

Aug. 9, 1960

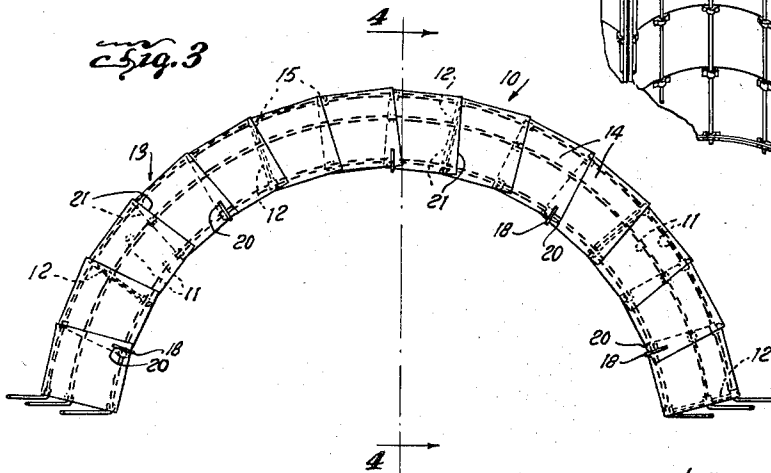
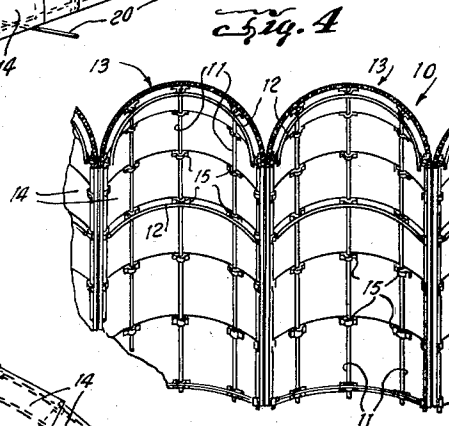
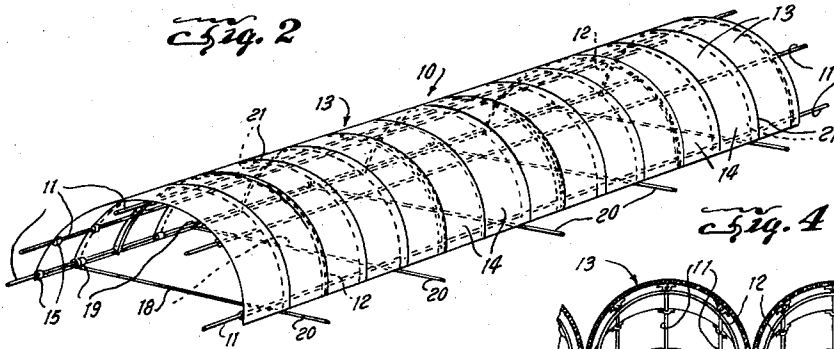
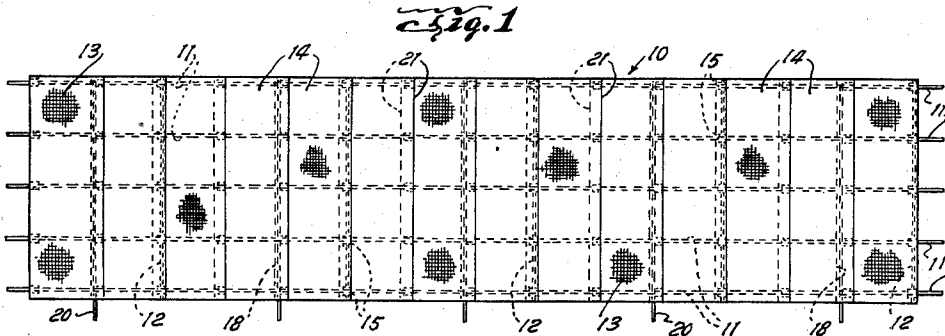
L. F. PEELER ET AL

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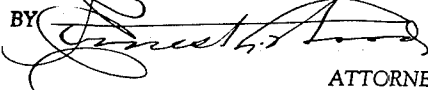
METHOD OF BUILDING STRUCTURES

