METHOD OF CONSTRUCTING A BUILDING

Filed Oct. 28, 1971

FIG. 1

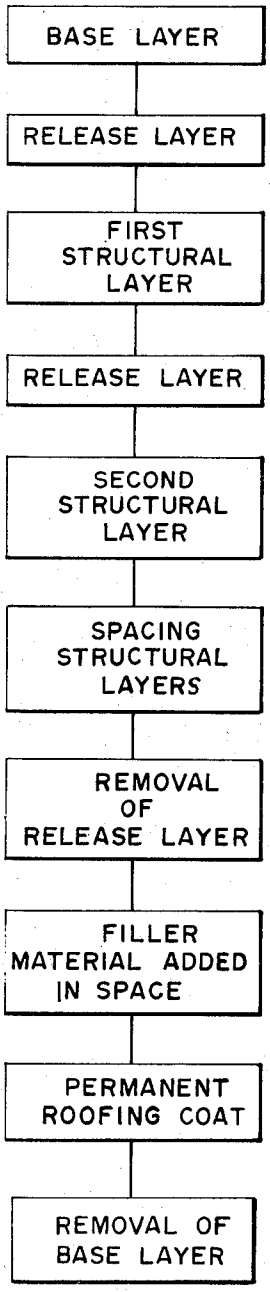


FIG. 2

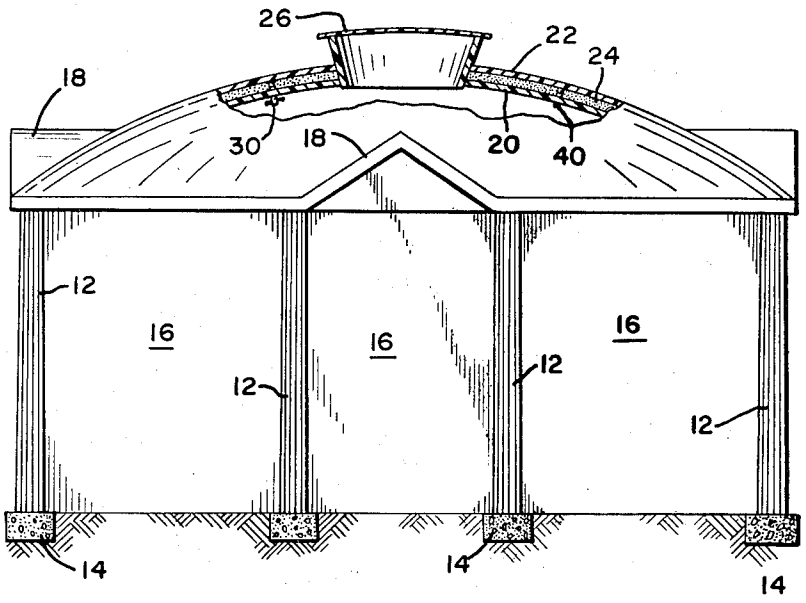


FIG. 3

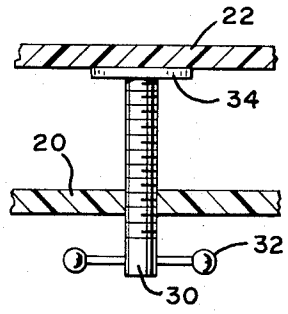


FIG. 4

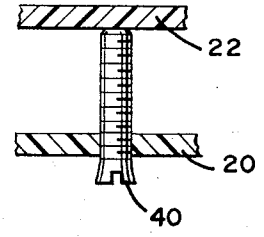
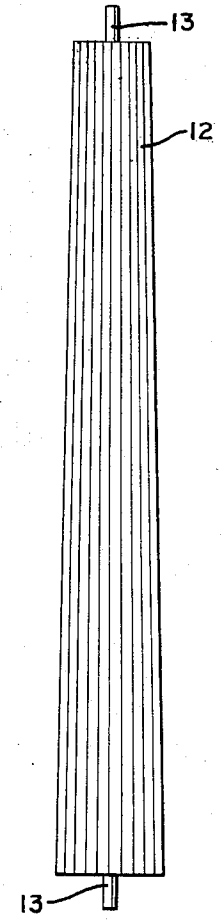


FIG. 5



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3,801,685

METHOD OF CONSTRUCTING A BUILDING

Robert C. Bell, Jr., 528 Main St.,
New Canaan, Conn. 06840

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ABSTRACT OF THE DISCLOSURE

A building having, at least in part, a domed surface is constructed by erecting side walls supported between vertical columns and then providing two structural roof layers spaced from each other with filler material between these layers. The structural layers are made in situ using fluent material which solidifies. The lower layer serves as the mold for the upper layer and means are used to pry the upper layer loose and lift it from the lower layer. The filler material suitably comprises a polymeric plastic compound foamed in situ.

