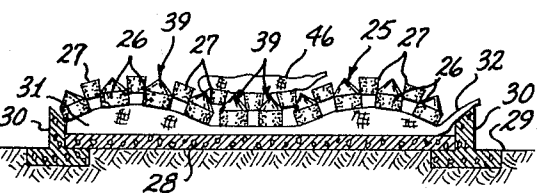


FIG. 5

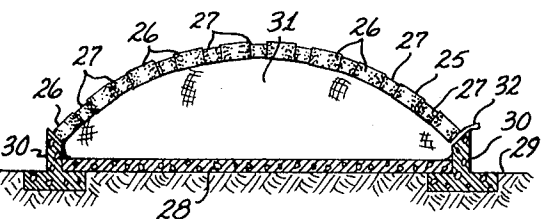


FIG. 6

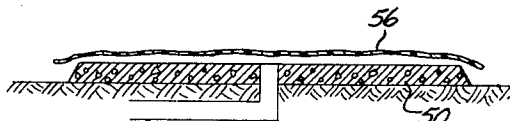


FIG. 7

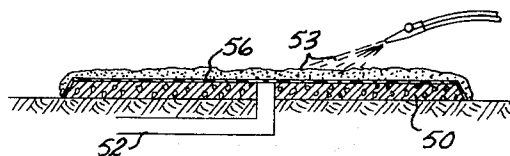


FIG. 8

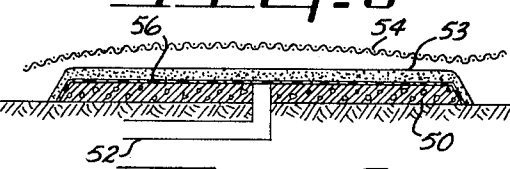


FIG. 9

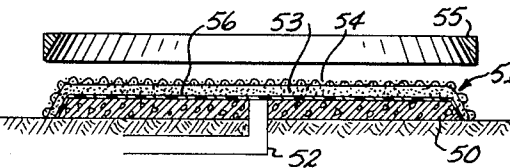


FIG. 10

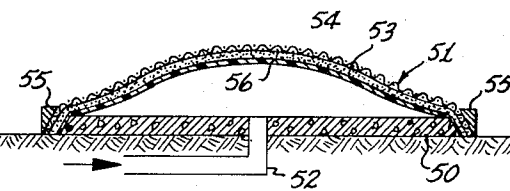


FIG. 11

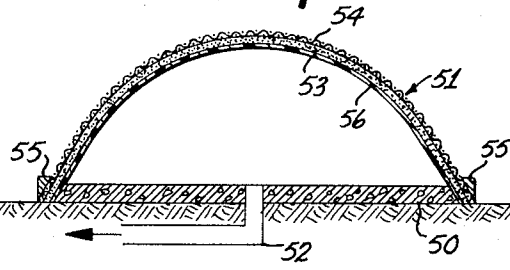


FIG. 12

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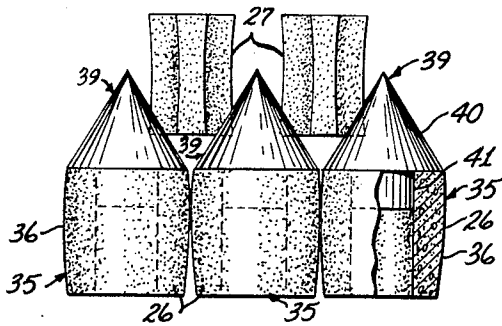


