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Gillis

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[45] **Feb. 4, 1975**

[54] **SHELTER STRUCTURE**

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[52] **U.S. Cl.** ..... **135/4 R,** 24/90 HA, 24/73 VA, 24/73 R, 24/219, 52/83, 135/3 E, 135/15 CF, 248/317, 403/64

[51] **Int. Cl.** **A45f 1/16**

[58] **Field of Search** .... 135/1 R, 3 E, 4 R, 8, 15 CF; 52/63, 80, 81, 82, 83

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3,454,021	7/1969	Morris	135/3 E
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Primary Examiner—Jordan Franklin
Assistant Examiner—Conrad L. Berman
Attorney, Agent, or Firm—Robert G. McMorrow

[57] **ABSTRACT**

Shelter structures have an external strut assembly with strut members hingedly connected in rows. The rows are interwoven, and connections depend therefrom at spaced locations. The connections are engaged with a skin, and the skin and strut assembly are mutually supportive of one another.

9 Claims, 15 Drawing Figures

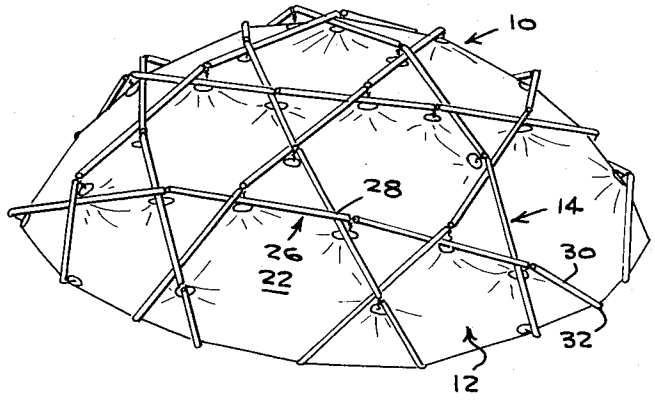
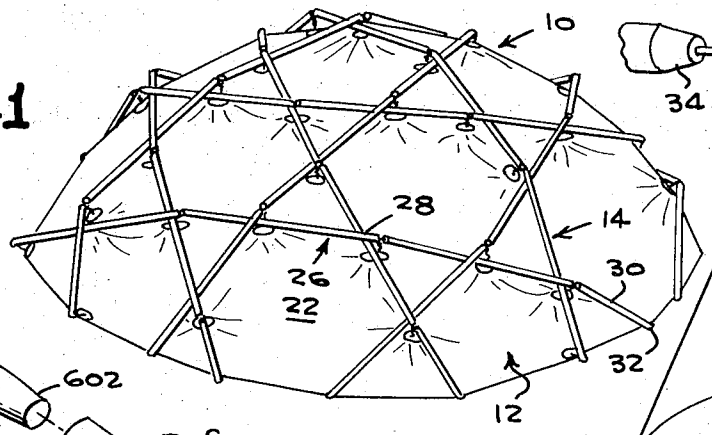


