Oct. 23, 1962 T. R. FINLAYSON 3,059,658

SHELTER FRAMEWORK

Filed Aug. 9, 1959 2 Sheets-Sheet 1

Fig. 1.

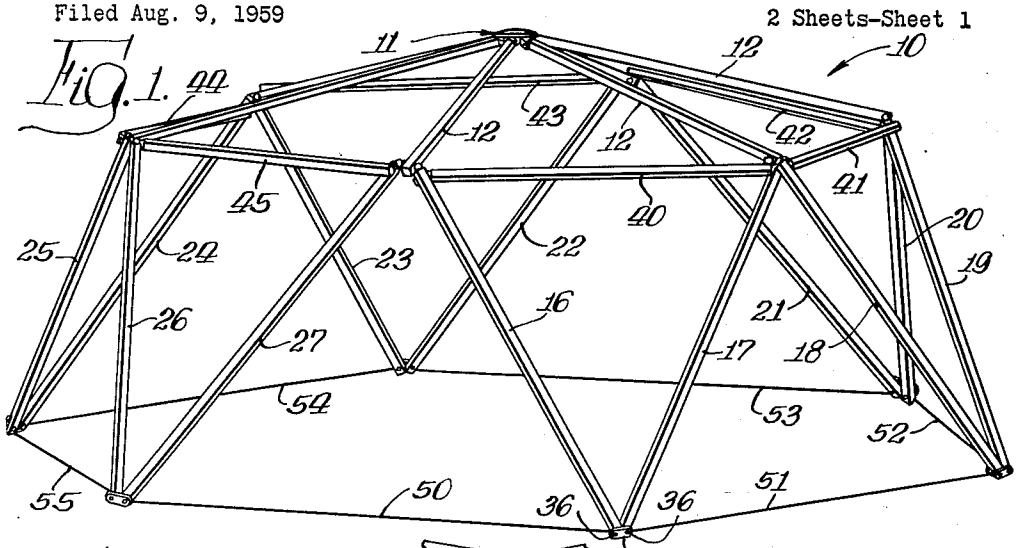


Fig. 2.

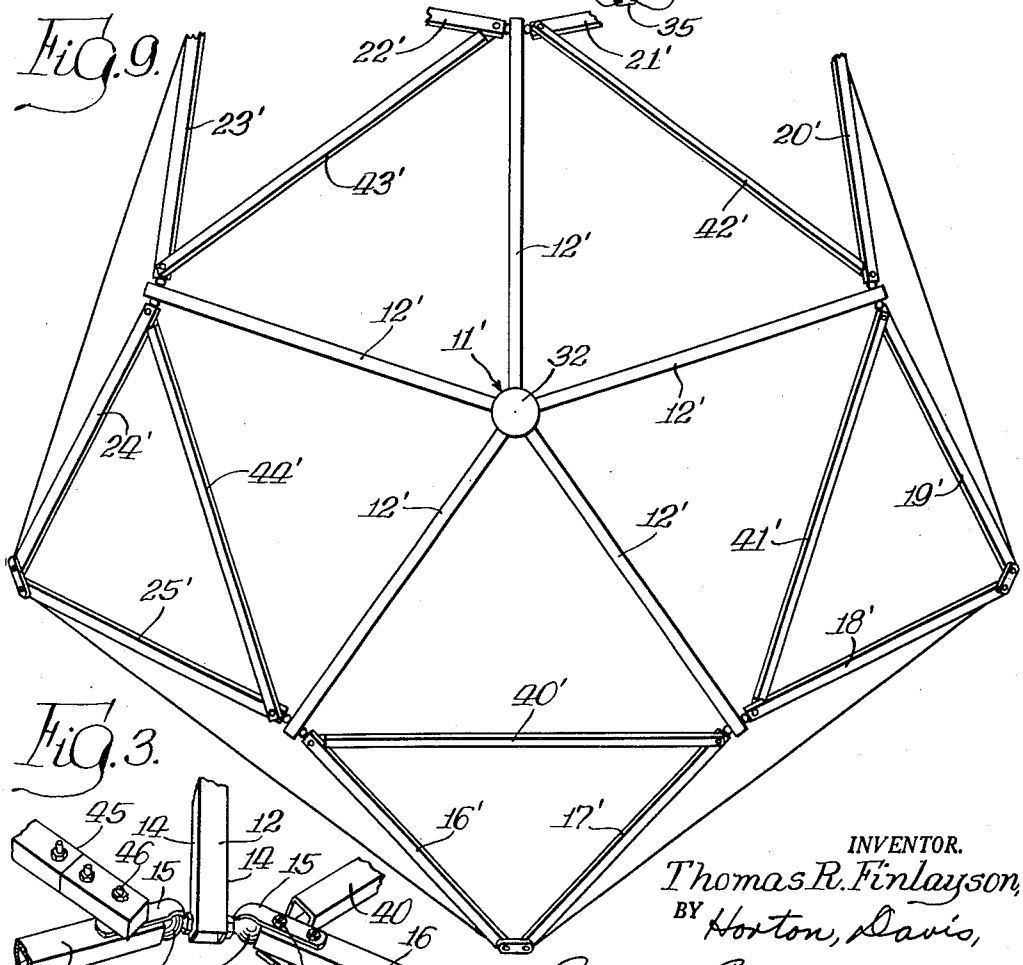
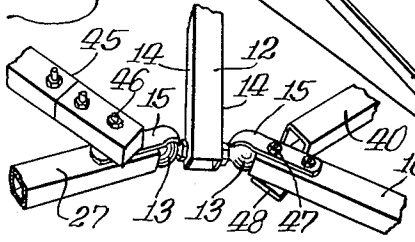


