

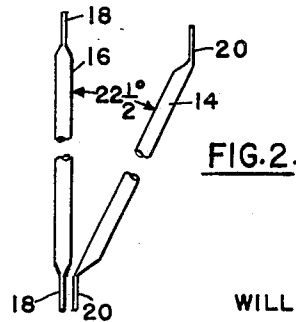
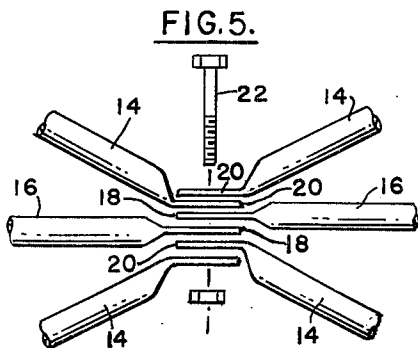
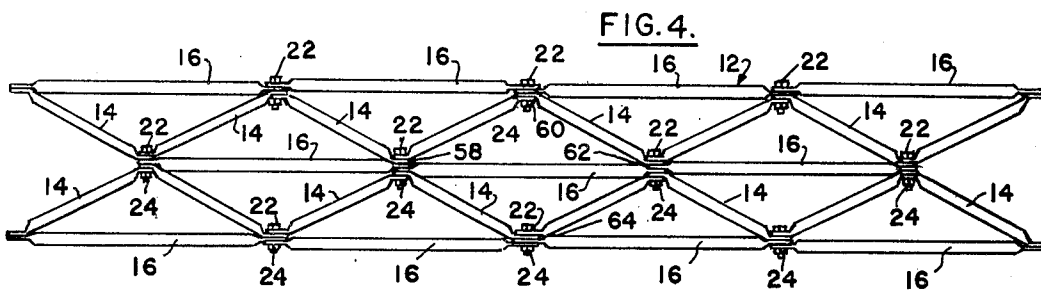
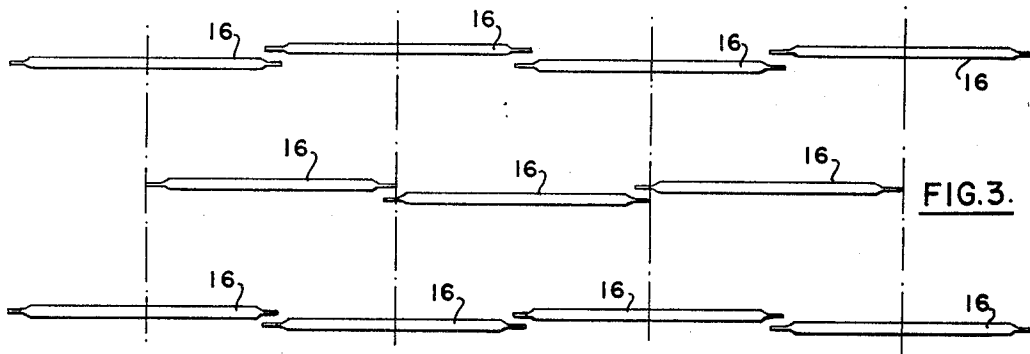
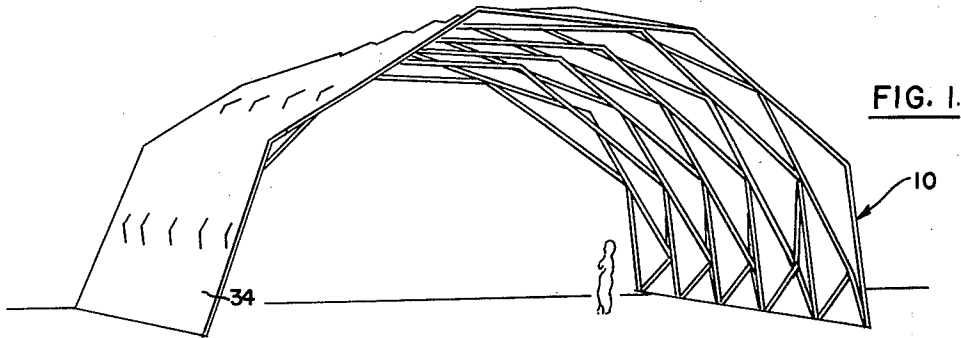
March 24, 1970

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MODULAR STRUCTURE

3,501,876

Filed Jan. 2, 1968

5 Sheets-Sheet 1



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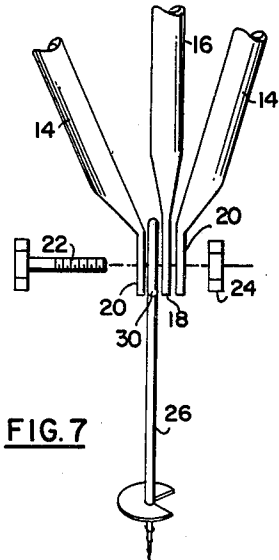