Fig-1



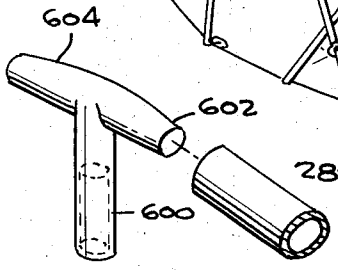


Fig-1A

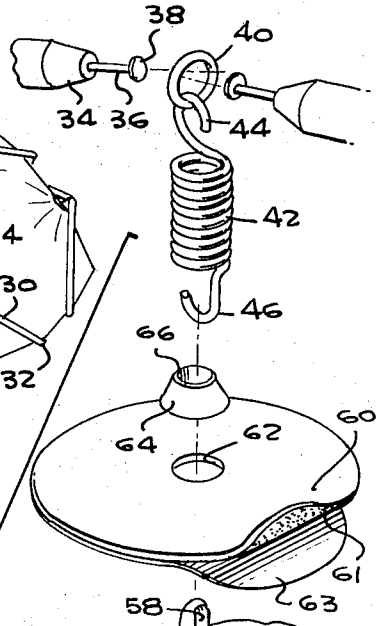


Fig-3

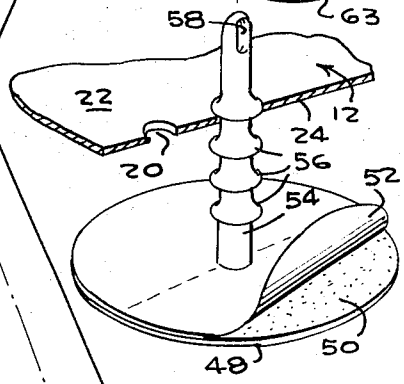


Fig-2

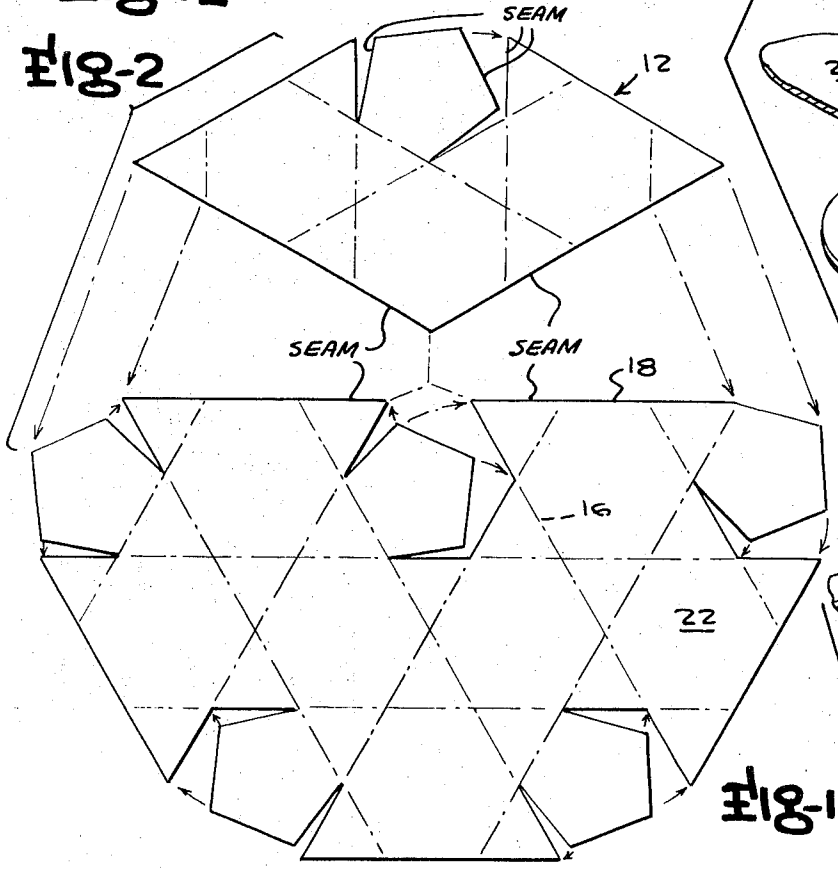


Fig-13

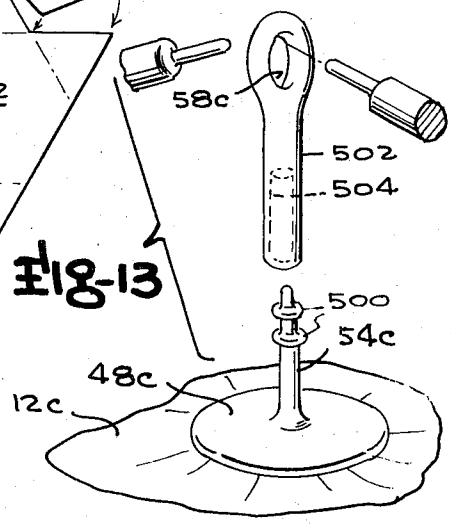