Fig. 13

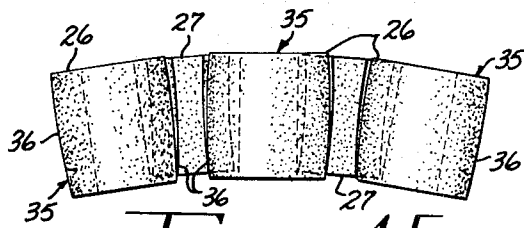


Fig. 15

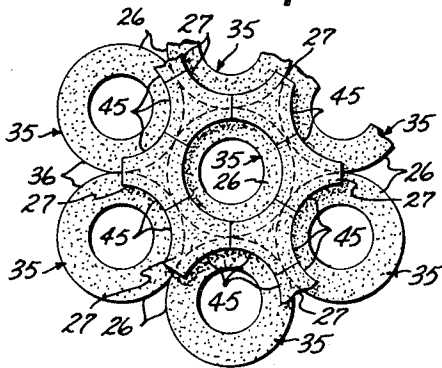


Fig. 14

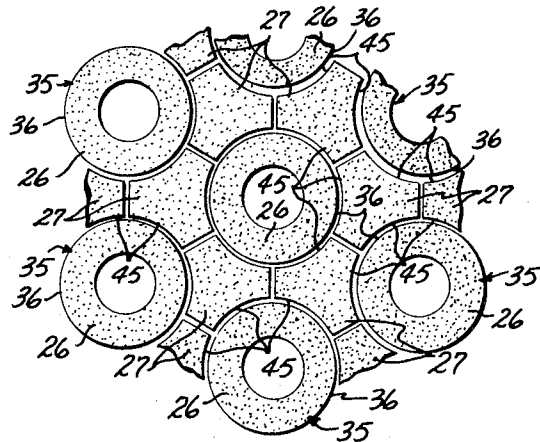


Fig. 16

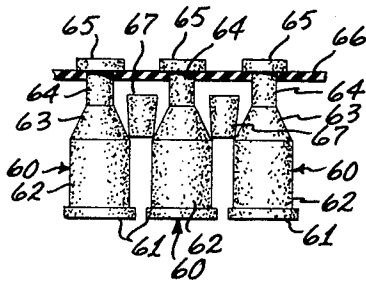


Fig. 18

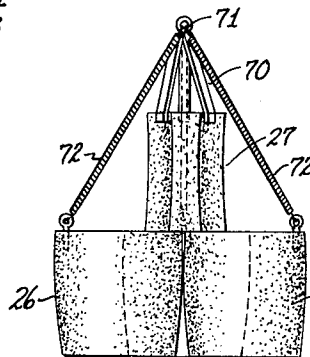


Fig. 20 Fig. 17

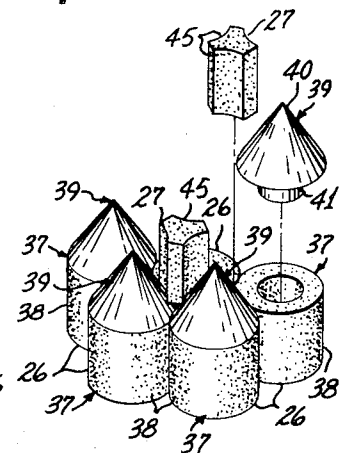
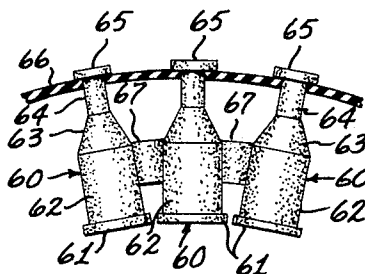


Fig. 19

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ROOF STRUCTURE

BACKGROUND OF THE INVENTION

This invention relates to architectural designs of roof structures and more particularly to arcuate roof structures formed of inelastic materials. Scarcity of timber and the difficulty of obtaining good stone for structural use forces the involvement of structural systems adapted to the use of modern building materials including plastics, metals, brick, concrete products and the like. This invention eliminates the need for scaffolding during erection regardless of the height of the structure.

1. Field of the Invention

This invention is particularly directed to arcuate roof and dome type buildings constructed of prefabricated materials assembled on a plane before erection.

