April 5, 1955 B. SHAW 2,705,349

STRUCTURAL ELEMENT FOR PORTABLE BUILDINGS

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Fig. 1.

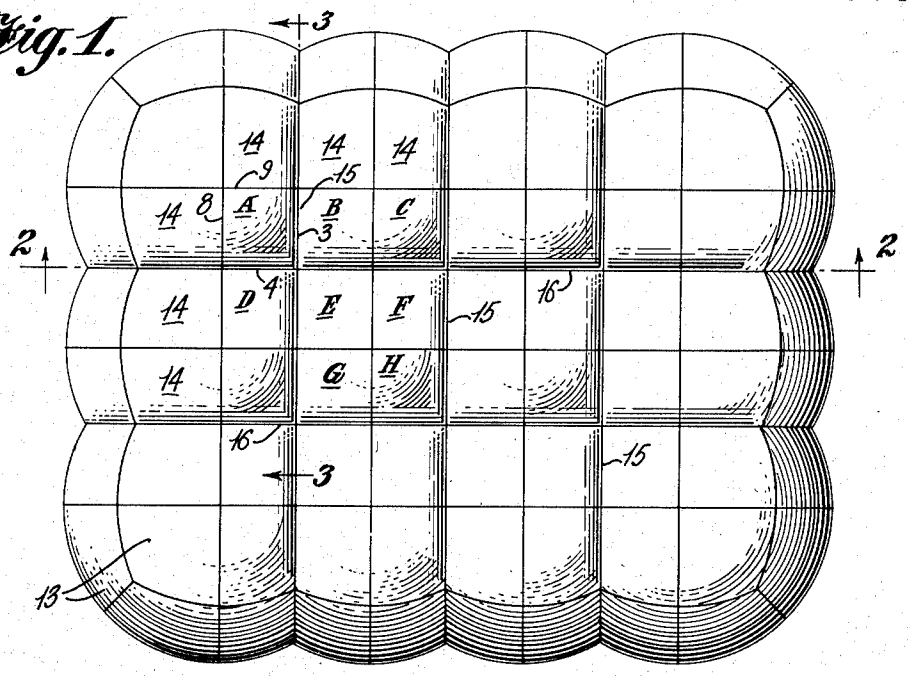


Fig. 2.

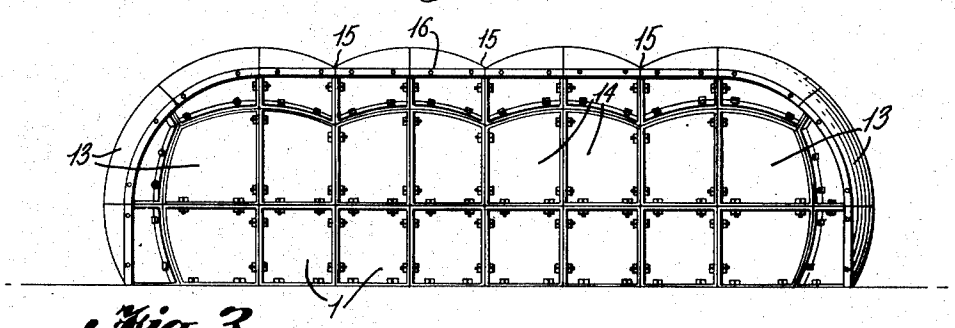
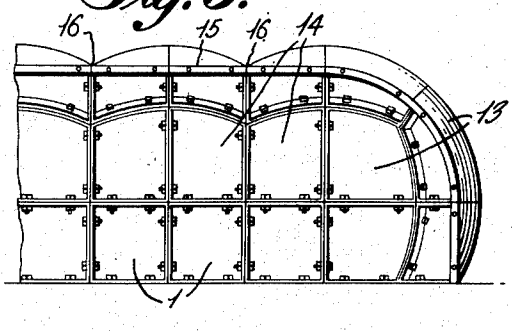


Fig. 3.



INVENTOR
Brackley Shaw

BY Mason, Fenwick & Lawrence
ATTORNEYS

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Fig. 4.