Fig. 3.



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Filed Aug. 9, 1959 2 Sheets-Sheet 2

Fig. 2.

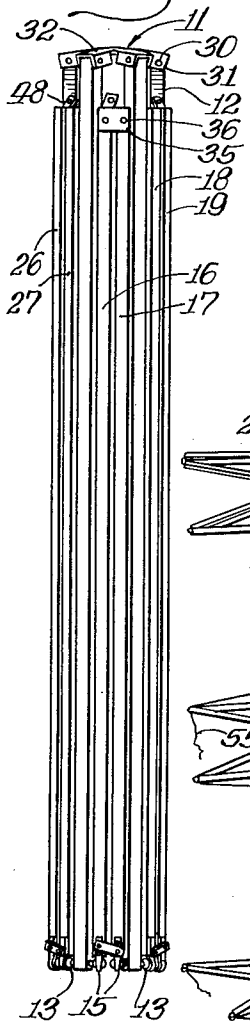


Fig. 4.

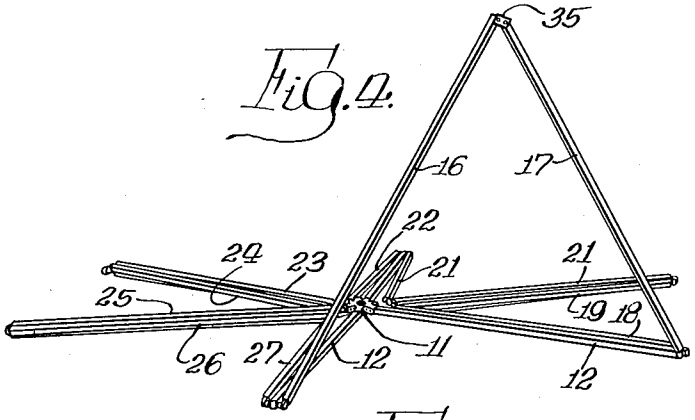


Fig. 5.

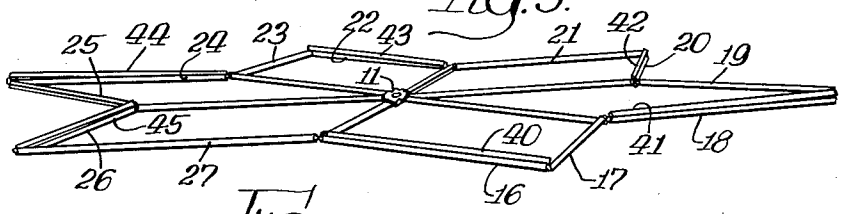


Fig. 6.