2. Description of the Prior Art

At the present time inelastic roof materials are held up by wood or metal frames. Some arch building structures formed of bricks have been assembled on a curved form. The bricks being inelastic material and in compression exert lateral pressure or thrust which are ultimately transmitted to walls or abutments. The thickness of the walls must be proportionate to the amount of arch thrust. The repetition of the arch, i.e., continuous arch, forms a vault and the vault upon a circular base produces a dome.

Since modern needs require buildings of different sizes and sometimes for only a minimum period of time, a new and inexpensive roof structure is needed. Further, the use of complicated drawings so important to the architect must be avoided if unskilled and semiskilled labor is to be used in construction.

SUMMARY OF THE INVENTION

In accordance with the invention claimed new and improved hollow arcuate and dome structures are provided which are formed on a plane by a plurality of building components, units, modules, blocks or the like which either interlock at that time or are interlocked as the plane of interlocked blocks is raised into an arcuate or dome like configuration.

It is, therefore, one object of this invention to provide a new and improved roof structure.

Another object of this invention is to provide a new and improved dome structure.

A further object of this invention is to provide a new and improved roof structure that is constructed of a plurality of similar interlocking parts.

A still further object of this invention is to provide an improved roof structure formed of similar interlocking building units, components, modules, blocks or the like which are elevated into position by air under pressure.

A still further object of this invention is to provide an improved dome structure of similar parts which are assembled on a plane surface and elevated into a dome configuration by a single lifting action.

A further object of this invention is to provide an improved dome structure of a plurality of interlocking parts which may be assembled in a dome configuration and collapsed for disassembly in a minimum period of time.

Further objects and advantages of the invention will become apparent as the following description proceeds and the features of novelty which characterize this invention will be pointed out with particularly in the claims annexed to and forming part of this specification.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention may be more readily described by reference to the accompanying drawings in which:

FIG. 1 illustrates a cross-sectional view of a foundation for use in constructing a roof;

FIG. 2 illustrates the foundation of FIG. 1 with an air bladder spread substantially across the full area of the foundation;

FIG. 3 illustrates the foundation and bladder of FIG. 2 with building components positioned in accordance with the invention;

FIG. 4 illustrates the foundation, bladder, building components and a weight positioned over the center of the structure;

FIG. 5 illustrates the structure shown in FIG. 4 with air under pressure being forced into the bladder to raise the structure formed by the blocks and wedges into a roof configuration;

FIG. 6 illustrates the structure shown in FIG. 5 with the bladder fully inflated and the weight removed from the center of the structure;

FIGS. 7 - 12 are a modification of the invention shown in FIGS. 1 - 6 wherein FIG. 7 is a cross-sectional view of the foundation and an air inlet pipe extending therethrough;

FIG. 8 is a view similar to FIG. 7 wherein an uncured mixture of plastic material is being sprayed over the foundation;

FIG. 9 is a view similar to FIG. 8 wherein yielding wire net or mesh is being placed over the plastic material;

FIG. 10 is a view similar to FIG. 9 wherein the yielding wire mesh is formed around the foundation and plastic material, and a hollow ring is positioned above the foundation for insertion around the foundation;

FIG. 11 illustrates the structure shown in FIG. 10 with the ring in place and air being forced through the inlet pipe underneath the yielding wire mesh and plastic material;

FIG. 12 is a view of the dome formed by the construction shown in FIGS. 7 - 10 and the air under pressure being normalized in the dome structure after curing of the plastic material;

FIGS. 13 - 17 illustrate details of the building blocks and wedges that may be used in forming the dome structure shown in FIGS. 1 - 6 wherein FIG. 13 illustrates a front view of a number of building blocks, wedges and cone-shaped guides;

FIG. 14 is a top view of an assembly of building blocks, wedges and cone-shaped guides;

FIG. 15 is a partial view of the building blocks and wedges in interlocking position;

FIG. 16 is a partial top view of the center of a dome formed of the building blocks and wedges shown in FIGS. 13, 14 and 15;

FIG. 17 is a perspective view of the building blocks showing in more detail the wedge and guide structures;

FIG. 18 illustrates a partial view of a modification of the building blocks shown in FIGS. 13 - 17 and shown in their assembled but unlocked position;

FIG. 19 illustrates a view of the building blocks and wedges shown in FIG. 18 in interlocked position; and

FIG. 20 is a modification of the assembly of the air pressure system disclosed in FIGS. 1 through 6 and 13 through 19 wherein spring means are shown for biasing the blocks and wedge structures together.