FIG. 7

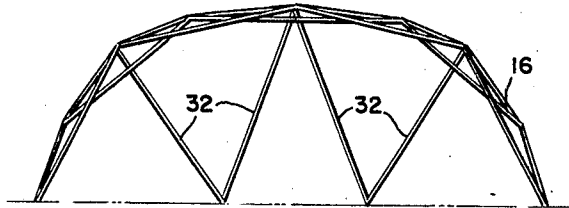


FIG. 8

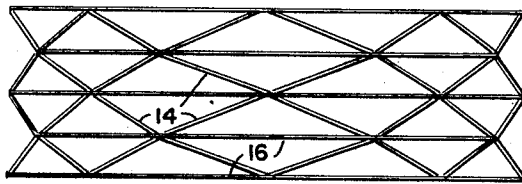


FIG. 9

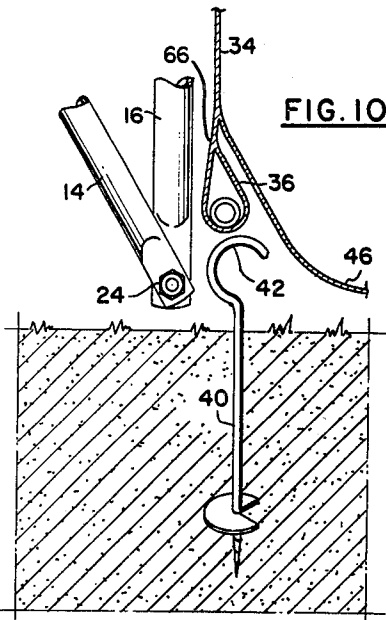


FIG. 10

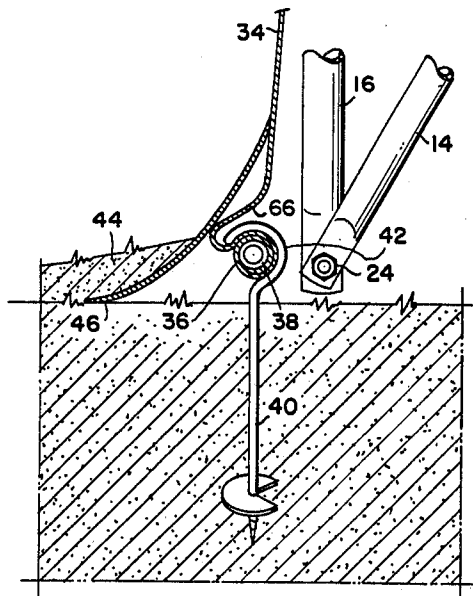


FIG. 11

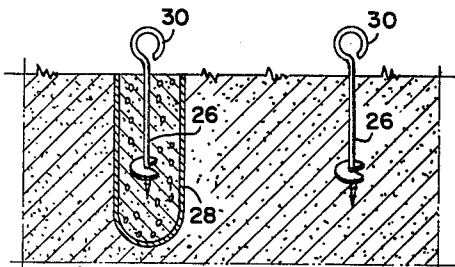


FIG. 6

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FIG. 12

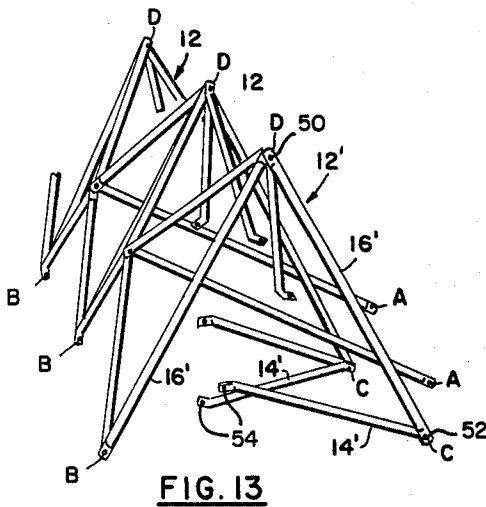
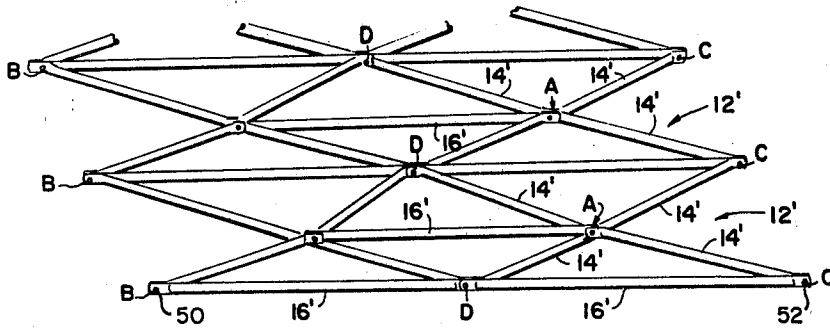