Fig-5

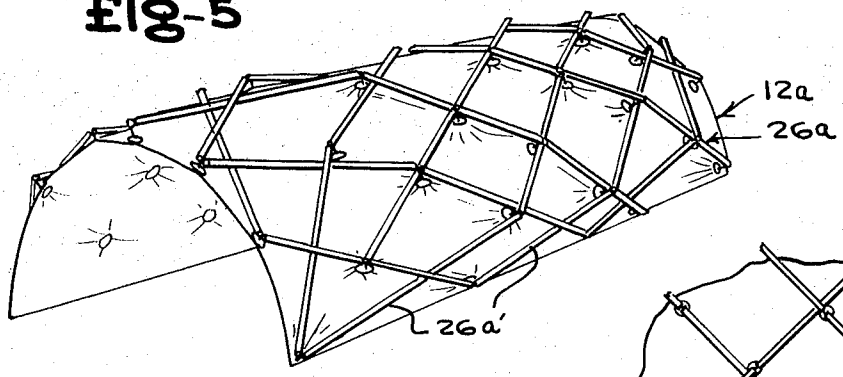
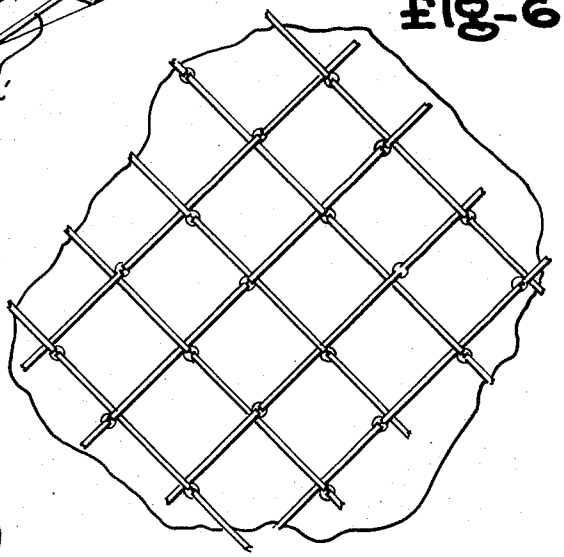


Fig-6



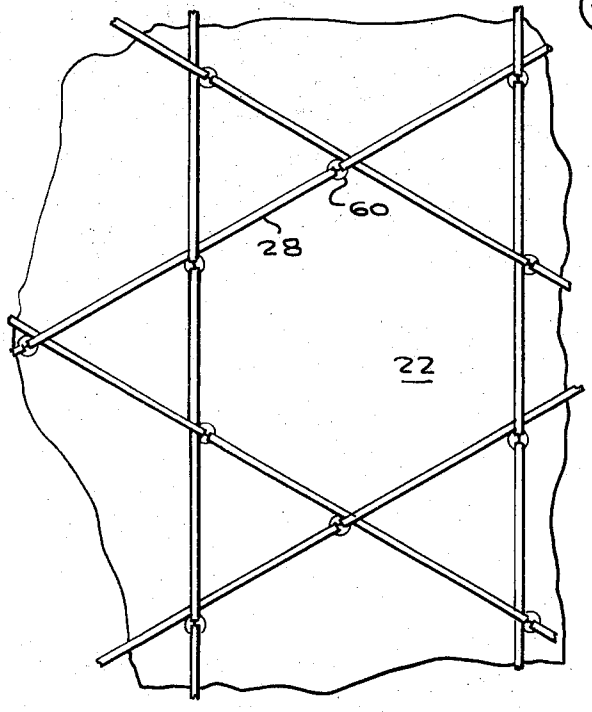


Fig-4

Fig-12-A

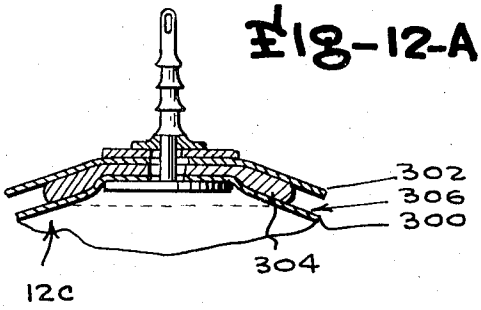
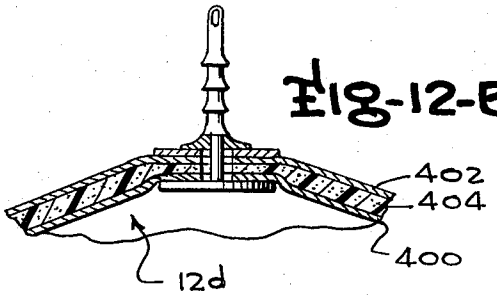