DESCRIPTION OF PREFERRED EMBODIMENT

Referring more particularly to the drawing by characters of reference FIGS. 1 - 6 disclose a new and improved roof structure 25 and method of forming it. The roof structure is formed of a plurality of building components, units, modules and the like such as, for example, blocks 26 held together by a plurality of wedges 27.

As shown in FIG. 1 the dome structure 25 is formed on a slab 28 setting on a firm foundation such as solid ground 29. The slab may be circular in area configuration and is provided with a ridge 30 around its edges.

FIG. 1 illustrates a cross-sectional view of the ridge showing that it is anchored below the slab 28 and extends above the slab and laterally thereto. The slab 28 and ridge 30 may be formed of concrete. If so desired the ridges 30 could be omitted and in place thereof grooves may be provided in the slab or surrounding ground support.

As shown in FIG. 2 the slab 28 is then substantially covered with a balloon or bladder 31 which is provided with a nozzle 32 for air intake purposes.

FIG. 3 illustrates the assembly of a plurality of building blocks 26 and cooperating wedges 27 upon the surface of bladder 31. These building blocks and wedges are shown more clearly in FIGS. 13-17. Each building block 26 may comprise a hollow cylindrical body 35 as shown in FIG. 13 of from substantially 1.5 to 3 inches or 15 to 30 inches in length with an outer concave surface 36 or a body 37 having a straight longitudinally extending surface 38 as shown in FIG. 17. The hollow cylindrical bodies 35 and 37 may be formed out of suitable plastic, ceramic or concrete materials which are capable of withstanding all types of weather conditions. As noted from FIGS. 3, 13 and 17 each block may be provided with a detachable top 39 comprising a cone-shaped configuration 40 having a cylindrical bottom 41 which has a diameter slightly smaller than the inside diameter of the hollow interior of the cylindrical bodies 35 and 37.

This top 39 not only serves as a cover for the opening in the cylindrical body but also serves as a guiding surface when wedges 27 are inserted in an assembly of cylindrical bodies as hereinafter explained.

As shown in FIGS. 3 and 13 the building blocks 26 whether of the configurations of bodies 35 or 37 are placed in side by side relationship and the wedges 27 are assembled on their upper most ends so as to drop by gravity or other force between the building blocks when they are separated.

Wedges 27 may be formed from a longitudinally extending body member having a triangularly shaped cross sectional area wherein the outside edges of the triangle are each deformed to provide a convex surface 45 having a curvature similar to the curvature of the outside surface of the building blocks 26. Since these surfaces 45 are of a similar curvature to the outside periphery of the base of the cones 40 of the tops 39 the tops serve as a guide for properly placing the wedges in position between the blocks.

After the building blocks 26 with the tops 39 in place on the ends of at least most of the building blocks have been arranged, as shown in FIG. 3, the wedges 27 are positioned on top of and between all juxtapositioned building blocks. One wedge will be positioned between three cylindrical building blocks 26 as shown in FIG. 14.

FIG. 4 illustrates the next assembly step of placing a suitable weight such as a pliable bag of a given size and containing a given quantity of water over the center of the assembled building blocks and wedges. This weight is intended to retard the upward movement of the assembly of the building blocks as they are elevated into position until the periphery of the geometrical configuration starts to expand. The quantity of water may be varied during use to control expansion.

Air under pressure is then forced into the bladder 31, FIG. 5, to gradually expand the assembly of building blocks 26 and wedges 27 so as to spread the building blocks to cause the wedges to fall under gravity or other force between them.

