United States Patent [19]

Moss

[11] **3,744,205**

[45] **July 10, 1973**

[54] **METHOD OF ERECTING PREFABRICATED SHELTER**

[75] Inventor: **Charles W. Moss**, Ann Arbor, Mich.

[73] Assignee: **Tension Structures, Inc.**, Milan, Mich.

[22] Filed: **Mar. 1, 1972**

[21] Appl. No.: **230,807**

Related U.S. Application Data

[62] Division of Ser. No. 32,051, April 27, 1970, Pat. No. 3,675,380.

[52] **U.S. Cl.**..... **52/747**, 29/429, 52/80, 52/741

[51] **Int. Cl.**..... **E04b 2/12**, E04b 1/32, B23p 11/00

[58] **Field of Search**..... 52/747, 741, 80, 52/81, 82, 403, 469, 471, 472, 222, 393, 396, 400; 29/81 B, 429

[56] **References Cited**

UNITED STATES PATENTS

2,820,990	1/1958	Johnson	52/82 X
3,137,253	6/1964	Clayton	52/747 X
3,636,676	1/1972	Moss	52/747
3,675,380	7/1972	Moss	52/80

FOREIGN PATENTS OR APPLICATIONS

899,373	8/1944	France	52/80

Primary Examiner—Price C. Faw, Jr.
Attorney—Olsen & Stephenson

[57] **ABSTRACT**

A shelter which has panels bowed and secured together in a stressed condition to define a domelike building. An improved flexible joint is provided between the panels to aid in erecting and in retaining the structure together, and to provide a weather seal. A method of erecting the shelter and inserting the flexible joints in place is disclosed.

2 Claims, 10 Drawing Figures

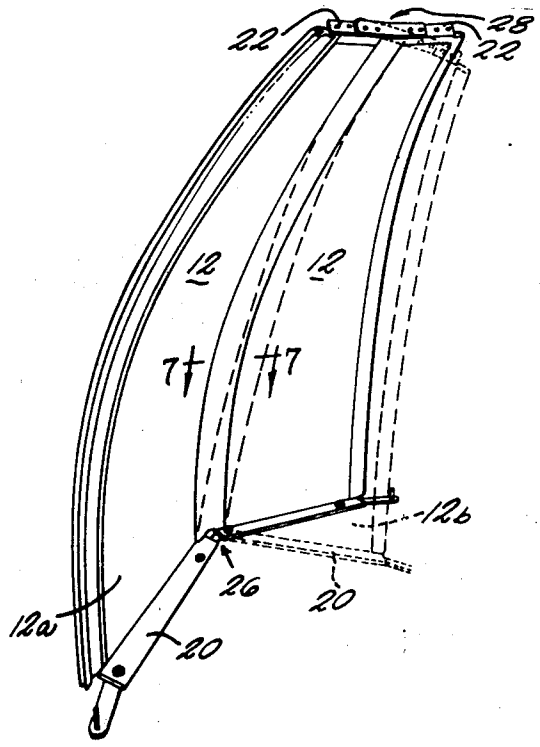
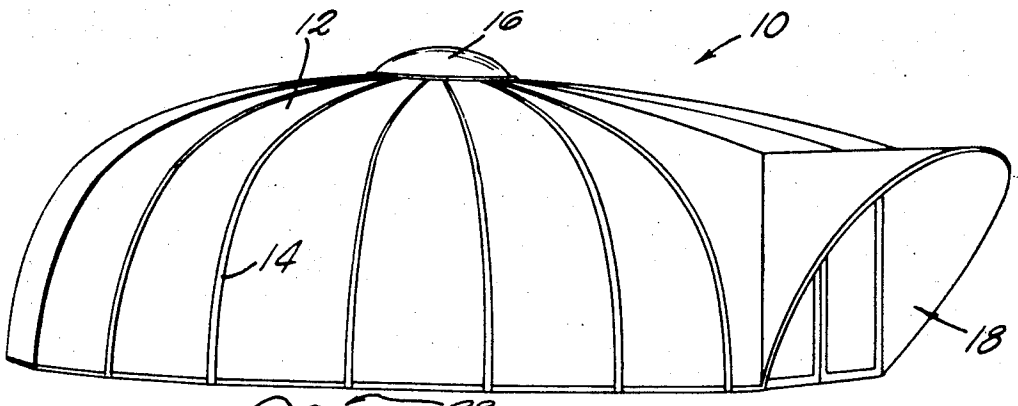