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3 Sheets-Sheet 1



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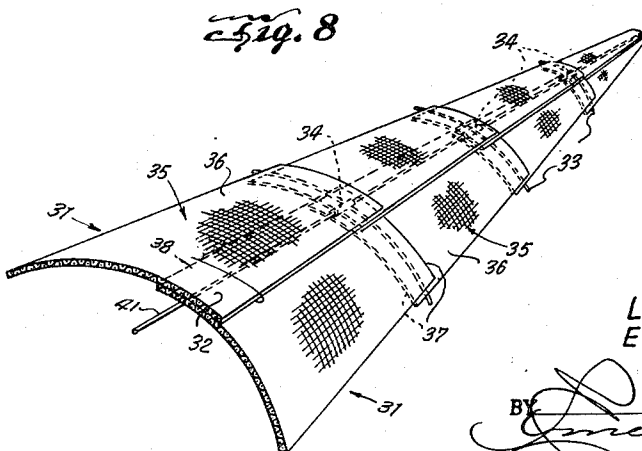
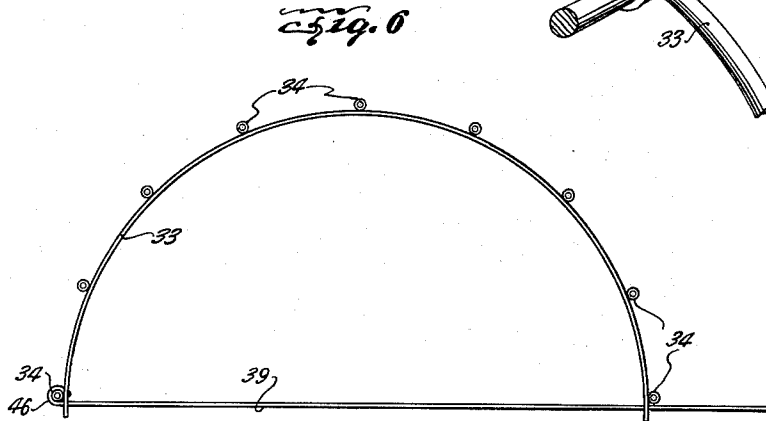
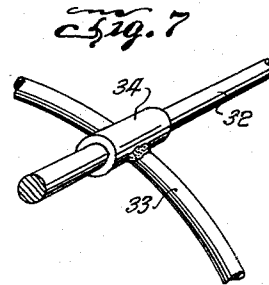
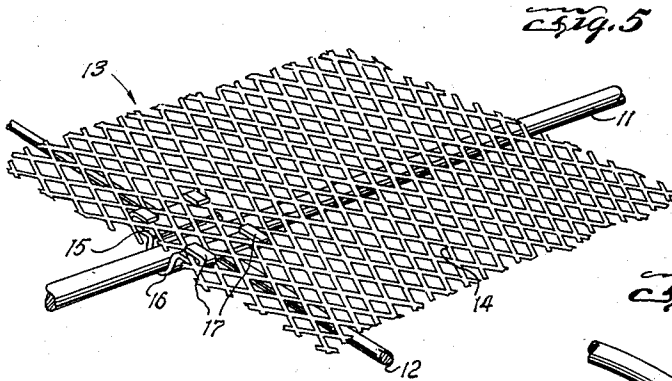
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METHOD OF BUILDING STRUCTURES

