A segmented inflatable beam truss includes at least first, second and third separate inflatable beams mounted or mountable to one another and having, respectively, first, second and third lengths and a substantially constant diameter among all of the three beams. Each beam of the three separate beams includes an outer flexible substantially non-resilient sleeve along the entire length of the beam and an inner inflatable bladder extending substantially entirely along and in the entire length of the sleeve.
INFLATABLE BEAM TRUSS AND STRUCTURE

CROSS REFERENCE TO RELATED APPLICATION


FIELD OF THE INVENTION

[0002] This invention relates to the field of inflatable structures and in particular to an inflatable beam truss and the resulting inflatable structure using the beam truss or trusses, where each beam truss includes multiple separate or segmented pneumatic beams.

BACKGROUND OF THE INVENTION

[0003] Inflatable tents for use in camping are known in the prior art and are sold commercially by for example Airzone Recreation Products of Kelowna, British Columbia, Canada. Such tents typically replicate camping tents available commercially which rely on bent fibreglass poles for their support structure and instead substitute inflatable poles which, when inflated, provide the supporting framework for the exterior fabric skin or canopy of the tent over which a so-called fly sheet may be mounted. In the other extreme, large tents are known in the prior art for use such as by the military for providing field barracks, field hospitals and various depot facilities, such tents often being made of canvas and supported on tubular metal-pole supporting structures.

[0004] Applicant believes that a commercial need exists for relatively large pneumatically inflatable tent-like structures which are much larger than conventional recreational camping tents. It is believed that such structures will find commercial acceptance and use by the owners of large for example sport utility vehicles, boats, trailers, and other wheeled vehicles or towables which ordinarily would require a large garage or shed for their safe storage and which are often not housed in, for example, conventional residential homes as not having extended garage facilities. Also applicant believes that commercial acceptance and use of such larger pneumatically inflatable tent-like structures may include those in the field of general purpose coverings such as portable corporate sponsorship pavilions for example for use in trade-shows, portable pneumatically inflatable recreational and professional sports shelters for sheltering equipment, non-engaged players, or sickly or wounded players on for example the side-lines of a sports field, portable medical or military or emergency relief housing or shelters or the like.

[0005] What is required, is a relatively larger pneumatically inflatable structure which may be readily transportable in that, when collapsed, the structure is not exceedingly heavy or overly bulky so the structure may be transported in light trucks including for example sport utility vehicles, in minivans, or in the beds of ordinary pickup trucks and the like, and for example may be carried by two or more adult males to a convenient location for their use, and wherein the structure may be erected using for example a high volume, low pressure air compressor running for example from the twelve volt power source of the vehicle used to transport the collapsed structure.

SUMMARY OF THE INVENTION

[0006] In the prior art applicant is aware of the following issued patents illustrating aspects of the state of the art in pneumatically erectable structures including tents:

prior art using single narrow inflatable beams. This structure also does not necessarily result in a vertex of the beam truss which is overly high above the floor of the enclosure. In other words, it is not required with the present invention to form, using one or more inflatable beam trusses, an air-inflated structure in the manner of a tepee-shape or conventional tent shape where the vertex is relatively quite high above the floor of the enclosure, due for example to the beam truss forming a semi-circle, in order to provide rigidity to the structure.

In summary, the segmented inflatable beam truss according to one aspect of the present invention may be characterized as including at least three, that is, first, second and third, separate inflatable beams mounted or mountable to one another and having, respectively, first, second and third lengths and a substantially constant diameter among all of the three beams. Each beam of the three separate beams includes an outer flexible substantially non-resilient sleeve along the entire length of the beam and an inner inflatable bladder extending substantially entirely along and in the entire length of the sleeve.

Each beam is substantially linear when unconstrained and inflated. Each beam is flexible so as to form an arch-shape when opposite ends of each beam are constrained by anchoring of the opposite ends on the ground at a distance between the ends which is less than the length of each beam.

At least the first and second beams are of substantially equal length and are mounted adjoined to one another in side-by-side parallel relation so as to be co-extensive with one another along the arch-shape. The third beam is mounted adjoined to the first and second beams so as to extend therealong in side-by-side parallel relation and positioned so as to extend over at least a vertex portion of the arch-shape.