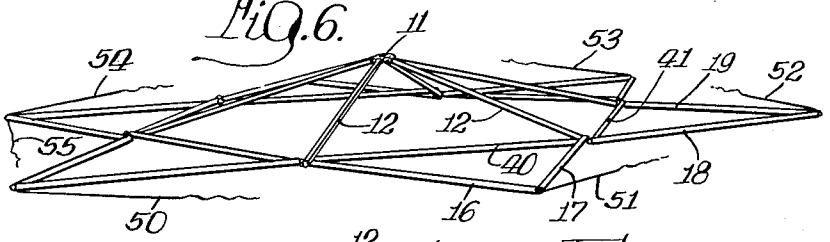


Fig. 7.

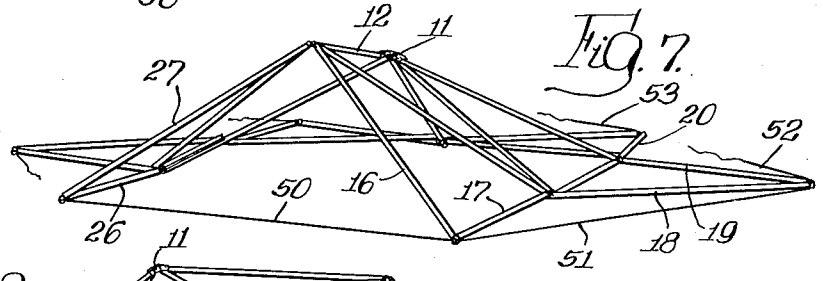
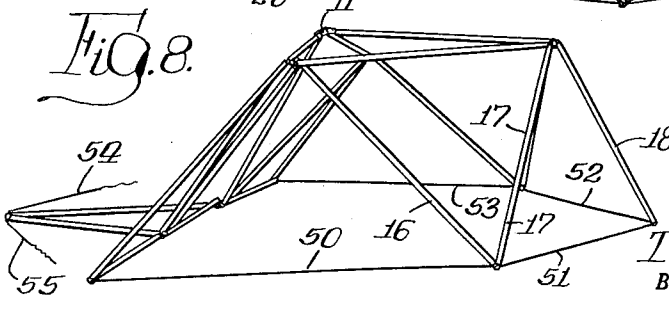


Fig. 8.



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SHELTER FRAMEWORK

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3 Claims. (Cl. 135—4)

This invention relates generally to shelter structures and more particularly to improvements in structural features of a lightweight portable knocked-down or collapsible framework for constructing buildings employed for temporary portable shelter purposes.

While the present invention has particular adaptation for the construction of portable building structures or the like, it is more specifically directed to an improved skeletal framework which may be readily assembled and disassembled with minimum time and manpower to afford a convenient, economical, and simplified structure primarily intended to be of a portable and temporary nature, likened somewhat to a tent. Previous structures of this class and general category, like the present invention, have preferably employed flexible weather protective coverings which are either suspended within the skeletal framework or supported thereover to effect a suitable protective enclosure for the housing of men, vehicles, materials, and the like, against the elements. One of the principal objectives of all such shelter structures is the striving toward compactness, especially in the collapsed, folded or knocked-down condition, while at the same time maintaining a high strength-to-weight ratio and insuring a maximum of interior space and comfort to the user. The present invention achieves the foregoing objectives with marked improvement over previous known structures of this class, and brings thereto increased efficiency in both erection and dismantling while advantageously presenting a structure having a high strength-to-weight ratio especially adapted for portability.

In brief, the present invention presents an improved shelter framework made up of a plurality of lightweight linear strut elements, pivotally interjoined in such a manner as to afford a compact bundle when in a folded or collapsed condition, with the several strut elements thereof lying in a substantially parallel relationship. To provide maximum strength while maintaining minimum weight requirements, the several strut elements embodied in the improved web-like framework of this invention are preferably constructed of a lightweight metal such as aluminum or a magnesium aluminum alloy formed in tubular or channel form. Such strut elements further are arranged with suitable pivot means at their points of interconnection so that they may be unfolded from the compact bundle condition into a unitary stable building framework embodying a low profile, a large base dimension, and a minimum number of frame elements. The arrangement of interconnecting the several strut elements is also such as to form a series of triangles which provide a polyhedral roof truss and a plurality of substantially vertically disposed ground-engaging triangular sidewall frames depending from the periphery of the roof truss. The wall frames constitute ground-engaging supports for maintaining the roof truss in an elevated generally horizontal attitude, and in this function their ground-engaging ends are normally interconnected by suitable tension-resistant members such as cables or rigid strut elements. This latter feature particularly maintains the ground-engaging ends of the roof supporting means in a fixed array to give static stability and rigidity to the otherwise collapsible, foldable framework.