CROSS-REFERENCE TO RELATED APPLICATION

This patent application is related to my copending application for U.S. Letters Patent entitled "Method of Constructing a Building" Ser. No. 82,308 filed Oct. 20, 1970, now abandoned.

BRIEF SUMMARY OF THE INVENTION

My copending patent application describes a method of constructing an economical, practical and attractive building having, at least in part, a curved or domed roof surface constructed in situ. For this purpose an inflated membrane is used which acts as a base upon which material adapted to harden in situ is laid or sprayed. Material of this type may comprise a mixture of fiber glass and epoxy, plastic resins, concrete and the like which upon solidification retain the curved shape so that the membrane can be removed and a free standing structural layer supported only by the side walls of the building is achieved.

The present invention discloses an improvement in that two structural layers of this type are formed with a filler or insulating material disposed between both structural layers for the purpose of providing improved rigidity and thermal insulation. Moreover, a roof structure of the type described hereinafter may be provided with a more permanent and sturdy roofing layer, such as sprayed-on cement, for achieving an extremely rugged, sturdy and permanent structure.

The invention, furthermore, discloses the use of vertical columns which are readily transportable and erected in situ, thus achieving a simple and economical construction, yet one which is pleasing in appearance and economical and easy to fabricate.

Other features of the present invention will be more clearly apparent by reference to the following description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a tabulation of the steps for providing a roof structure in accordance with the present invention;

FIG. 2 is an elevational view, such as the front, of a typical building constructed in accordance with the present invention.

FIG. 3 is a detailed view of a lifting arrangement for spacing two structural layers which form a part of the roof structure;

FIG. 4 is a detailed view showing an alternative lifting mechanism, and

FIG. 5 is an elevational view of a typical vertical column which may be used for constructing the building shown in FIG. 1.

DETAILED DESCRIPTION

Referring now to the drawings and FIG. 2 in particular, a typical building or dwelling is shown which comprises a set of spaced vertical columns **12**, each column resting on a concrete pad **14** whose top surface is at ground level, but which may be elevated above or recessed below ground level as circumstances dictate. The space between the columns **12** is occupied by side wall panels **16** which, preferably, are prefabricated and which may include windows as desired. Alternatively, an entire side panel **16** may form a window which may be fixed or comprise two sections slidable relative to one another. There may be provided also one or more lintels and gables **18** and the like in order to provide a pleasing appearance which may be varied from dwelling to dwelling. The present design can readily use prefabricated portions which are erected at the building site with the roof structure constructed in situ.

The roof, in accordance with the present invention, comprises a sandwich-type assembly which includes a first structural layer **20**, a second structural layer **22** and filler material **24** filling the space between the layers **20** and **22**. In addition, a permanent roofing coat (not shown) may be applied to the top surface of the second structural layer **22**. As desired, a skylight **26** may be disposed in a cut-out of the roof structure, or the roof structure may be thinned and made sufficiently light transmitting so that the desired degree of light entry and light diffusion is obtained.

In order to construct the present roof, the columns **12** and side walls **16** are erected and the columns **12** are lashed or braced together so as to achieve a reasonably stable side wall structure. To provide the first structural roof layer **20**, see also FIG. 1, a base or mold is constructed. Flat or gabled areas of the roof to be constructed are covered with plywood, fiber board or other flat forms and supported or propped into location. Curved or domed surfaces are covered by an air supported membrane or balloon which can be made economically from any suitable paper base material, rubber, plastic, fiber or other air containing or inflatable material as described in the copending patent application supra.

When the desired mold or base is achieved, it will be advisable to apply to the top of this base a layer of release material, such as a coating of silicone material, wax or the like in order to provide a parting line along which this base can be separated and removed after the roof structure has been completed.

The top surface of the base and release layer is then covered with material which is either fluent or has a liquid constituent in order to give it the property of flowing and solidification in the flowed contour and shape. Material of this type includes fiber glass or polymeric plastic resins applied by either the hand lay-up or spray process. A base of burlap or other fabric will be advisable to provide sufficient strength and continuity and to give to the base protection from the chemically generated heat. Suitable filler and reinforcement of the plastic resinous material may be achieved by fabric or woven rovings or mats embedded or laminated or chopped and mixed into sprayed or spread plastic material. One or more of these applications may be required depending upon the consistency of the material and the roof area, i.e. strength requirement. After this first structural layer has been achieved, providing sufficient time for solidification and curing, this first layer is used as a base or mold for a second and very similar layer.

Before proceeding with the second structural layer, a release coating is applied once again to the first structural layer. As described above, a silicone release coating, wax or the like is most suitable and exemplary of many compounds usable for this purpose.