FIG. 1



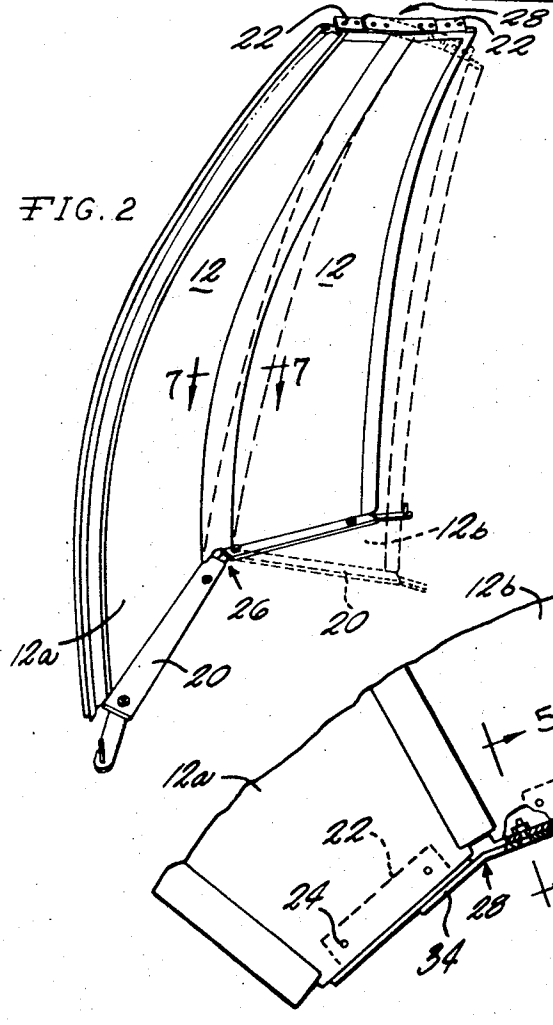


FIG. 2

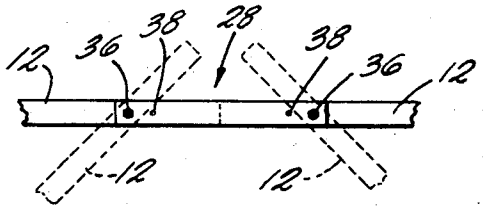


FIG. 3

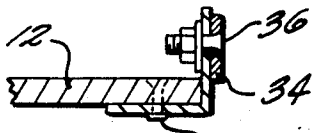


FIG. 5

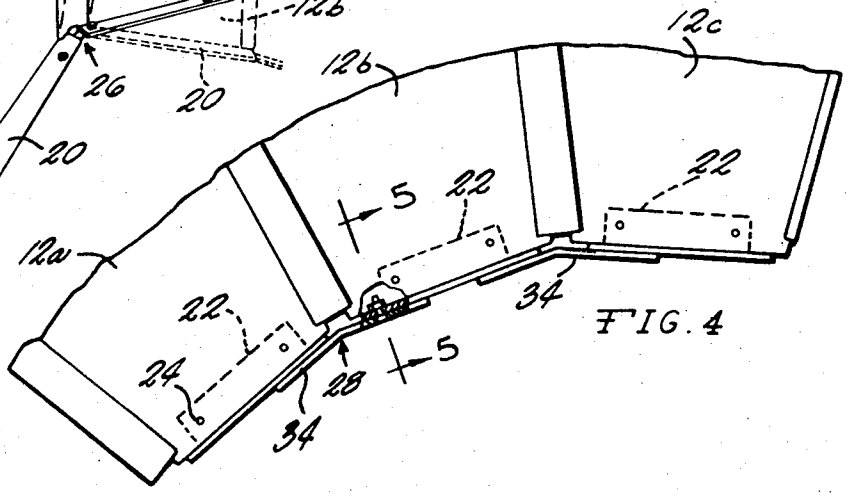


FIG. 4

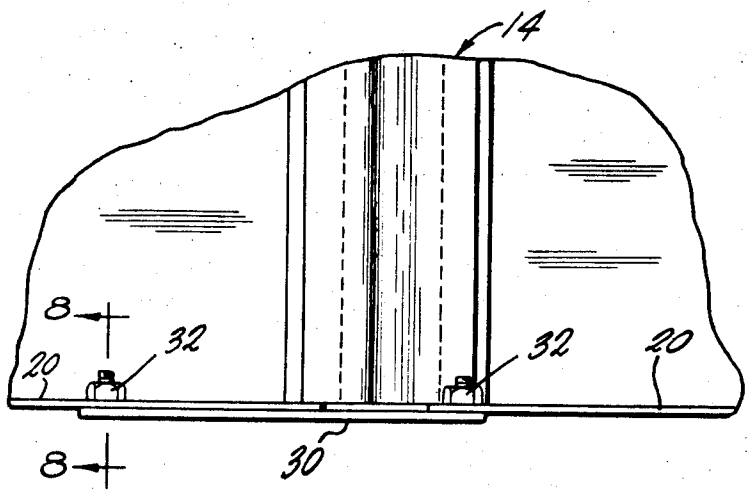


FIG. 6

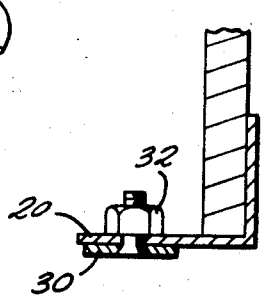


FIG. 8

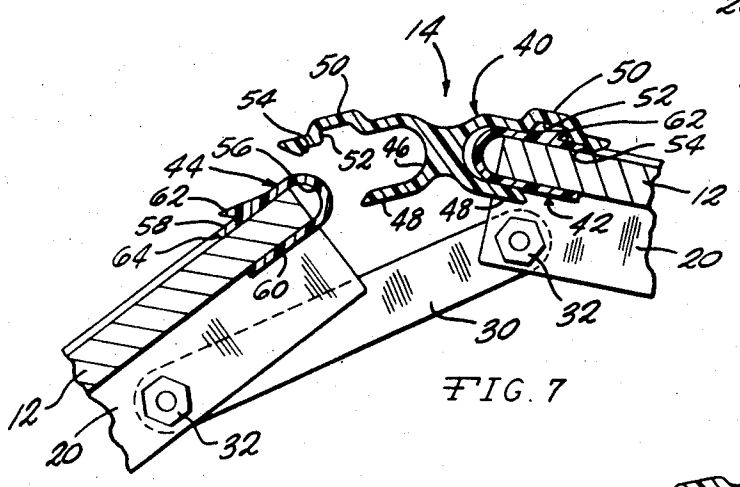


FIG. 7

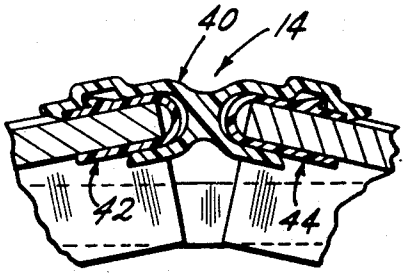


FIG. 9

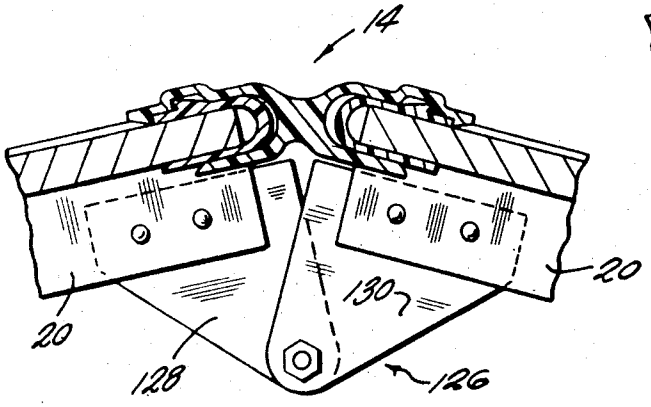


FIG. 10

METHOD OF ERECTING PREFABRICATED SHELTER

CROSS REFERENCE TO RELATED APPLICATION

The present application is directed to improvements over the method and apparatus disclosed in application Ser. No. 790,930, filed Jan. 14, 1969 for "Prefabricated Shelter and Method of Erecting Same," now U.S. Pat. No. 3,562,975, issued Feb. 16, 1971. This application also is a division of pending application Ser. No. 32,051, filed Apr. 27, 1970, now U.S. Pat. No. 3,675,380.

BACKGROUND OF THE INVENTION

The present invention relates to an improved prefabricated dome-like shelter and to the method of erecting the improved prefabricated shelter.

One of the early shelters which is constructed by bowing and securing together a plurality of prestressed panels so as to define a domelike structure which is free of internal supporting structure is disclosed in French Patent No. 899,373. As there shown, the panels are secured together by overlapping the panels and then bolting them together, or by bolting bands to adjoining panels.