Fig-12-B



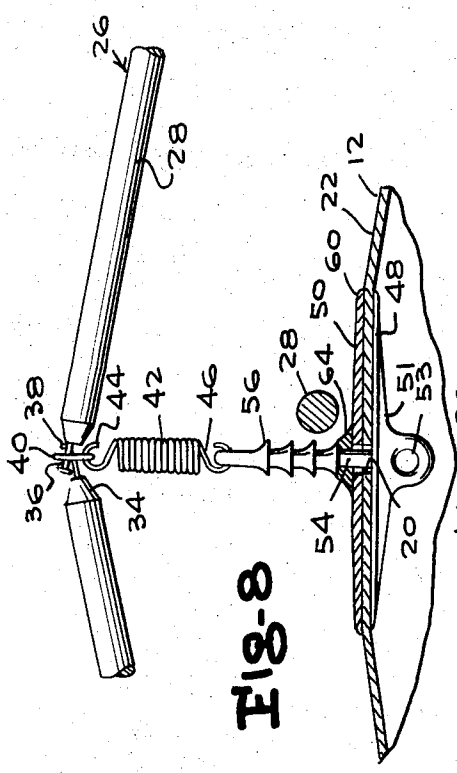


FIG-8

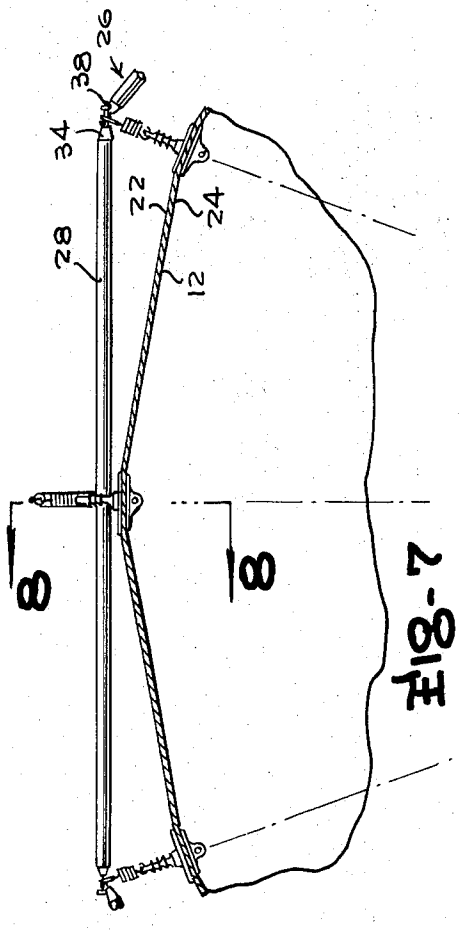


FIG-7

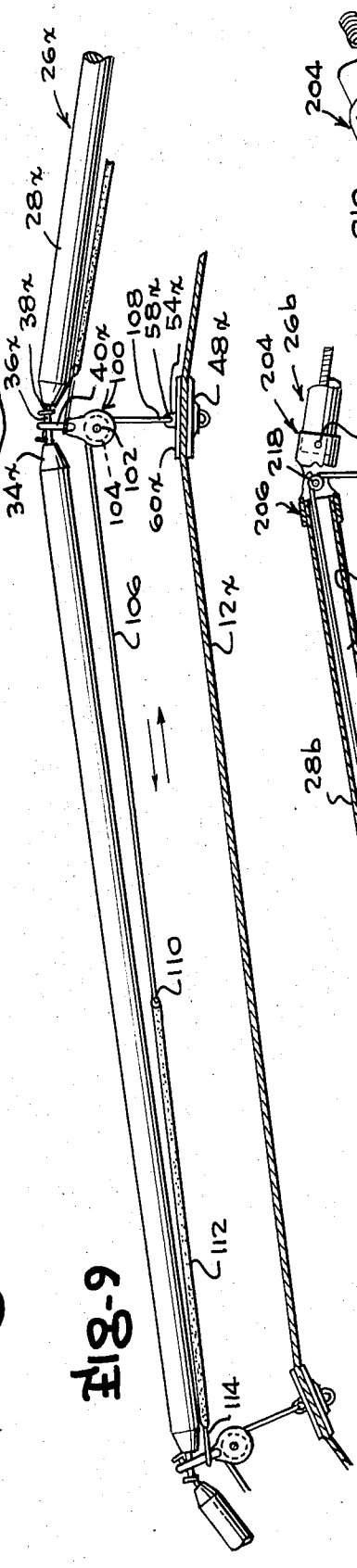


FIG-9

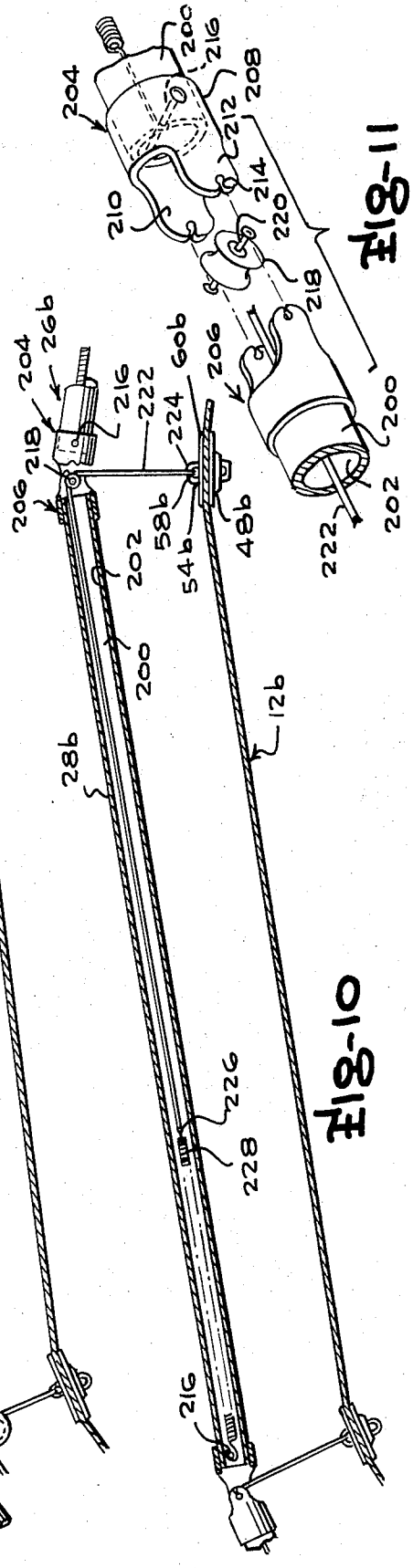


FIG-10

FIG-11

SHELTER STRUCTURE

BACKGROUND OF THE INVENTION

1. Field of the Invention:

This invention pertains generally to structures of a readily assembled type, such as tents or the like.

2. Statement of Prior Art:

It has heretofore been known to provide a tent in which an exterior mounting frame supports a skin at spaced apart stress locations. Illustrative prior patents in this field include the following:

Patent No.	Patentee	Issued
2,682,235	R. B. Fuller	June 29, 1954
2,914,074	R. B. Fuller	Nov. 24, 1959
2,938,524	G. O. Benson	May 31, 1960
3,168,101	J. C. Porter	Feb. 2, 1965

Such prior art structures depend completely on the exterior frame for support.

SUMMARY OF THE INVENTION

A principal objective of this invention resides in the provision of a new and novel shelter structure in which the external strut assembly and the structure forming skin are integrated so as to become mutually supportive of one another. This is accomplished through the correlation of these components in a structural unit. In modified forms of the structure, means is provided to constantly maintain a tension relationship.

The shelter hereof may be portable or permanently installed, and may take several configurations. The selected shape of the structure is a function of its intended employment, and thus may be dome-like, or elongate.

The connector means hereof are adjustable to compensate for variation in the thickness of the skin. In alternate forms, the connectors may also be separable.

The invention is based upon the employment of stress forces in stabilization of the skin with minimal dependence upon the supporting strut structure. The structure is of minimum weight consistent with its intended environment of employment and has been found to avoid any tendency to collapse or distend when subjected to high winds and the like.

A further object of the invention resides in the provision of a structure as aforesaid wherein forces such as wind applied to the structure are distributed evenly between the skin and the supporting strut assembly, thus minimizing the possibility of collapse.