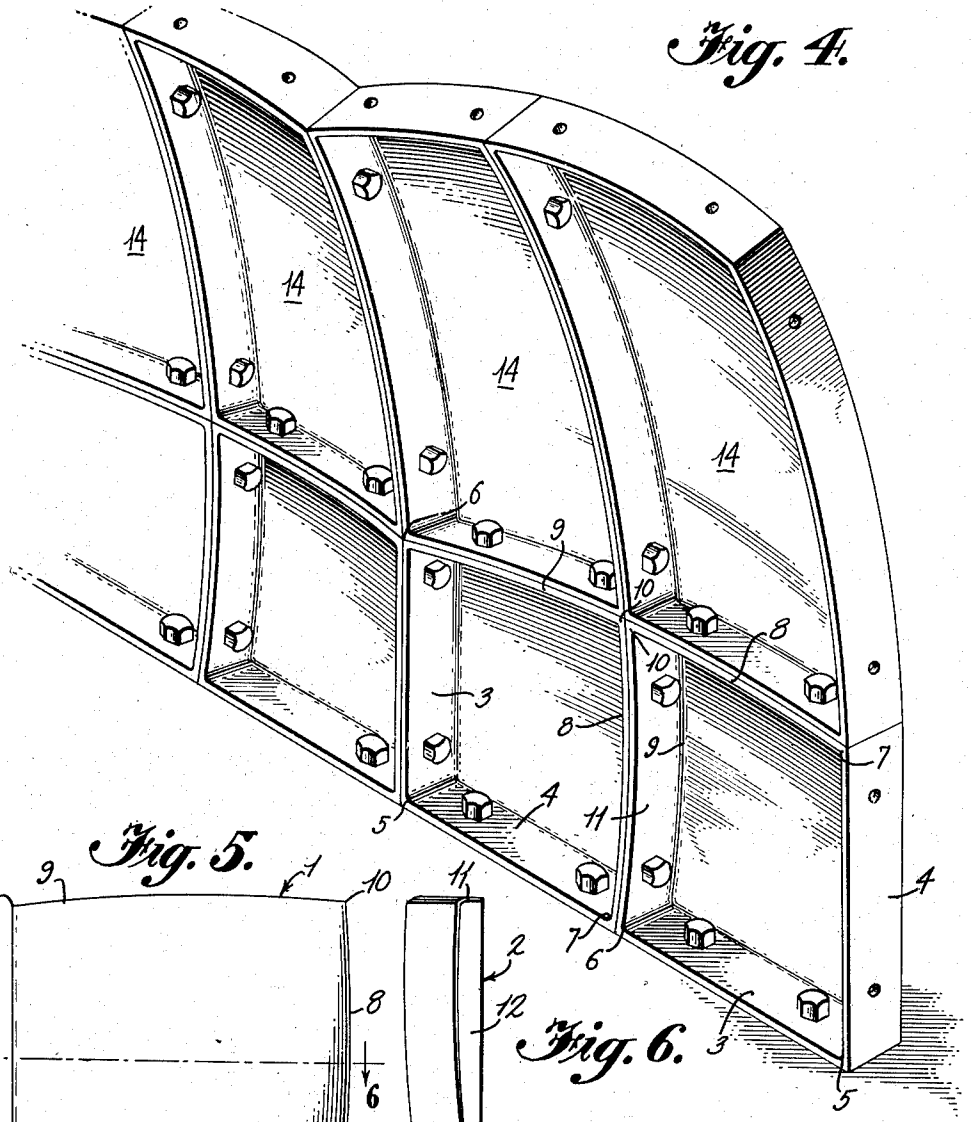
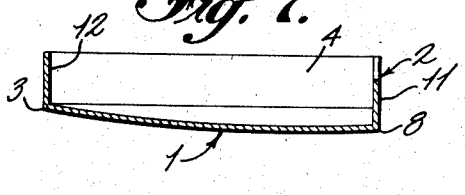


Fig. 5.

Fig. 6.

Fig. 7.



INVENTOR
Brackley Shaw

BY
Mason, Fenwick & Lawrence
ATTORNEYS

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STRUCTURAL ELEMENT FOR PORTABLE BUILDINGS

Brackley Shaw, Washington, D. C., assignor to Spheric Structures, Inc., Washington, D. C., a corporation of Delaware

Application April 20, 1951, Serial No. 222,069

2 Claims. (Cl. 20—2)

This invention relates to shelters having a generally spherical surface or surfaces, and more particularly to a structural unit for use with other units in fabricating such structures.

An application for patent, now pending, in the name of George Bryant Woods, Serial No. 178,961, discloses a series of structural units for producing shelters having spherical surfaces. All of the series, or group, of pieces interfit to form a basic unit which is the aliquot part of a sphere. A number of these basic units may be assembled to form any desired segment of a sphere, and the individual pieces of the series may be used in any desired combination to provide variations from a shelter having the shape of a true spherical segment to ones having spherical surfaces but other than spherical outline.