Another prior art shelter of this general character is disclosed in the U.S. Pat. No. 2,820,990, granted Jan. 28, 1958 to Johnson. As there shown, the panels are joined by clips and a cable is connected to the uppermost clip between each adjoining panel for retaining the upper ends of the panels together.

The shelters disclosed in the two cited references create many significant problems when an effort is made to erect them. Also, when such shelters are erected, problems exist with respect to providing proper weather seals at the joints between the panels.

The aforesaid U.S. Pat. No. 3,562,975 discloses a new dome-shaped shelter which includes a novel flexible joint and weather seal which is located between the panels, and the patent also discloses a new method of erecting a dome-shaped shelter.

SUMMARY OF THE INVENTION

The present invention relates to improvements in a prefabricated domelike shelter, and particularly in a flexible joint which is adapted to be positioned between stressed panels and locked in place during the erection of the shelter. The present invention also relates to improvements in the method of erecting the domelike shelter.

According to a preferred form of the present invention, a shelter is provided, comprising a plurality of resilient panels each having the general shape of an isosceles trapezoid with curvilinear sides. Each panel is mounted in an upright position at its base and is prestressed into a bowed position with its curvilinear edges substantially in abutting relationship throughout their lengths with respect to the curvilinear edges of the next adjacent panels. First means are provided securing the bottoms of adjacent panels together, and second means are provided securing the tops of such panels together. Flexible joints extend between the substantially abutting lateral edges the full lengths of the panels and overlap the inner and outer surfaces of such panels. Each lateral edge of a panel has a locking strip extending along its length, said strip and its associated flexible joint being interlocked when the flexible joint is in its overlapping position with respect to the panels.

A preferred embodiment of an interconnected flexible joint for use in the prefabricated shelter comprises a first extruded organic plastic U-shape strip defining a longitudinal channel with generally parallel sides. The first strip being fitted over the edge of one of the panels with the sides secured to inner and outer surfaces of the panel, and a second organic plastic U-shaped strip of similar construction is similarly fitted over the adjacent edge of the next panel. An extruded organic plastic H-shaped strip is provided defining longitudinal grooves having laterally projecting legs which straddle the U-shaped strips. The sides of the U-shaped strips that are located on the outer surfaces of the panels and the corresponding legs of the H-shaped strip have interlocking portions.

An improved method of erecting the above-defined shelter is provided comprising the steps of pivotally connecting the first and second panels adjacent to the tops and bottoms of their adjacent curvilinear sides, fitting one of said flexible H-shaped strips in tongue-and-groove relationship onto one of said curvilinear sides, pivoting said panels relative to one another to an angle less than a preselected obtuse angle and bowing said panels to the extent necessary while fitting the upper and lower ends of said one flexible strip in tongue-and-groove relationship to the upper and lower ends to the other of the adjacent curvilinear sides, pivoting said panels relative to one another to at least said preselected obtuse angle while continuing to fit the remainder of said flexible strip in tongue-and-groove relationship to the remainder of the other of the adjacent curvilinear sides, and successively joining additional panels in a similar manner to the next preceding panels.

Accordingly, it is an object of the present invention to provide an improved method of erecting a shelter.

Other objects of this invention will appear in the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a dome-shaped shelter embodying one form of the present invention;

FIG. 2 is an enlarged perspective view showing two panels joined together at a selected obtuse angle during the erection process, and showing in broken lines an initial position of one of the panels at a lesser angle during a step of positioning the panels together;

FIG. 3 is a schematic illustration showing two steps in the method of joining two panels together at their top portions;

FIG. 4 is a fragmentary top plan view of three panels that have been joined together during the erection of the shelter;

FIG. 5 is an enlarged fragmentary view taken on the lines 5—5 of FIG. 4;

FIG. 6 is a fragmentary side elevational view showing bottom portions of two adjacent panels that have been joined together;

FIG. 7 is a fragmentary sectional view taken on the line 7—7 of FIG. 2 showing the one panel in its broken line position of FIG. 2;

FIG. 8 is a fragmentary sectional view taken on the lines 8—8 of FIG. 6;

FIG. 9 is a fragmentary sectional view, similar to that of FIG. 7, showing the two panels secured together by the joining flexible strip; and

FIG. 10 is a view similar to FIG. 9, but showing a modified form of a hinge joint for connecting the bottoms of the panels together.

DESCRIPTION OF THE PREFERRED EMBODIMENTS.