The main object of this invention is to provide a new and improved framework structure especially adaptable for temporary shelter enclosures.

A further object of this invention is to provide an improved farmework as aforesaid which comprises a plurality of pivotally interjoined linear rigid strut elements arranged to present a polyhedral roof truss and a plurality of ground-engaging triangular sidewall supports for holdthe roof truss in an elevated position.

A still further object of this invention is to provide a new and improved shelter framework as aforesaid which is foldable into a compact unit or bundle for convenience in transporting.

Another object of this invention is to provide a new and improved framework for a shelter structure which is adapted to support suitable flexible covering materials in forming a shelter enclosure and which is readily collapsed to adapt such a shelter for quick, efficient erection and dismantling.

Still another object of this invention is to provide a new and improved portable shelter which may be folded into a substantially cylindrical bundle and into an expanded domelike shelter framework exhibiting rigidity, strength and stability.

The above and further objects, features and advantages of this invention will be recognized by those familiar with the art from the following description of a preferred embodiment thereof illustrated in the accompanying drawings.

In the drawings:

FIGURE 1 is an elevational view of a preferred form of shelter framework embodying the features of this invention;

FIG. 2 is a side elevational view of the structural framework seen in FIG. 1 in a retracted or collapsed condition;

FIG. 3 is an enlarged partial perspective view of a typical junction means employed between the several strut elements of the structural framework set out in FIG. 1;

FIGS. 4 through 8 are successive perspective views illustrating the manner and technique of erecting the shelter framework of FIG. 1 from the folded or retracted condition thereof set out in FIG. 2; and

FIG. 9 is a partial top plan view of a modified shelter framework embodying a pentagonal roof truss unit according to this invention.

Turning now to the features of the improved framework structure of this invention and more particularly to the features, functioning, and structural aspects of the embodiment illustrated in FIGS. 1–8 of the drawings, it will be recognized from FIG. 1 that the particular framework indicated generally by numeral **10** thereat comprises a central disc-like hub element **11** which is normally disposed at the apex of a polyhedral roof truss comprising a plurality of linear rigid radial strut elements **12, 12** radiating outwardly and angled downwardly from the hub element **11** like the spokes of a wheel. The radially outer end of each of the radial strut elements **12**, as viewed in FIG. 1, carries a pair of ball elements **13, 13** which project outwardly from opposite sides **14, 14** of their associated radial element (see FIG. 3 of the drawings). Each of the ball elements **13, 13** is rigidly bolted or otherwise fastened to its associated radial strut element **12** and is designed and intended to cooperate with a U-shaped strap means **15** associated therewith. Each strap means presents a socket for ball-and-socket connection therewith so as to provide substantially universal pivotal movement between each of the radial struts **12** and an associated support strut, numbered successively **16–27**. Further, as seen in FIG. 3, each radial strut such as strut **12** therein illustrated is joined to a pair of support struts such as struts **27** and **16**.

The opposite or radially inner end of each radial strut member **12** of the roof truss, as shown in FIGS. 1 and 2 in particular, is attached to the central hub element **11** by means of a pin element **30** extending through and

between an associated pair of spaced ear portions 31 depending from the underside of the hub element's main body portion 32. It will be noted that body portion 32 is generally dome-like in formation with the several depending ear elements 31 being paired in parallel spaced relation for receiving one end of an associated radial strut element 12 therebetween. With this arrangement each radial strut element is swingable about the central hub element on individual, separate pivotal axes as defined by the connective pin means 30. The radial strut elements 12 therefore may be moved from their positions of substantially spaced parallelism, as viewed in FIG. 2, to their unfolded positions, as illustrated in FIG. 1, whereat they radiate outwardly from the hub element.