Among the additional objects and advantages of the invention are the following:

The compression elements employed in support of the structure need not be manufactured of finished material, but may instead be of any readily available and suitable substance. The outer membrane portion of the invention may be machine hot welded and may be easily and inexpensively produced; the compression elements are arranged such that no more than two compression elements join at one point and the load on the compression elements is mutually parallel; the tension on the membrane skin is substantially perpendicular to the curvature of the skin; and large structures may be erected using the struts of identical lengths; the various components of the structure may be moded or otherwise fabricated; the joints are mutually identical to one another; the structure is lightweight and the skin and strut members share equally in supporting the structure; the structure has the characteristic of elasticity, and may maintain a heavier load than one of rigid or semi-rigid construction; the lightness of weight of the structure makes it readily adaptable to assembly and disassembly and to storage when not in use; in emergency situations, readily available material, such as wood, and the like, may be employed in place of the struts, eliminating the need to transport parts of the assembly to rural areas; and the same struts can be employed in various shapes and structures of the unit.

Other and further objects and advantages of the invention will become apparent to those skilled in the art from a consideration of the following specification when read in conjunctin with the annexed drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an isometric view showing a completed shelter structure constructed and assembled in accordance with the teachings of this invention;

FIG. 2 is a partially disassembled top plan view of a skin portion of a shelter of the type shown in FIG. 1;

FIG. 3 is an enlarged, disassembled perspective view of a connector hereof;

FIG. 4 is a typical top plan view of a portion of the structure as seen from without;

FIG. 5 is a perspective view of a second form of shelter hereof;

FIG. 6 shows the strut assembly arrangement embodied in the form of the invention shown in FIG. 5;

FIG. 7 is an enlarged sectional view showing details taken through a skin and strut of a shelter hereof;

FIG. 8 is a further enlarged sectional view through the connector at location 8—8 of FIG. 7, looking in the direction of the arrows;

FIG. 9 is a view similar to FIG. 7, but disclosing a modification;

FIG. 10 is another view like FIG. 9 showing still another embodiment of the invention;

FIG. 11 is an enlarged perspective view of a portion of the strut assembly of FIG. 10;

FIG. 12A is a sectional view of a connector and skin hereof as applied, the skin being of modified type;

FIG. 12B is a view similar to FIG. 12A disclosing a variation in the skin construction;

FIG. 13 is a perspective view showing a different type of connector, separable in nature; and

FIG. 14 shows an alternate form of separable strut and connector.

DESCRIPTION OF THE PREFERRED EMBODIMENS

Referring to the drawings in more detail, a first form of shelter according to this invention is shown in FIGS. 1 through 4, 7 and 8. This dome-like structure 10 comprises a skin 12 and strut/connector assembly 14. The skin 12 is initially formed as a flat polygon of single layer type, having a series of fold lines 16 and seams 18 which enable it to be formed to its final dome shape. A series of reinforced aperatures 20 are formed in the skin at selected, spaced apart locations. For purposes of description herein, the skin has an outer surface 22 and an inner surface 24.

The strut/connector assembly includes a series of elongated strut means 26 each including a plurality of

intermediate strut members **28** and two terminal strut members **30.** The terminal strut members contact the ground or other supporting surface at their respective distal ends **32,** while the proximal ends of the terminal struts and each of the ends of the intermediate struts have a reduced portion **34** with an axial prong **36** projecting therefrom. The prongs have enlarged heads **38.**

In FIG. **1** it is to be noted that the strut means are interlaced, with the respective strut members extending alternately over and below one another.

The strut members are connected together in linear fashion to form the aforementioned strut means by engagement of adjacent prongs **36** within annular ring components **40.** These rings also support the suspended connectors which effect interengagement between the strut members and the skin.