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3 Sheets-Sheet 2



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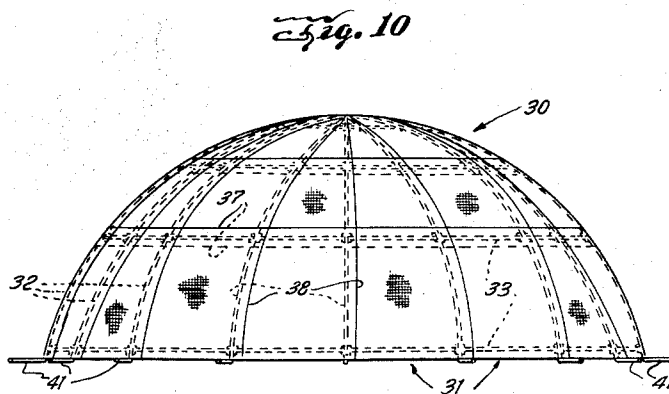
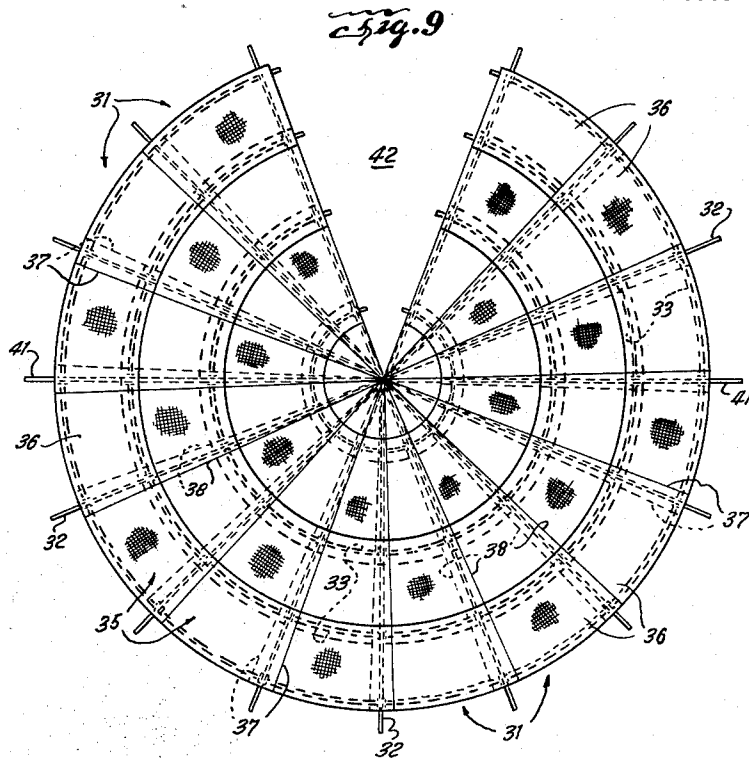
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METHOD OF BUILDING STRUCTURES

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3 Sheets-Sheet 3



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METHOD OF BUILDING STRUCTURES

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2 Claims. (Cl. 25-154)

This invention relates to shell type concrete building construction and it refers more particularly to the method by which individual units may be produced as well as to the method of combining the units in erecting a building.

The principal object of the invention is to improve upon known methods of erecting shell type buildings by first creating a new basic unit composed of a frame-work of relatively slidable and intercrossing rods and a covering consisting of rows of correlated overlapping sections of expansible flexible material so connected to the frame-work as to permit the sections to move independently and collectively, thus to assume the curvature of the rods along two transverse axes as the rods are bent into the shape in which they are to remain in association with like assemblies in a completed building.

Another object of the invention is to provide a shell type building composed of a multiplicity of interconnected flexible units which are prefabricated on a flat plane where they are arcuated along their minor axes and hoisted into the relative positions they will assume as the frame-work of the completed building, during which each unit is arcuated along its major axis, if the building is to be dome-shaped, tubular or of other designs involving compound curves. Subsequent to the erection of the building units individually or collectively to complete the building frame-work, a plastic or cementitious material is shot onto or otherwise applied to the fabric covering which hardens and permanently integrates the assembly into a structure capable of withstanding all normal compressive stresses without need for the supporting and reinforcing mediums common to conventional buildings.

Still another object of the invention is to provide a structural unit as specified, whose initial configuration predetermines the ultimate shape of the building of which it forms a part, whether the building is to be a warehouse, airplane hangar, shelter or even a spheroid, the latter being composed of two dome-like or hemispherical structures anticipated herein.

Other objects will appear as the description proceeds when considered with the annexed drawing wherein:

Figure 1 is a top plan view of a typical structural unit in its initial stage of construction.

Figure 2 is a perspective view of the unit shown curved along its major or longitudinal axis as the second stage of its formation.

Figure 3 is a side elevational view of the unit on a slightly reduced scale, shown curved along its minor or transverse axis.

Figure 4 is a transverse sectional view taken on line 4-4 of Figure 3.

Figure 5 is a fragmentary perspective view showing intercrossing rods of the frame, a retaining clip therefor and a section of the fabric covering.

Figure 6 is an end elevational view of a unit comparable to the showing in Figure 2, devoid of the fabric covering but revealing a slightly modified form of retaining means for the rods.