While each of the radial strut elements 12 is joined to two of the ground-engaging support struts 16–27, as above described, each support strut is in turn joined pivotally to one other support strut at its lower or ground-engaging end; such pivotal interjoining of the support struts being effected by a cross-connecting strap means 35 and suitable pin connectors or bolts 36, 36 or the like. Thus it will be appreciated that the support struts 16–27 are coupled pivotally together at one end in pairs so that reading in a counterclockwise direction from strut element 16 in FIG. 1, the support strut pairs are formed of elements 16 and 17; 18 and 19; 20 and 21; 22 and 23; 24 and 25; and 26 and 27.

Like the radial strut elements 12 associated with the polyhedral roof truss, the ground-engaging support struts are likewise capable of being folded into substantially parallel relation relative to themselves and to the radial roof struts 12 when the structure of this invention is collapsed, as illustrated in FIG. 2. In this respect each pair of the support struts, for example strut pair 16 and 17, is folded into a position of parallelism with and between the two radial strut elements 12, 12 to which they are respectively pivotally joined by the ball-and-socket connector means (see FIG. 4). When the radial struts are then swung downwardly about their pivotal axes of connection with the hub element to gain their positions of substantial parallelism (as set out in FIG. 2) the ground-engaging support struts 16 and 17 are likewise disposed in parallel relationship therewith and with respect to themselves. In accomplishing the latter described folded positioning of elements 16 and 17, for example, the same also pivot about their respective pivotal connections with the strap connector means 35 between their outer ends.

In addition to the radial strut elements 12 and the ground-engaging support elements 16–27, the frame structure 10 also includes a plurality of intermediate eave struts numbered successively 40–45, each of which extends between like opposing ends of adjacent paired support struts and the pair of radial struts associated therewith to form a regular base polygon for the polyhedral roof truss. Thus, for example, eave strut 40 extends between the inner ends of the paired support struts 16 and 17 and the two radial struts 12, 12 substantially at the points at which the latter are pivotally joined to the related or associated pair of adjacent radial struts 12, 12; one end thereof being pivotally attached to strut 16 and the opposite end thereof being detachably joined to support strut 17, as will be explained presently.

To attach the several eave struts 40–45 between each pair of associated support struts, one end of each eave strut is bolted or pivotally pinned adjacent one end of a support strut. This permits swinging of each eave strut between positions of parallelism and intersection with the pair of support struts to which it is related. For example, strut 45 is joined by bolt means 46 to its underdisposed and associated support strut 27 substantially at the point of the latter's connection with the ball means 13 (as seen in FIG. 3). Bolt means 46 defines a single pivotal axis for eave strut 45 to permit the latter to swing or pivot thereabout if and when the other or opposite end of strut 45 is free. To this purpose the opposite end of the eave strut 45 is detachably coupled to the inner end of support strut 26 which, it will be recalled, is paired with support strut 27. Such detachable connection of strut 45 with strut 26 is accomplished conveniently by a pin means or a like fastening device, such as single bolt means 47 which is adapted to pass through an extending ear portion 48 at the outer or detachable end of strut 45 and through strut 26. This relationship will best be understood by examining FIG. 3 wherein the connector means 47 is shown in its condition of attaching eave strut element 40 to the inner end of the related support strut 16; such pivotal and detachable connection of the opposite ends of the several eave struts 40–45 being carried out throughout the framework 10.

From the foregoing it will therefore be recognized that by detaching one end of each of the several eave struts 40–45, the same may be readily swung parallel to the support struts to which it is pivotally connected by pin means 46, thereby to achieve the bundled condition for the support framework as seen in FIG. 2.

With the several strut elements in their folded or bundled condition as above described, their organization into the supporting framework structure of FIG. 1 is accomplished substantially in the manner and according to successive steps set out in FIGS. 4–8 of the drawings. Such operation will now be described briefly.