Inflatable beam trusses may be employed as a frame for mounting a canopy thereto to provide a covered structure such as a housing, tent, shelter, sports enclosure whether fully or only partly enclosed, storage facility to name just a few possible uses of the many available. Such a covered structure may include a plurality of inflatable beam trusses for example in a criss-cross pattern as illustrated by way of example herein to form a dome-style enclosure, or may for example be employed in a parallel spaced-apart array to form a quonset-style enclosure to name just two possible uses of the several or many available enclosures may have doorways or otherwise be open-ended or open-sided or may be otherwise open with merely a sun-slate on the vertex of the enclosure.

The beam trusses may have various embodiments. For example, they may include more than three individual separate inflatable beams. The third beam, or at least one or more of the separate beams where there are more than three separate beams in each beam truss, may be shorter than the two long separate beams, that is, the minimum pair of first and second beams that span the entire length of the truss.

Further, each separate beam may be tubular in shape, for example such as described in shape and construction in my U.S. Pat. No. 6,263,617, incorporated herein by reference. Advantageously at least the first and second beams are substantially dimensionally identical. The third beam may be of substantially the same diameter as the first and second beams.

Further still, each of the separate beams, and in particular at least the first and second beams have a high aspect ratio, that is, a ratio of length to width which is much greater than one. For example, if each separate beam is advantageously uniformly tubular or cylindrical in shape when un-bowed, and if each separate beam has a circumference of generally twenty-two inches for example, meaning a diameter of approximately six to seven inches, and an overall circumferential length arched between where the opposite ends of the beam truss are anchored to ground (that is, directly to the ground or to a base which itself may be anchored to the ground) of generally twenty-four feet, then the beam truss has an aspect ratio of approximately forty-five (288 inches long: 6.4 inches in diameter).

BRIEF DESCRIPTION OF THE DRAWINGS

In drawings which illustrate embodiments of the invention wherein similar characters of reference denote corresponding parts in each view,

FIG. 1 is, in perspective view, one embodiment of the inflatable beam trusses according to the present invention employed in a criss-cross fashion to form a dome-like enclosure.

FIG. 1a is, in perspective view, an alternative embodiment shown in dotted outline, the structure of FIG. 1.

FIG. 2 is, in side elevation view, the structure of FIG. 1.

FIG. 3 is, in plan view, the structure of FIG. 1.

FIG. 4 is, in end elevation view, the structure of FIG. 1.

FIG. 5 is an enlarged partially cut away view of the underside of the vertex of the structure of FIG. 1.

FIG. 6a is an enlarged partially cut away view taken from FIG. 4.

FIG. 6b is an enlarged partially cut away view taken from FIG. 4.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

In the example illustrated, a relatively large inflatable structure is supported by three criss-crossed segmented air beams or inflatable beam trusses 10. It is understood that the use of three such beam trusses 10 is by way of example only in that structures employing fewer or greater numbers of the beam trusses according to the present invention may also be useful.

Thus as may be seen, each beam truss 10 is comprised of a bundle of separate inflatable tubes or beams. In the illustrated example, each beam truss 10 includes a pair of long spanning tubes 12a and 12b mounted together side-by-side so as to be coextensive between their opposite first and second ends. These longer spanning tubes 12a and 12b form an arch extending between their opposite ends when their opposite ends are fixed to the ground or to a base such as base sheet 14. Thus with the first and second opposite ends of the pair of tubes 12a and 12b constrained by being mounted to for example the outer edges of base sheet 14, and advantageously, with the edges of the base sheet secured to the ground, the length of the spanning tubes dictates that they form an arch because their length is greater than the diameter of the base.

In the illustrated embodiment, which is not intended to be limiting, each spanning tube 12a and 12b is itself made up of two individual inflatable tubes mounted end-to-end at vertex 8 for example by stitching the ends together. In this fashion, the entire beam truss 10 may be constructed of a multiplicity of identical shorter, for example approximately
twenty-four foot long, inflatable tubes which are used to construct, in this example, the approximately forty-eight foot long spanning tubes 12a and 12b, and to serve individually as the casing tubes 16.