One of the pieces of the series mentioned above, is substantially square when viewed in plan, and is designed for use in forming the roof of a shelter and the lower part of the side wall when that wall is to be heightened. While this structural piece has many uses, certain results of its use are not desirable. When a plurality of the pieces are connected as roof elements, a depression, or pocket, is formed at the common juncture between four of the pieces. This is due to the spherical curvature of the piece, and the fact that four pieces must necessarily come together at every point of sudden direction change of the surface curvature. Where the piece is of spherical curvature, having sides which are arcs of the sphere, it is possible to erect a substantially flat surface, such as a roof, only by constructing a series of interconnected small domes. Where four of these domes connect, the depressions are formed. These depressions form pockets which catch and hold rain water. When the piece is used to raise the height of a wall, it is placed beneath the pieces of other shape making up the balance of the wall, and the lower edge which results from the use of a plurality of these pieces is scalloped. The inwardly projecting points of the scallop formation cause loss in floor area in the shelter, and do not present a very pleasing floor line.

The aim of the present invention is to eliminate these undesirable features while maintaining all of the structural advantages which a piece of this general outline possesses.

The primary object of this invention is to provide a structural piece which will have the outline of the piece mentioned in the George Bryant Woods, Serial No. 178,961, application, filed August 11, 1950, and therefore will be capable of use in any position in which that former piece is usable, which will provide a plurality of interconnected horizontal gutters for drainage when the pieces are used as roof sections and will provide a straight base edge when used as a side section.

A further object of the invention is to provide such a piece which, when used as a side section, will result in vertical load-bearing members, rather than the in-curved truss members of the above-mentioned pending application.

Other objects of the invention will become apparent from the following description of a practical embodiment thereof, when taken in conjunction with the drawings which accompany and form a part of this application.

In the drawings:

Figure 1 is a top plan view of a shelter having spherical surfaces, in which the structural element of the present invention is employed;

Figure 2 is a vertical, longitudinal section taken on the line 2—2 of Figure 1;

Figure 3 is a vertical, transverse section taken on the line 3—3 of Figure 1;

Figure 4 is a perspective view of a portion of the lower wall of the shelter viewed from the inside;

Figure 5 is a plan view of the improved structural element;

Figure 6 is a side view of the element; and,

Figure 7 is a horizontal section taken on the line 7—7 of Figure 5.

Referring to the drawings in detail, the structural element of the present invention is a curved slab **1**, which is square when viewed in plan, and has peripheral flanges **2** for use in joining the element to other structural pieces.

The surface of the slab is of unusual contour. This is due to the fact that two of the side edges of the slab are straight, when viewed from the side, and the other two edges are curved to conform to great circle arcs of a sphere having the surface curvature of the other structural elements with which the slabs of the present invention are to be used. The straight edges **3** and **4** of the slab are adjacent, and meet at the corner **5**. The edges **3** and **4** lie in the same plane, and, therefore the corners **5**, **6** and **7** all lie in a common plane. The curved edges **8** and **9** rise from this plane so that their intersecting corner **10** is considerably above the plane of the corners **5**, **6** and **7**. The surface of the slab emanates from these edges, and must conform to their contour in their immediate region. In other words, the surface in the vicinity of the curved edges **8** and **9** must have a curvature similar to that of the edges. As these edges are arcs of great circles of the sphere mentioned above, the surface of the slab in the area between these edges will be of compound curvature, or spherical. This surface, then, will be similar to, and form a continuation of, the surfaces of adjacent units in a completed shelter, whether the adjacent units be similar ones or other units of the group defined in application, Serial No. 178,961. On the other hand, the surface of the slab adjacent the straight sides **3** and **4** begins from the straight sides as a plane. The formerly described spherical surfaces and the latter plane surfaces gently merge to form the composite surface of the slab.

In order for the flanges of adjacent units to properly meet when assembling a shelter, these flanges must bear a particular relationship to the surfaces of the respective slabs, if the various units are to be interchangeable. The flanges **11** of the curved sides of the slab must be perpendicular to a tangent to the surface at the point of intersection of the flange and the surface. As these edges are great circle arcs, this arrangement of the flanges will result in the flanges **11** lying in planes which are radial to the sphere whose surface contour the slab has. As a great circle edge of one unit must be placed adjacent a great circle edge of another, the radial disposition of the respective flanges will cause the flange of one unit to be in surface contact with the flange of the next when the surfaces of the adjacent units are so disposed as to be in continuity of one another.