FIG. 5 illustrates the assembly of the building blocks 26 and wedges 27 with air under pressure partially filling the bladder. It should be noted that the wedges are starting to slip between juxtapositioned building blocks.

FIG. 6 illustrates the arcuate configuration formed by the building blocks 26 and wedges 27 in elevated position with the weight 46 removed. The bladder 31 is fully expanded. At this point in erection, the building blocks 26 and wedges 27 are in compression and exert lateral pressure or thrust on the ridges 30 anchored around the slab 28. The bladder may now be deflated and removed so that the building may be used.

Although the hollow building blocks 26 are shown as being cylindrical in shape any other suitable geometrical configuration can be used such as, for example, frustums and polyhedrons. The polyhedrons may have four or more faces and be hollow or solid in construction. The wedges must conform to the outward configuration of the style of blocks used.

FIGS. 7-12 illustrate a modification of the structure and method of assembly shown in FIGS. 1-6 wherein a slab 50 of concrete or like material is formed for supporting and forming the floor of a roof construction 51 shown in FIG. 12. The slab 50 is provided with an air inlet and exhaust pipe 52 which may be selectively connected to a source of fluid under pressure and the atmosphere. The slab is formed in a geometrical configuration similar to the base of the roof so that it may serve as the floor of the resulting building.

This slab is then sprayed with a suitable material 53 such as wet concrete or plastic (FIG. 8) which hardens relatively slowly over a limited period of time. Over this coating is placed an expandable wire net or mesh 54 which is intended eventually to sink into the concrete or plastic material 53 and accordingly is placed over and formed around the concrete or plastic material as shown in FIG. 10.

A hollow ring shape form 55 which may be metallic or any other suitable inelastic material is placed over the slab 50, concrete or plastic material 53 and mesh 54 so as to tightly bind and hold the mesh 54 and material 53 around the edges of slab 50. Although a ring shaped form is shown any other suitable restraining means may be used.

Air under pressure is now forced through pipe 52 to the under side of the concrete or plastic material 53 and forces the material and mesh 54 to form a concave dome like configuration. Since the consistency of the material is intended to be air tight an impervious material coating between the slab and material 53 is not intended. However, if this was not found to be the case with the material used, then such an impervious material 56 (FIG. 7) should be placed over the slab before the material 53 is sprayed or placed upon it.

As the air under pressure builds up under material 53 the mesh 54 settles into material 53 to form a dome configuration 51 which hardens to a strong impervious structure. After the material 53 has hardened air under pressure in dome configuration 51 may be exhausted to atmosphere.

FIGS. 18 and 19 illustrate a further modification of the structure and method of assembly shown in FIGS. 1-17 wherein a plurality of building blocks 60 in the form of bottle shaped configurations having a base 61, cylindrical body portion 62, tapered cone-shaped neck portion 63, cylindrical neck portion 64, and a top 65. The tops 65 of the bottle shaped building blocks 60 are hung from a sheet of substantially elastic material 66 as shown in FIG. 18. The material may be apertured prior to inserting the building blocks in an assembled arrangement or perforated during assembly as the need requires. In each instance suitable wedges 67 as shown in FIGS. 1-6 and 13-14 are arranged between juxtapositioned building blocks 60. These wedges may be shaped as shown in FIG. 17 so that they tightly hug the outer configuration of the bottle shaped building blocks when they are arranged between the cylindrical body portions 62 of juxtapositioned building blocks.

When an assembly of the building blocks 60 are arranged to extend from apertures in material 66 and wedges 67 are arranged along the cone-shaped neck portion 63 of these blocks as shown in FIG. 18, air under pressure is inserted under material 66 in a manner similar to that described for FIGS. 7-12. The material 66 shapes itself in a dome configuration if its free circumferential edges are held down firmly to the ground. The wedges 67 then drop into place between the portion 62 of the building blocks 60 and lock the structure together as heretofore explained.