The second structural layer is then prepared substantially as described before in connection with the first structural layer, the material used may or may not be exactly identical, however, it will include a constituent which solidifies in situ. After the second layer is of sufficient thickness and is properly cured, the second structural layer is lifted from the first structural layer. The second hardened layer can be pried up from the edges, but more suitably lift screws are used from the first structural layer against the inner surface of the juxtaposed second structural layer in order to obtain a gradual and more or less even lifting. Such lifting aids are located at points in interior locations and will assist the separation of the second layer at more difficult and less accessible places.

FIG. 3 shows a typical lift screw **30** having a handle **32** and being inserted through the first structural layer **20**. A swiveled push plate **34** is adapted to engage the underside of the second structural layer **22**. It will be apparent to those skilled in the art, that this lifting arrangement must be provided in the first structural layer after the release layer is applied but before the second structural layer is formed. A simpler screw-type lifting arrangement is shown in FIG. 4, using a pushing screw **40**.

When the second structural layer has been separated from the first structural layer and lifted, generally a few inches, it may be suspended over the first layer by pegs, props, lifting screws as shown, blocks or chocks or other means to provide air spaces or interstices. A chemical flushing may or may not be required at this time to remove the release coating or layer previously applied to the first layer which provided the parting line between those layers.

The edges between the suspended structural layers are then sealed or blocked to provide an enclosed area or mold or chamber into which plastic foam or foaming materials are poured or injected. Due regard must be had for the high temperatures often developed by such chemical curing processes and interactions so that the structural layers are not unduly weakened. The plastic foam or foaming materials act as filler material to provide structural strength and thermal insulation. The roof assembly obtained in this manner is then essentially a sandwich construction comprising two structural layers, which may be slightly flexible, with filler material therebetween to provide structural strength and rigidity as well as thermal insulation.

As necessary and if desired, a permanent roof layer may then be applied to the previously provided structure. This layer may include suitable reinforcing bars and portland cement laid on by pouring or spraying, the latter being known also as the gunite method. Chemical incompatability between plastic compounds and the concrete (lime) must be investigated and avoided. This may be accomplished also by using an intervening coating of asphalt, rubber or other protective material.

Finally, the base material is removed, unless removed previously.

It should be recognized that the weight and thrust of a pitched roof carries outward as well as downward. The outward thrust must be contained, in the case of large domed surfaces by a constricting ring, and in the case of a pitched flat or linear area by tie rods, beams or buttresses. The outward thrust and the consequent engineering problems are minimized, of course, by the light weight of the roof contoured to provide a high strength to weight ratio.

A substantial advantage of the first molded structural layer resides in the fact that once it is created, successive layers can be made using the first layer as a mold. The layers either wholly or in the form of cut sections can be transported to other sites, placed upon similar side wall structures, sealed along the edges and used as a new first structural roof layer. The steps recited heretofore are then repeated.

Similarly, the sandwich-type roof structure, numerals **20**, **22** and **24**, can be cut into sectional panels and removed from their place of manufacture or old location along with doors, sidewall panels, pillars, lintels, pediments, windows, skylights, etc. and then can be reassembled, disassembled and reassembled as living requirements and location changes dictate.

The construction of the columns **12** merits special mention. The design provides for a fluted and somewhat tapered column of poured concrete of special shape as shown in FIG. 6. The core is a round pipe **13** projecting slightly at both ends and of a diameter which can slip and fit into a matching female hole or pipe embedded in a pad in the ground. The column has groves or slots into which glass sidewall doors or panels are fitted and caulked. The columns are more difficult, expensive and subject to manufacturing defects if they are fluted and/or tapered but this design produces a more classical and attractive effect. The taper is from the bottom to the top and is not precisely straight. It may bulge or is slightly convex toward the top to provide a better optical effect and to avoid a concave appearance. Suitable reinforcement of the aggregate may be devised from coiled or round reinforcement screen. Attractive surfacing of marbleized design may be superimposed. This may be achieved by modern plastic sheet or coating material joined to the columns by suitable inert materials. The columns are quickly erected by slipping the lower end of the projecting pipe **13** into the matching post-holes in the pad **14**. Panels between the columns are then slipped into place and a connecting ring, wire or bar run from the top of each column to adjoining columns around the perimeter of the structure to lash the columns in place and to counteract the outward thrust of the pitch of the roof. The columns may also be affixed by cementing them to the pad or footing or, if future removal and transference of the house is contemplated, the column may be seated on a plastic circle or doily or similar material to avoid adhesion and then secured merely by a cement collar, ring or base poured into a frame or mold around the base, which collar or base may be subject to easy breakage and subsequent removal as needed.

The pediments and lintels of the structure shown in the drawing do not carry structural weight and can be economically and easily designed and cut from standard plastic foam panel sections, or they may be specially designed to size on a mass production basis and specially-poured, if need be, where a suitable number of similar structures or units are in production.