Before explaining the present invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

Referring now to the drawings, the invention will be described in greater detail. A preferred embodiment of a dome-shaped shelter **10** is shown in FIG. **1** in its assembled position. The shelter **10** includes a plurality of prestressed bowed panels **12** which had been cut to have a desired shape generally consisting of an isosceles trapezoid with curvilinear sides or edges, a plurality of flexible interlocking joints **14** fitted between adjacent panels **12**, a cap member **16** which is seated on the upper ends of the panels **12**, and an entranceway or doorframe assembly **18**.

The panels **12** include a suitable resilient material, such as plywood or the like, and have the general shape when in an unstressed position of an isosceles trapezoid with curvilinear lateral or side edges, as is particularly described and explained in the aforesaid U.S. Pat. No. 3,562,975. As is also disclosed in that application, various other materials can be used, or various layers of material can be laminated together. For more detailed description of various types of materials and arrangements of material to form the panels, as well as for further descriptions of the general construction of the shelter, reference is made to the copending application.

Attached to each panel **12** to provide a bottom edge is an L-channel **20**, which can be attached in any suitable manner, as by rivets, not shown. A similar L-channel **22** is secured to the top of each panel **12** by suitable means, such as rivets, **24**.

When assembled, adjacent panels **12** are connected at their upper and lower ends by first and second means **26** and **28** which permit relative pivotal movement between the panels during one stage of their erection. The first means **26** comprises a hinge bracket or bar **30** which is secured to the respective L-channels **20** of the adjacent panels **12** by any type of suitable threaded studs and nuts **32**. Preferably, the holes for the studs and nuts **32** are asymmetrically arranged as shown in FIG. **7** to facilitate pivoting the panels together. However, by virtue of providing a pivotal arrangement, whether symmetrical or asymmetrical, the one panel **12**, shown in broken lines in FIG. **2**, can be moved from the broken line position to the solid line position therein shown. The second means **28** also includes a hinge bracket or strap **34** which is adapted initially to be connected at the upper ends of the panels **12** by the bolts **36** so that the panels **12** can be pivoted relative to one another from the broken line position to the solid line position shown in FIG. **3**. Thereafter, when the panels are in the solid line position shown in FIG. **3**, at a selected obtuse angle relative to one another to fit the dimensions of shelter **10**, additional bolts can be inserted through the bolt holes **38** for rigidly securing the panels together with respect to the hinge strap **34**.

In the illustrated embodiment, the flexible interlocking joints **14** are formed from three extruded strips **40**, **42** and **44**. The strips can be extruded from suitable organic plastic material such as polyvinyl chloride, which has resilient properties. The extruded strip **40** has a generally H-shaped cross section defining longitudinal grooves **46** between laterally projecting legs **48** and **50**. The outer legs **50** each have a locking slot **52** extending lengthwise thereof and also an inturned shoulder **54** similarly extending lengthwise thereof. When the extruded strip **40** is in an unstressed condition, the included angle between the outwardly opening grooves **46** is less than **180** angular degrees and less than the included angle between adjacent panels **12** when in their final erected positions. For a more detailed explanation of the relationship of the strips **40** and the panels **12** during erection and final installation reference is made to U.S. Pat. No. 3,562,975.

Each of the U-shaped strips **54** defines a longitudinal channel **56** having generally parallel sides **58** and **60**. The outer sides **58** of each U-shaped strip **44** has a longitudinal barb or rib **62** which is adapted to fit into the locking slot **52** of the H-shaped strip **40**. The outer extremities **64** of each U-shaped strip **42** is located so that the corresponding inturned shoulder **54** of the H-shaped strip **40** can overlap such extremity **64**.

For the purpose of fitting the interlocking joint **14** together, the U-shaped strips **42** and **44** will initially be bonded to the inner and outer surfaces of the panels **12**, in the positions shown in FIG. **7**. The H-shaped strip **40** can then be fitted onto the strip **44** to the position shown in FIG. **7**. This is accomplished by pressing the H-shaped strip **40** over the U-shaped strip **44** so that the latter penetrates the longitudinal groove **46** somewhat like an arrowhead until the barb **62** penetrates and is locked in the locking slot **52**. The inturned shoulder **54** will also be pressed over the extremity **64** of the U-shaped strip **44**. Thereafter, by a method to be described, the other U-shaped strip **42** will also be interlocked into the other groove **46** of the H-shaped strip **40**. When so interlocked, the H-shaped strip **40** will be in the interlocked position shown in FIG. **9** with respect to the two U-shaped strips **42** and **44**, and the outer surface of the H-shaped strip **40** will be tensioned, especially by virtue of bowing of the panels **12**, so as to oppose unlocking of the interlocked strips.