Each connector, in the first form of the invention, comprises a coil spring **42** having an upper hook portion **44** engaged in the ring **40,** and having a lower hook **46.** A lower disc **48** has an upper side **50** coated with an adhesive substance, and a lower side **51** with an opening **53.** Prior to application to the skin, the adhesive substance is protected by a removable backing **52** of non-adhered material, which is torn away and discarded when the connector is placed in use. An elongated connector shaft **54** projects vertically from the center of the disc **48.** The shaft has a series of flared skirts **56** thereon, and has an eye **58** formed in its upper end. A second disc **60** of a dimension substantially equal to that of the disc **48** is provided, and has a central opening **62** therein expandable to a size to accommodate the flared skirts **56.** The second disc has adhesive **61** on its lower side also protected by paper **63** prior to application. An expansion nut **64** has a bore **66** and is sufficiently flexible to permit passage of the shaft and its flared skirts **56** therethrough in one direction. The flat bases of the skirts, however, prevent withdrawal of the shaft from the bore when once inserted. This effectively suspends the skin from the strut assembly and integrates the components in such a manner as to mutually support one another.

The assembly of this unit involves joining of those seams **18** not needed for shelter access or ventilation, temporary connectors of any suitable type being used at other seams. The shafts **54** are then extended through the openings **20** in the skin, and the discs **48** adhesively bonded to the inner surface **24** of the skin. The struts are then positioned and the shafts extended to maximum extent through the second discs **60** and expansion nuts **64.** The eyes **58** of the shafts are then engaged on the hooks **46** of the springs **42.**

FIGS. **5** and **6** disclose generally a Quonset-like structure embodying the components hereof. Here, a skin **12***a* is initially of flat, substantially rectangular form. The strut means **26***a* are arranged in substantially parallel rows, once again in interwoven fashion, alternately crossing one another. The connectors are of the type described above. It will be appreciated that other and different forms of the structure may be accomplished without departure from the invention. It will be observed in FIG. **5** that base struts **26A** prime are elongated with respect to the other struts, in order to provide rigidity at the base of the structure.

FIGS. **7** and **8** further show the support accomplished in the system of FIGS. **1** through **4.** Here it will be noted that the skin is tightly stressed by the strut means, and the interwoven relation of the crossing strut members may also be observed. The spring means incorporated in the connectors maintain the stress relationship between the strut assembly and the skin regardless of the particular placement of the strut members, without unduly stressing the skin. This incorporation of the spring means also makes non-critical the precise alignment of the respective strut means.

Other alternate means for maintenance of stress and integration of the unit are shown in the modified strut/connector assemblies of FIGS. **9** through **11.** In the first modified form, FIG. **9,** the skin is identified by reference character **12***x*. A strut means **26***x* includes individual strut members **28***x* with reduced ends **34***x*, projecting prongs **36***x* and enlarged heads **38***x*. The strut members are hingedly joined at their ends by engagement of the prongs in annular rings **40***x*. From each of of the rings **40***x* depend a pulley wheel assembly **100** comprising a casing **102** and a wheel **104** rotatably mounted therein. A lower disc **48***x* has a shaft **54***x* extending through the skin **12***x* and through a second disc **60***x*, the shaft having an eye **58***x* at its upper end. The skin is engaged between the discs **48***x* and **60***x* either adhesively or by other fixed connection means. An elongated cord **106** has a first end **108** secured to the shaft **54***x* at its eye **58***x* and extends about the wheel **104.** The other end **110** of the cord is fixedly secured to an elastic cord section **112** which extends, along with the main extent of the cord, in generally parallel relation to the strut. A short length **114** of cord secures the elastic to the next successive ring member.

In the second modified form of the invention, shown in FIGS. **10** and **11,** the strut means is denoted **26***b* and has strut members **28***b*. The strut members each comprise an elongated tubular main body portion **200** having a passageway **202** extending therethrough. The body portions **200** are closed at their ends by end cap members **204** and **206.** The cap members are hingedly secured to one another. Each has a sleeve portion **208** which fits about and tightly engages the end of the body portion, and a pair of ear members **210, 212** which project outwardly. The ear members each have a slot **214** therein. The cap members **206** are of reduced diameter relative to the cap members **204,** and the ears of the former fit within those of the latter whereby when the caps are placed as shown in FIG. **10,** the respective slots **214** of each of the ears may be transersely aligned. In addition, the sleeves **208** of the cap members **204** are drilled to receive a cross lug **216** which also extends through aligned openings formed in the end of the body portion. A pulley wheel **218** is rotatably mounted on a central axle **220** which extends outwardly at each side thereof. The axle fits within the aligned slots **214** of the cap members thereby hingedly joining the adjacent strut members and serving a further function described below.