It is often desirable to have light sources or lighting panels in addition to transparent sidewalls, skylights or artificial lighting sources. The roof structural layers previously described may be made as transparent or as opaque as the builder may desire, depending on the choice of plastic, filler, coating, pigments, or other materials which may be used. However, there is another method of lighting control which should receive consideration, namely the density and character of the air or gas bubbles embedded in foam plastic. Light rays or beams striking a transparent or translucent body or surface suffer a prismatic effect. They tend to be reflected or refracted at an angle to the surface. In a foam sheet they tend to pass through the body at right angles to the surface instead of at a direct angle, partly because it is the shortest distance through the body. Air or gas bubbles give translucene to an otherwise transparent sheet. Their density or frequency can be regulated to give varying degrees of opaqueness or translucency. Translucence gives dispersion to a light source. A translucent dome tends to focus

or direct the light rays toward the center of the dome. By reflecting or refracting or focusing or directing light rays downward and centrally instead of sideways, a translucent roof provides diffuse yet adequate overhead lighting and eliminates light glare from lower and more distant roof areas which may be within the field of vision. Foam panels become opaque if their thickness is increased much beyond one-half inch with any substantial number or proportion of gas or air bubbles. If translucency is desired and opaqueness avoided, the foam plastic portion of the roof must be kept thin. Of course this causes a proportionate decrease in strength and insulating qualities of the roof structure.

Changes in lighting and/or thermal control can be achieved if sections and/or layers of multiple roof laminates are made removable. Interlocking or fastened sections of a multiple layer roof or an entire layer of such a roof can be removed and/or replaced much like storm windows, depending on whether translucency or additional roof insulation is desired in varying periods of hot or cold weather or seasons of the year.

It will be apparent to those skilled in the art that I have described the construction and a method for providing a house or houses of classic design employing modern materials and using components which will enable persons of moderate skills to put together an attractive do-it-yourself home at a minimal cost.

What is claimed is:

1. The process of providing a roof comprising in combination:
- providing a substantially horizontally positioned base contoured to conform to the underside of said roof;
- applying sufficient material having at least in part a fluent component adapted to solidfy in situ upon the top surface of said base to provide after solidification thereof a first layer over said base;
- applying after solidification and curing of said first layer upon said first layer sufficient material having at least in part a fluent component adapted to solidify in situ to form after solidification thereof a second layer over said first layer;
- separating and spacing after solidification and curing of said first layer from said second layer to provide a space between said layers;
- filling the space between said layers with filler material to provide a sandwich structural assembly.

2. The process of providing a roof comprising in combination:
- providing a substantially horizontally positioned base contoured to conform to the underside of said roof;
- applying sufficient material having at least in part a fluent component adapted to solidify in situ upon the top surface of said base to provide after solidification thereof a first layer over said base;
- applying after solidification and curing of said first layer a layer of release material upon the top surface of said first layer;
- applying upon said layer of release material sufficient material having at least in part a fluent component adapted to solidify in situ to form after solidification thereof a second layer of release material;
- separating and spacing after solidification and curing of said second layer said first layer from said second layer, said release material forming substantially the parting line;
- sealing the peripheral space between said spaced layers, and

- filling the space between said spaced layers with filler material to provide a sandwich structural assembly.

3. The process as set forth in claim 2, including the steps of spacing said second layer from said first layer comprising elevating said second layer relative to said first layer and supporting said second layer distanced from said first layer.

4. The process as set forth in claim 2 and including the step of substantially removing said layer of release material from said first layer before filling the space between said first layer and second layer with filler material.

5. The process as set forth in claim 4, said step of removing said layer of release material comprising a flushing process.

6. The process as set forth in claim 2, said filler material being plastic foam.

7. The process as set forth in claim 2, said filler material comprising fluent plastic material adapted to foam and solidify in situ.

8. The process as set forth in claim 2 and including the additional step of applying a layer of material upon said second layer after filling said space with filler material.

9. The process as set forth in claim 8, said layer of material being applied upon said second layer comprising cement.

10. The process as set forth in claim 2, said first layer and second layer comprising at least in part fiberglass material.

11. The process, as set forth in claim 2, said first layer and said second layer comprising at least in part polymeric plastic material.

12. The process as set forth in claim 2 and including the further step of providing a layer of release material on said base prior to applying said material adapted to solidify to said base to provide said first layer.

13. The process as set forth in claim 12 and including the step of separating said base from said solidified first layer after said sandwich assembly has been formed, said layer of release material between said base and first layer forming substantially the parting line.

14. The process as set forth in claim 2 and including the additional steps of cutting said sandwich structural assembly into portable sections adapted to be reassembled, and reassembling said sections at a different site.

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DONALD E. CZAJA, Primary Examiner

R. W. GRIFFIN, Assistant Examiner

U.S. Cl. X.R.

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