The method of erecting and joining together the panels **12** and of interlocking the joints **14** will now be described in greater detail, with initial reference being made to FIG. **2**. At the outset a first panel, such as panel **12*a*** will be secured in an upright position to a supporting surface, and the first and second panels **12*a*** and **12*b*** will then be connected at their lower ends by the first means **26** at an angle less than said obtuse angle. This can readily be accomplished by fitting the bracket **30** under the L-channels **20** and securing the threaded nuts **32** onto the bolts projecting up from the bracket **30** through appropriate holes in the L-channel **20**. While performing this function, the panel **12b** can be in the broken line position shown in FIG. **2**, and the H-shaped strip **40** will have been press fitted onto the edge of panel **12*b*** as previously described. Next, the panels **12*a*** and **12*b*** are pivotally connected at their

upper ends by means of the bolts **36,** FIG. **3,** and this can readily be facilitated by bowing as well as pivoting the panels relative to one another. At the same time that this is being done, the U-shaped strip **44** which is located on channel **12***a* will be pressed into the channel **46** of the H-shaped strip **40** at both the upper and lower ends thereof. Then, by pivotally moving the panel **12***b* at least to its proper position defined by the aforesaid obtuse angle, as shown in solid lines in FIG. **2,** the U-shaped strip **42** can be fitted into the H-shaped strip **40** throughout the remainder of the length thereof and the bolts, not shown, can then be fitted through the holes **38** of the strap **34** to finish securing the upper ends of the panels **12** together. The straps **34** and the L-channels **22** will, when all are joined together, define a rigid, continuous strap or ring around the top portions of the panels **12.** The outer surfaces of the H-shaped strip **40** will then be in a state of tension overlying the outer surfaces of the U-shaped strips **42** and **44** to provide a strong weathertight joint, especially where the inturned shoulders **54** overlie the extremities **64.** The same sequence can then be carried out in joining a panel **12***c* to panel **12***b*, and this operation can be repeated with each succeeding panel until all of the panels have been erected.

The present invention can be carried out using various other types of hinge means **26** and **28** at the upper and lower ends of the panels **12.** For example, a modified arrangement of the first means **26** is shown in FIG. **10.** As there shown, a hinge means **126** is provided wherein a pair of brackets **128** and **130** are riveted to the L-channels **20,** and a single threaded nut **130** is used to secure the brackets in hinged relationship.

It will be noted by reference to FIGS. **7, 9** and **10,** that the interlocking arrangement between the U-shaped strips **42** and **44** and the H-shaped strip **40** permits the arrow heads or strips **42, 44** to be in a somewhat floating relationship within the grooves **46.** This is a significant feature because it allows a limited amount of flexing of the dome structure so as to avoid stress concentrations in any specific location, which in turn could result in a structural failure.

It is claimed:

1. In the erection of a prefabricated dome-shaped shelter from a plurality of panels having the general shape of isosceles trapezoids with curvilinear sides, wherein said flexible joints include a flexible strip having an H-shape cross section so as to define longitudinal grooves between laterally projecting legs for receiving the curvilinear sides in tongue-and-groove relationship, the method of erecting the shelter comprising the steps of fitting one of said flexible strips in tongue-and-groove relationship onto one of the curvilinear sides of a first panel, pivotally connecting the first and a second panel adjacent to the tops and bottoms of their adjacent curvilinear sides, pivoting said panels relative to one another to an angle less than a preselected obtuse angle and bowing said panels while fitting the upper and lower ends of said one flexible strip in tongue-and-groove relation to the upper and lower ends of the other of the adjacent curvilinear sides, pivoting said panels relative to one another to at least said preselected obtuse angle while continuing to fit the remainder of said flexible strip in tongue-and-groove relationship to the remainder of the other of the adjacent curvilinear sides, and successively joining additional panels in a similar manner to the next preceding panels.

2. The method that is defined in claim **1,** wherein said flexible strips and the outer surfaces of said panels adjacent to said curvilinear sides have complementary interlocking segments, and said method includes pivoting said panels relative to one another to a position slightly beyond said obtuse angle to facilitate interlocking said segments, and then moving said panels back to said preselected obtuse angle so as to tension said strip in its interlocked position.

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