A flexible cord **222** is connected at a first end **224** thereof to an eye **58***b* on a shaft **54***b*. The skin **12***b* is sandwiched between discs **48***b* and **60***b*. The cord is then trained about the pulley wheel **218** and extends down the passageway **202** defined by the body portion **200** of the strut. A second end **226** of the cord is connected to an elongated coil spring **228.** The spring is retained at an end of the strut opposite from the cord entry end by engagement with the lug **216.**

FIGS. **12A** and **12B** show alternate skin structures. In FIG. **12A,** the skin **12***c* comprises an inner layer **300** and an outer layer **302.** At connection locations, a

spacer **304** formed of a suitable flexible material is provided. This maintains an air space **306** between the layers to provide an insulating function. If desired, as shown in FIG. **12B**, layers **400, 402** of a skin **12***d* may have an intermediate layer **404** of insulation material permanently bonded therebetween.

FIG. **13** shows a connector of separable form having a disc **48***c* which is permanently affixed, as by a heat weld, to the skin **12***c* A shaft **54***c* forming a male connector extends from the disc. The shaft has a series of radially enlarged portions **500** adjacent its outer end. A female shaft section **502** has an eye **58***c* at its upper end, and is formed with a chamber **504** which is permanently engageable via a snap fit with the shaft **54***c*. It will be noted that in this form of the invention the spring means per se is eliminated and the length of the female portion of the joint, together with the length of the strut, determines the curvature of the erected structure. This form of the invention particularly lends itself to use of temporary or make-up struts gathered at the site of the erection of the structure.

Another modification of the connection between the strut and connector is shown in FIG. **14**. Here, the strut members **28***f* are of hollow construction and have open ends. The upper end sections of the connector shafts **600** have oppositely facing projections **602, 604** which may be engaged in the open ends of the struts.

I claim:

1. A shelter structure comprising:
a skin having an inner side and an outer side;
the skin having a series of apertures formed therein and extending therethrough;
a strut assembly comprising a plurality of strut members, with said strut members arranged in rows;
the strut members of each row being pivotally joined to one another at adjacent ends thereof, the rows being elongated;
a first series of said rows in substantially parallel relation to one another, and a second series of said rows in substantially parallel relation to one another;
the first and second series of rows being interwoven with the respective struct members thereof passing sequentially above and below one another;
connectors depending from the strut members at spaced locations above the aperatures of the skins, said connectors including means engaged with the skins; and
spring means interposed between the skin and the strut assembly, the skin and strut assembly being mutually supportive of one another.

2. The shelter structure of claim **1**, wherein:
the adjacent ends of the strut members have longitudinal projections thereon, each such projection having an enlarged head;
ring members between the adjacent strut members;
the heads of adjacent abutting strut members being extended through one of said ring members;
the spring means being connected to said ring members; and
the connectors being secured to the respective spring members.

3. The shelter structure of claim **2**, wherein:
the connectors each comprise an elongated shaft with projections thereon;
the shafts having outer ends;
and enlarged disc fixedly secured on the outer end of each shaft; and
a clamping disc about the shaft clampingly engaging the skin to the enlarged disc.

4. The shelter structure of claim **3**, wherein:
the projections include a flared skirt with a flat lower wall substantially perpendicular to the main extent of the shaft; and
the clamping disc having an expansion nut associated therewith which is extendable over the flared skirts and lockable against the flat walls of said clamping disc.

5. The shelter structure of claim **4**, wherein:
the clamping disc has an inner side and an outer side; and
the inneer side has an adhesive surface for engagement with the skin.

6. The shelter structure of claim **1**, wherein:
the spring means comprises a cord having opposite ends, one of said ends being secured to the connector and the other of said ends being secured to one of the struts.

7. The shelter structure of claim **6**, wherein:
the adjacent ends of the respective strut members are hingedly connected to one another;
a roller mounted between adjacent strut members; and
the cord passing over said roller.

8. The shelter structure of claim **7**, wherein:
the strut members are tubular; and
the cord extends through the adjacent strut member.

9. The shelter structure of claim **8**, wherein: the cord includes a spring section.

* * * * *