Figure 7 is a fragmentary perspective view of the rod retaining means shown in Figure 6.

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Figure 8 is a perspective view of two modified structural units, each composed of a plurality of progressively tapered fabric cover sections in slidable overlapping relationship.

Figure 9 is a plan view of an assembly of the structural units shown in Figure 8 in the initial stage preparatory to springing into the position shown in Figure 10, and

Figure 10 is a side elevational view of the supporting fabrication of a dome shaped structure formed by the assembled units of Figure 9, preparatory to receiving the cementitious coating.

Continuing with a more detailed description of the drawing, reference is made primarily to Figures 1 to 5 wherein reference numeral 10 denotes generally what is herein referred to as a building unit or a structural unit, of which several are employed in juxtaposed and interconnected relationship to form the supporting fabrication of a building whose shape is determined by the configuration of the individual unit 10, as will become apparent as the description proceeds.

Each structural unit 10 is composed primarily of a plurality of longitudinally parallel rods 11 and a plurality of intercrossing transverse rods 12. Overlying the assembly of rods 11 and 12 is a fabric covering, generally indicated by reference numeral 13 but which is actually in overlapping, slidable sections, each identified by reference numeral 14.

The rods 11 and 12 are placed on a flat surface in the relationship shown in Figure 1 and the sections 14 of the fabric covering 13 are attached to the rods at the points of intersection by means such as the clips 15, one of which is shown on an enlarged scale in Figure 5. It will become evident presently that the rods 11 must be slidable in relation to the fabric cover sections 14, hence the clip 15 is formed with a loop 16 (Fig. 5) through which these rods 11 slide longitudinally. Since the fabric 13 is expendable, the rods 12 extending across the short axis of the fabric covering can be and are affixed to the clips 15, as by welding and the clips 15 are secured to the cover sections 14 by means of the legs 17, Figure 5, which extend through and are bent upon the fabric.

The described elements of the structural unit 10 are assembled over a plurality of transverse parallel base rods 18. The ends of the rods 18 along one side of the assembled unit 10 are secured to the adjacent outermost longitudinal rod 11 by any suitable means such as having the ends 19 (Fig. 2) bent around said outermost rod 11. The opposite edge of the structural unit 10 need not be connected to the transverse base rods 18 since the covering 13 is to be warped or arcuated, as shown in Figure 2 along the longitudinal axis of the unit by exerting a force laterally against the edge of the unit opposite the anchored points 19 of the base rods 18. This is done by any suitable tool but preferably by ratchet jacks, not shown, which are attached to the base rods 18 and advanced thereon toward their anchored ends 19, meanwhile engaging the free edge of the cover 13, causing the said cover and the transverse rods 13 to bow upwardly between the sides of the unit 10 in the manner shown in Figure 2. When the required curve obtains, the free edge of the unit 10 is suitably tied to the transverse base rods 18 or their opposite ends 20 (Fig. 3) may be bent upwardly against the sides of the now arcuated unit to prevent recoil.

It is to be observed in the several figures that the sections 14 of the fabric cover 13 have their adjacent edges 21 overlapped. This is done in order that the sections 14 may individually shift their positions to compensate for the curvature imposed in the longitudinal rods

11 when the unit 10 is bowed along its transverse or minor axis, as shown in Figure 3.

There are many ways in which the units 10 can be brought into the shape shown in Figure 3 and since this would be obvious to those skilled in the art, it is considered adequate to explain that the most suitable manner of springing the unit would be by means of a crane hoist with cables connected at strategically shaped points along the length of the unit 10, depending upon the particular curvature of the arch, that is, whether true centered, three centered, cantilevered or other design. This would apply also to the dome structure shown in Figures 8 and 10, which will be presently described.

In constructing a tunnel type structure, such as suggested in Figure 4, whether it be a building, culvert, bridge or other fabrication, the units 10, when preformed in the manner explained or in the shape illustrated in Figure 2, they are progressively joined together by suitable ties and the fabric covering 13 is shot with a cementitious outer covering which, when it hardens, forms a rigid shell which reinforces the supporting fabrication against all normal stresses to which any conventional building is subjected, the greatest of which is compression. No other support is needed to make the structure self-sustaining because of the continuous wall span created by the arcuated units.