[0030] A casing inflatable air tube, such as the illustrated shorter casing tube 16, is mounted to the pair of spanning tubes 12a and 12b across the vertex 8 of the arch so as to extend symmetrically along the arch from the vertex along a distance which is proportionally shorter than the length of the spanning tubes. The casing tube 16 provides both for strengthening and stiffening of the vertex 8 of the beam truss 10 and for flattening the curvature of the upper portion of the beam truss on either side of the vertex along the length of the casing tube. The flattening of the curvature of the arch reduces the height of vertex 8 above the base sheet 14 and forces the ends of the spanning tubes where they extend between the ends of the casing tube and the base sheet to bulge outwardly and upwardly thereby forming more vertical wall portions of the beam truss from the ends of the pair of spanning tubes effectively raising the ceiling height around the perimeter of the base and thereby making the enclosure more useful towards and around the periphery of the base sheet.

[0031] Thus as may be seen in the illustrated embodiment, which is not intended to be limiting, the length of the casing tube may be approximately one half of the length of each of the spanning tubes so as to provide the strengthening, stiffening and flattening of the resulting beam truss 10 when the casing tube is mounted onto the vertex portion of the pair of spanning tubes. Thus with each beam truss 10 so formed, a plurality of beams trusses may be mounted in radially spaced array about a vertical axis extending through their common vertex so that, with the ends of the plurality of beam trusses mounted to the corresponding circumferentially spaced locations around the periphery of the base sheet, a rigid inflatable frame is formed over or under which may be mounted a flexible canopy to serve as the tent or other enclosure.

[0032] Advantageously, at least one air hose 18 is mounted in fluid communication between each inflatable tube 12 and 16 in each beam truss 10, and between adjacent beam trusses 10 so that the inflation of a first beam truss causes simultaneous inflation of the rest of the beam trusses in the frame so that the inflatable frame becomes self-erecting for example when advantageously the vertices of the beam trusses are mounted to one another and the ends of the beam trusses are mounted to the base sheet and also secured to the ground prior to inflation. For example, in each beam truss, the pair of spanning tubes 12 and the casing tube 16 may be mounted to one another by the use of straps which may include hook-and-loop fasteners, and similarly, the vertices of each of the beam trusses may be mounted to one another also by means of straps or hook-and-loop fasteners or the like. Of course, the separate tubes in each beam truss may also be stitched or otherwise fastened to one another by known means in whole or in part, that is, with or without the further use of hook-and-loop fastening straps or strips.

[0033] As shown in dotted outline in FIG. 1a, casing tube 16 may in one embodiment have a length substantially equal to the length of the spanning tubes 12a and 12b. In alternative embodiments not illustrated, each beam truss may include more than two spanning tubes and more than a single casing tube in order to increase the strength of the resulting beam truss to thereby accommodate spanning greater distances without the need for supporting poles to uphold, for example, the vertex of the inflated structure.

[0034] In one embodiment which is not intended to be limiting, each spanning and the corresponding casing tube in each beam truss are constructed as a separate sleeve for each tube, each sleeve constraining a resilient inflatable inner tube or bladder extending the length of the sleeve. For example, each sleeve may have a circumference of approximately twenty inches and the spanning tubes may be approximately forty-eight feet long and the casing tubes may be approximately twenty-four feet long in the illustrated embodiment.

[0035] As will be apparent to those skilled in the art in the light of the foregoing disclosure, many alterations and modifications are possible in the practice of this invention without departing from the spirit or scope thereof. Accordingly, the scope of the invention is to be construed in accordance with the substance defined by the following claims.

What is claimed is:

1. A segmented inflatable beam truss comprising:
   at least three, that is, first, second and third, separate inflatable beams mounted or mountable to one another and having, respectively, first, second and third lengths and a substantially constant diameter among all of said three beams, wherein each beam of said three separate beams includes an outer flexible substantially non-resilient sleeve along the entire length of said beam and an inner inflatable bladder extending substantially entirely along and in said entire length of said sleeve, wherein said each beam is substantially linear when unconstrained and inflated, and wherein said each beam is flexible so as to form an arch-shape when opposite ends of said each beam are constrained by anchoring of said opposite ends on the ground at a distance between said ends which is less the length of said each beam, and wherein at least said first and second beams are of substantially equal length and are mounted adjoined to one another in side-by-side parallel relation so as to be co-extensive with one another along said arch-shape, and wherein said third beam is mounted adjoined to said first and second beams so as to extend therealong in side-by-side parallel relation and positioned so as to extend over at least a vertex portion of said arch-shape.

* * * * *