To unfold the bundle of strut elements illustrated in FIG. 2, the several radial struts 12 therein are first swung about their pivotal connections with the hub element 11 so as to radiate in spoke-like fashion outwardly therefrom. This operation disposes the several support struts and eave struts radially of the hub element as well. This initial stage of unfolding is illustrated in FIG. 4. As shown in that figure, each radial strut 12 is disposed in spoke-like fashion relative to the central hub 11 with two support struts and one eave strut lying parallel thereto. The interconnected, paired support struts, such as pair 16 and 17, are then swung upwardly in an arcuate fashion from in between adjacent radial struts to move from their positions of substantial parallelism with their respectively related radial struts 12, 12 to a condition extending outwardly of the outer ends of such radial struts. In this manner the point of interconnection between the members of the support strut pairs is disposed in a plane passing through the hub element 11 and substantially bisecting the angle of separation between adjacent radial struts 12, 12. Carrying out this second unfolding operation eventually resolves the several radial and support struts into positions as illustrated in FIG. 5, defining a somewhat star-shaped pattern. Thereafter the several eave struts 40 through 45 are cross-connected between the inner ends of the support struts and the outer ends of the radial struts to which they are respectively related. Thus for example eave strut 40 is swung from its position of substantial parallelism with support strut 16, as shown in FIG. 5, to its FIG. 6 position wherein the same extends between the inner ends of the paired support struts 16 and 17. Bolt connector means 47 is then operated to join the disconnectable end of strut 40 to support strut 17. In this manner the several eave struts are each in turn connected between the support struts of each pair thereof as shown in FIG. 6. This operation also causes hub element 11 which defines the apex of the polyhedral roof truss to be elevated. Thereafter the several paired support struts such as the pairs 16 and 17, and 26 and 27, as shown in FIG. 7, are swung downwardly about their respective pivotal connections with their associated radial struts 12 to elevate their points of interconnection. This operation is carried on progressively about the periphery of the polyhedral roof truss until all of the paired support struts are disposed substantially in upright condition, making point contact with the ground substantially beneath the center of the several eave struts to hold the roof truss in an elevated

substantially horizontal condition. In so raising the several junction points defined at the pivotal connector assemblies which join the roof truss to the support struts as illustrated in FIG. 3, after each adjacent pair or set of support struts is elevated to a substantially upright condition, a flexible cable or, if preferred, a rigid strut connector means is fastened between their ground-engaging ends. Thus, for example, as shown in FIG. 7, after raising the junction point between the support struts **16, 27**, and the related intervening radial strut **12**, a cable means **50** is connected at its opposite ends to the ground-engaging ends of struts **27** and **16**. Likewise cable means **51** is extended between the lower ground-engaging ends of struts **17** and **18**; cable **52** is extended between the ground-engaging ends of struts **19** and **20**; and so on around the structural framework employing the several cables numbered successively **50** through **55** until the rigid, stable raised framework of FIG. 1 is gained.

It is contemplated within the scope of this invention that the several cable means **51–55** may be detachably separate from the strut framework or alternatively stored within the hollow interior of the several support struts; there being one such cable associated with each pair of support struts. Further, as noted above, in certain conditions the cable means **51–55** may be replaced with rigid strut elements similar to the eave struts **40–45**, while, alternatively, such rigid struts or cables may be eliminated entirely by anchoring each of the ground-engaging points of related pairs of support struts with suitable stakes or the like, much as in anchoring the corners of a tent. Be that as it may, it is essential to the accomplishment of a rigid, stable support framework from the several pivotally interconnected radial, support and eave strut elements which go to make up the improved structural framework of this invention, that the ground-engaging ends of the several support struts be firmly anchored and held in stable position, otherwise the supporting framework as illustrated in FIG. 1 will readily collapse to the condition shown in FIG. 6.

Once the structural framework **10** has been achieved by the unfolding operation as above described, any suitable covering may be placed either over the exterior of the strut elements, or suspended within such structural framework, for instance, according to the concepts and teachings set out in my previous patent application Serial No. 744,517, filed June 25, 1958, now Patent No. 2,962,034, and entitled Shelter and Method of Making Same. In any event it will be understood that the framework **10** of FIG. 1 is designed and intended to support a suitable covering such as a flexible tent covering of canvas, nylon, or other similar flexible material, or in certain instances it may be desirable to affix rigid structural plate elements across the several struts of the frame assembly **10**.