It is evident also that the same units 10, constructed and formed in the manner explained, may be disposed on a horizontal plane instead of the vertical plane shown in Figure 3 and joined end to end to form a circle. The circular structures thus fabricated may then be superimposed one upon the other to form a structure in the nature of a silo or grain elevator. Moreover, in any such construction, the units 10 may be arcuated along the major axes opposite to that shown in Figure 3 so that when the units are assembled in a building, the curve on the transverse axes of the units will be concave instead of convex on the exterior of the building.

In Figures 6 to 10, the same method is used in forming the structural units to produce a supporting fabrication in a dome-like building identified broadly in Figure 10 by reference numeral 30. The only difference between the structural units of the modification shown in these figures and those just described being in the configuration of the unit which, in Figures 8 to 10, are generally indicated by reference numeral 31.

The units 31 are identical to each other and each consists of longitudinally coextensive rods 32, converging towards one end of the unit. Intercrossing the rods 32 are transverse rods 33 and to the rods 33 is welded a series of tubular retainers 34 through which the longitudinal rods 32 slide. The expandable fabric covering, generally indicated by reference numeral 35 is composed of progressively tapered sections 36 whose adjacent transverse edges 37 and adjacent longitudinal edges 38 are overlapped (Figures 8 and 9).

In Figure 9 the units 31 are shown assembled on a flat plane such as concrete slab (not shown). The apices of the triangular units 31 meet at the center. As each individual unit 31 is formed, it is sprung into the arcuate form shown in Figure 6 by means of the transverse, longitudinally spaced base rods 39, one end 40 being secured to the outermost longitudinal rod 34 while pressure is applied inwardly all along the the opposite edge of the fabric covering 35. As each unit is thus arcuated along its major axis, its edge is tied in any suitable manner to the adjacent edge of the companion unit.

After all of the units have been assembled in the manner explained, a crane hoist is employed to raise the assembled units to the positions shown in Figure 10. A cable may be connected to the center of the assembly and a series of cables connected at annularly spaced points to the units between their inner and outer ends. By controlling the pull on the cables, the dome-shaped supporting fabrication shown is erected.

As the units 31 are sprung into the shape shown in Figure 10, the individual sections 36 of the fabric covering 35 slide relative to each other both laterally and horizontally to compensate for the changing curvature of the rods 32 and 33. Also, the circumference of the body composed of the radially arranged units 31 becomes smaller, hence the gap 42 in the body (Figure 9) in the flat position of the units, which closes as the units assume their final position in the structure, after which the adjacent edges of the units between which the gap 42 was formed, are joined together.

When the assembly of units has been sprung to the desired shape, the fabric covering 35 is shot with a cementitious composition which, when dry, provides a rigid weathertight shell about the supporting fabrication.

By constructing two identical hemispherical bodies resembling that in Figure 10 and joining these bodies together to form a spheroidal body, a tank may be thus produced which may be supported on a tower or embedded in the earth to contain liquids or solids for storage.

It is evident from the foregoing that the rod retaining members shown in Figures 6 and 7 may be interchangeably used with the structures shown in Figures 1 to 5 and 8 to 10.

Manifestly, the steps of the method herein defined are subject to certain changes and modifications and these are considered to be within the spirit and intent of the invention as long as they fall within the scope and meaning of the appended claims.

What is claimed is:

1. A method of building structures which comprises arranging a supporting fabrication of inter-crossing and relatively slidable flexible elements on a flat plane, attaching expandable fabric covering material to the supporting fabrication, in rows of overlapping, individually movable sections, to form one of a plurality of structural units, exerting a force laterally against one edge of each of the units while restraining the opposite edge of the unit against movement to create a curve in the unit along one axis, hoisting the units successively from relatively spaced points between their ends to cause the units to curve along an axis transverse to the first axis under their own weight, joining the units together along their contiguous edges, and finally applying a cementitious material to the covering material.

2. A method of building structures which comprises providing a supporting fabrication of inter-crossing and relatively slidable rods, attaching a row of overlapping individually movable sections of cover fabric to the supporting fabrication to form a structural unit, restraining the unit along one edge while exerting a force along the opposite edge of the unit to produce a curve therein along one axis, exerting a force on the unit perpendicular to said one axis to produce a curve in the unit along another axis transverse to said one axis, and finally applying cementitious material to the cover fabric.

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