The above-mentioned application, Serial No. 178,961, defines the necessity for having the flanges opposite the great circle edges parallel to the flanges of the great circle edges. The same factor is present here. When two straight edges are abutted, a direction change in surface results, and to properly position the next great circle edge, the opposite flange **12** must be parallel to the great circle flange.

Thus it will be seen that the present invention provides a structural element which has two adjacent sides which are curved to coincide with the edges of the spherical structural elements described in the referred to pending application. The present element also has two straight sides which give it the particular advantages to be described.

Referring particularly to Figures 1, 2 and 3, it will be noted that the unit of the present invention is used only in two positions, as a roof unit, or as a side unit. In the former, the unit will assume a generally horizontal position, and the plane of the corners **5**, **6** and **7** will be truly horizontal. In the latter use, the unit will be vertically

disposed. The corners of the shelter will be composed of the basic unit of the pending application, indicated at **13**, and portions of the side walls a division of that basic unit, the pieces **14**. The sections **14** are used to elongate the structure either lengthwise or widthwise. It will be apparent that any length or width shelter may be obtained by using the units **14** in multiples of two.

To form the roof of this structure, the center space between the units **14** will be filled in with the elements of the present invention. Referring particularly to Figure 1, it will be noted that in the left-hand corner of the roof one of the elements of the present invention, indicated as A, is joined to two of the units **14**. The two curved sides **8** and **9** of the element will be adjacent the two units **14**. Therefore, the surface of the element will curve downwardly from the units **14**, to the straight edges **3** and **4** of the element. A second element B will be placed just to the right of the element A and it will have one of its curved surfaces in contact with the adjacent element **14** and its other curved edge in contact with a curved edge of the next adjacent element C. Still another element indicated at D is placed in position with one of its straight edges abutting the remaining straight edge of the element A and with one of its curved edges connecting to the adjacent element **14**. An element E is positioned with its two straight edges abutting the free straight edges of the elements B and D. An element F is then positioned with its two curved edges contacting the curved edges of the elements C and E.

Due to the shape of the elements and the above-described arrangement, each element will form a smooth continuation of the spherical surface of the adjacent unit **14**, and will merge into straight, horizontal valleys, or gutters, disposed at right angles and intersecting one another. These valleys are indicated at **15** and **16**. It will be noted that these valleys are so positioned as to be in direct communication with the valleys between adjacent sections **14**, so that those valleys may serve to carry off any accumulation of water in the gutters **15** and **16**.

The four elements, A, B, D and E will form two intersecting gutters with the point of intersection being at the common point of contact between the four elements. The four elements indicated as E, F, G and H will form a small dome which is entirely surrounded by the gutters **15** and **16**. The common point of contact of these elements E, F, G and H will be the high point, and the lines of juncture between these elements will be formed by the curved edges of the elements. This arrangement of elements is repeated until the entire roof area has been filled in. It will be seen that the roof will be formed of a plurality of domes separated by the horizontal gutters **15** and **16**. With this arrangement, it will be impossible for any water to stand on the roof.

Referring now to Figure 4, it will be seen that when the elements of the present invention are used at the base of a side wall, the base line of the shelter will be absolutely straight, and in this lower section vertically curving ribs will alternate will straight vertical ribs. The straight vertical ribs, and the resulting flattened portion of the surface of the element eliminate the inwardly projecting points at the floor line which was present with the old construction.

While in the above a practical embodiment of the invention has been shown and described, it will be understood that the structural details disclosed are merely for purposes of illustration and that changes may be made within the scope of the appended claims.

What is claimed is:

1. A structural element comprising, a four-sided slab all of the corners of which are 90° angles, two adjacent edges of said slab being arcuate in a depthwise direction and being arcs of great circles of a sphere of predetermined size, the remaining two adjacent edges being flat and lying in a common plane, whereby the corner between the straight edges and the corners at the opposite ends of said straight edges all lie in a common plane, the arcuate edges rising from the plane of the said straight edges so that the corner formed between said arcuate edges is out of and above the plane of said other three corners, the surface of said slab in the regions of said arcuate edges and therebetween being of spherical curvature and in the regions of the flat edges a plane surface with the spherical and plane surfaces merging gently into one another.

2. In a structural element as claimed in claim 1, said slab having flanges depending from the edges thereof, said flanges depending from the arcuate edges of the slab being normal to a plane tangent to the surface of said slab at the intersection of said slab and said flanges, and the flanges depending from the straight edges of the slab each being parallel to the flange on the opposite arcuate edge.

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