While the above-described framework assembly **10** comprises a polyhedral roof truss made up of the six radial struts **12**, six eave struts **40–45**, and the interconnection means therebetween, the exact number of sides for the polyhedral roof truss is not necessarily limited to a hexagon. For example, a pentahedral roof truss may be accomplished with like facility and purpose, as illustrated in FIG. 9 of the drawings. As therein shown, a modified five-sided roof truss and supporting framework **10'** is shown to comprise five radial struts **12'** which radiate in spoke-like fashion from a central hub element **11'** and are adjoined to five pairs of ground-engaging support struts **16'** through **25'**; the separated radial struts **12'** and the support struts **16'–25'** being cross-connected by five eave struts **40'** through **44'**. Since the roof truss of the modified assembly **10'** as set out in FIG. 9 is a five-sided or pentahedral structure, only five pairs of the ground-engaging support struts are employed therewith to thereby present five points of ground-engaging contact support for the structural framework. This produces a shelter having five triangular sides defined by the area between the ground-engaging points of adjacent pairs of support struts plus an additional five sides defined by the triangular areas between such each pair of ground-engaging support struts. Thus in effect a ten-sided figure is provided when employing a pentahedral roof truss of FIG. 9, as opposed to the twelve-sided shelter presented by the six-sided roof truss of FIG. 1.

Such modifications to include greater or fewer struts and sides for the shelter of course do not alter the concept or spirit of the present invention. Consequently it will be understood that a shelter framework constructed and formulated as above described and embodying the teachings and concepts demonstrated by the accompanying drawings provides a shelter structure having a relatively low silhouette, large ground dimensions, and enclosing a fairly substantial volume. Further, the interior of such a shelter is completely free and clear of any supporting obstructions which might interfere with maximum use of its interior volume. Additionally, the attic space, or that is the vertical height and volume of the shelter above the eave line, is maintained at a minimum.

From the foregoing it will therefore be recognized and understood that I have herein presented the teachings and features of a new and improved shelter and shelter framework having marked distinction for its simplicity, convenience of utility, and capability of being knocked down for transporting purposes. Further, while I have herein set forth the features and concepts of this invention as it relates to a particular preferred form of shelter structure, it will be readily recognized and appreciated that numerous changes, modifications and substitutions of equivalents may be made therein without necessarily departing from the spirit and scope of this invention. Consequently it is not my intention to be limited by the particulars of the herein described preferred and modified forms of my invention except as may appear in the following appended claims.

I claim:

1. A foldable structural framework for a shelter comprising, a central hub element, a plurality of linear radial struts each pivotally connected at one end to said hub element for movement about its respective pivot axis between parallel folded positions, with said hub element at one end thereof, and unfolded positions in which they radiate divergently outwardly from said hub element, a plurality of ground-engaging support struts each having one end thereof adapted to engage the ground and the other end thereof universally pivotally connected to the outer end of a said radial strut, remote from the latter's connection with said hub element, there being two support struts so connected to each radial strut; means pivotally interconnecting the ground-engaging ends of adjacent support struts so that the same are coupled in pairs for pivotal movement on parallel axes between parallel and intersecting positions with the pivotal interconnecting means therebetween lying in a plane passing through said hub element and substantially bisecting the angular separation between adjacent radial struts when the latter are in their unfolded radiating positions, and a plurality of eave struts adapted to be extended between the said other ends of the support struts of each pair thereof so as to maintain the latter's respectively associated radial struts separated in their divergently radiating positions, one end of each eave strut being disconnectably joined to a said support strut and the other end thereof being pivotally connected to an adjacent support strut so as to permit the eave struts to be swung into positions paralleling and intersecting said support struts, and the pivotal connection of said support struts with said radial struts providing movement of the said support and eave struts into positions of parallelism with said radial struts whereby all of said struts may remain interconnected and be disposed in side-by-side parallelism to form

an elongated bundle having the said hub element at one end thereof.

2. The combination of claim 1 including flexible cable means adapted to interjoin the ground-engaging ends of all said support struts, when the latter are in their unfolded positions, to thereby stabilize the framework.

3. The combination as set forth in claim 1 wherein the pivotal connection of each support strut with a said radial strut comprises a ball-and-socket means affording substantially universal pivotal movement, and a plurality of flexible connector means adapted to extend between the ground-engaging ends of the several pairs of support

struts when the latter are in their ground-engaging positions so as to hold said ground-engaging ends in substantially a fixed pattern to effect rigid stability for said framework.

References Cited in the file of this patent

UNITED STATES PATENTS

1,546,222	Finlay	July 14, 1925
2,113,118	Pyatt	Apr. 5, 1938

FOREIGN PATENTS

721,247	France	Dec. 13, 1931