FIG. 20 illustrates one way in which the wedges 27 and 67 may be aided in assuming their interlocking position and comprises a spring shape tripod harness arrangement 70 having a free end connected one to each side of the top of the wedge. At the apex 71 of the harness 70 is arranged a ring which forms an anchor for one end of three springs 72. The other end of each spring 72 is fastened to the top of a different building block. Since these springs are biased to force the wedge between juxtapositioned building blocks it aids the forces of gravity in interlocking the building block together in an arcu-

ate like configuration. After the roof is finished and the wedges are interlocked together the springs and harness may be removed from the building blocks and reused, if so desired.

Although but a few embodiments of the present invention have been illustrated and described, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

What I claim is:

1. A method for assembling a roof structure comprising the steps of:
 - placing a platform having a restraining means on a solid foundation;
 - covering the platform with an impervious material formable into an arcuate configuration;
 - placing a plurality of substantially identical blocks on said impervious material on end in side by side juxtapositioned arrangement;
 - placing a plurality of wedges on top of and at each of the junctions of said blocks;
 - forming said impervious material by applying fluid under pressure underneath it to raise said material causing said blocks to separate and said wedges to slip between said blocks, said impervious material forming into an arcuate configuration causing said blocks and said wedges to form an arcuate configuration; and
 - exhausting fluid under pressure from underneath said material to atmosphere wherein said blocks and wedges are in compression exerting lateral thrust on the restraining means of said platform.
2. The method set forth in claim 1 in further combination with the step of removing said impervious material from said roof structure upon exhaustion of said fluid under pressure.
3. The method set forth in claim 1 wherein said impervious material comprises a bladder and said bladder is inflated by fluid under pressure to raise said blocks and wedges until they form an arcuate configuration in compression exerting lateral thrust on said restraining means of said platform.
4. The method set forth in claim 1 in further combination with the step of guiding each wedge between juxtapositioned building blocks.
5. The method set forth in claim 1 in further combination with the step of biasing each wedge between juxtapositioned building blocks.
6. The method set forth in claim 1 wherein a plurality of substantially identical cylindrical building blocks are placed in side by side arrangement on said impervious material.

7. The method set forth in claim 1 wherein a weight of variable mass is placed over the center of the identical blocks for retarding expansion in a predetermined manner.

8. The method set forth in claim 1 including: attaching said blocks to said impervious material before applying fluid under pressure underneath the impervious material.

9. The method set forth in claim 8 wherein the blocks attached to the impervious material project downwardly from the bottom side of the impervious material and said wedges are located below said impervious material.

10. A method of making a convex curved structure comprising: providing a surface to be covered by the structure, placing on said surface a fluid impervious means formable into a curved configuration, associating a plurality of block means with said impervious means in side-by-side juxtapositioned arrangement, locating a plurality of wedge means adjacent upper portions of and at the junctions of adjacent block means, forming said structure by subjecting said fluid impervious means to fluid under pressure to raise said fluid impervious means, the block means and the wedge means from the surface into a convex curved configuration causing the block means to separate from each other and said wedge means to move between said block means, and exhausting the fluid under pressure from said fluid impervious means wherein said block means and wedge means cooperate with each other to maintain the convex curved configuration of the structure.

11. The method defined in claim 10 including: placing weight means on the block means before the forming of structure to a curved configuration.

12. The method of claim 10 including: removing said fluid impervious means from said structure after the fluid under pressure has been exhausted from the fluid impervious means.

13. The method set forth in claim 10 including: attaching said block means to said impervious means before applying fluid under pressure underneath the impervious means.

14. The combination set forth in claim 13 wherein: the block means attached to the impervious means project downwardly from the bottom side of the impervious means and said wedge means are located below said impervious means.

15. The method defined in claim 10 including: biasing each wedge means to a position between adjacent block means during the formation of said structure.

16. The method of claim 10 including: providing apertures in said fluid impervious means, and projecting a portion of said block means through said apertures to support said block means on the fluid impervious means.

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