FIG. 13

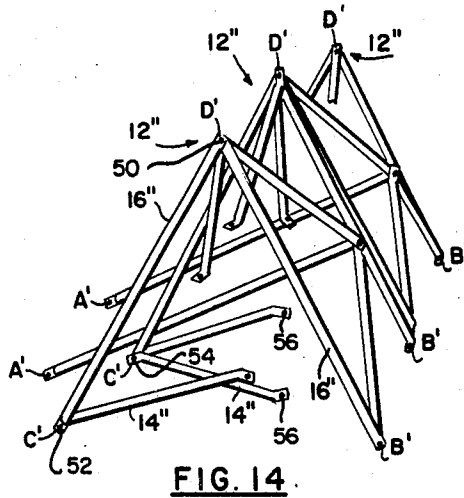


FIG. 14

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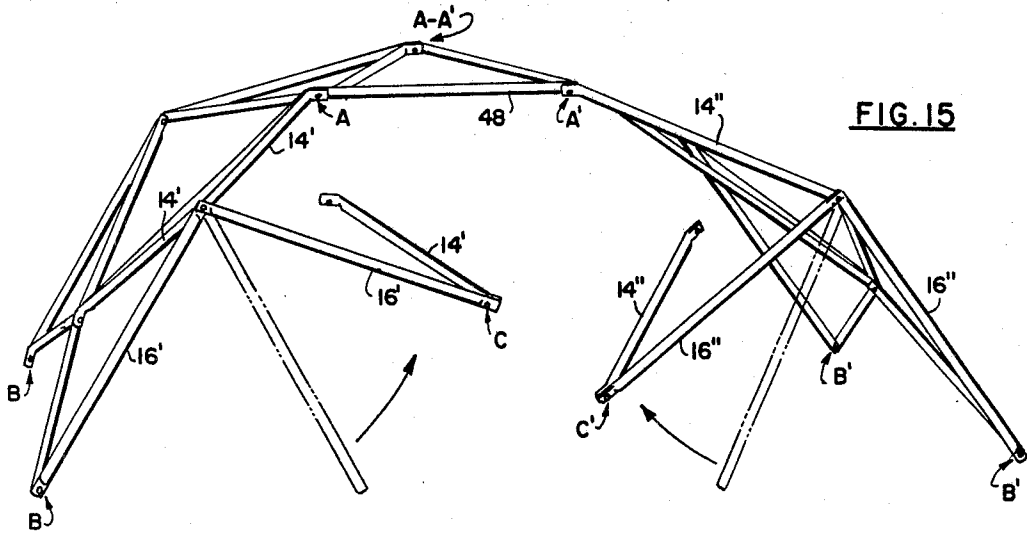


FIG. 15

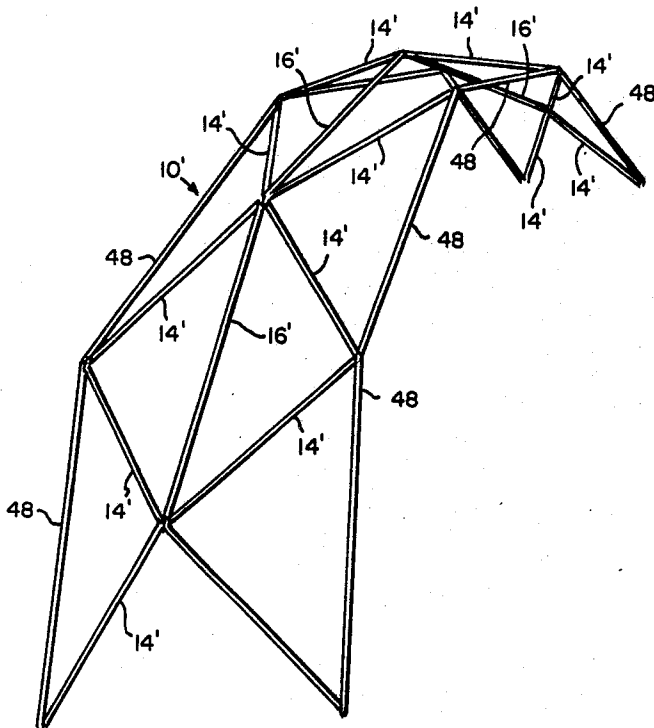


FIG. 16

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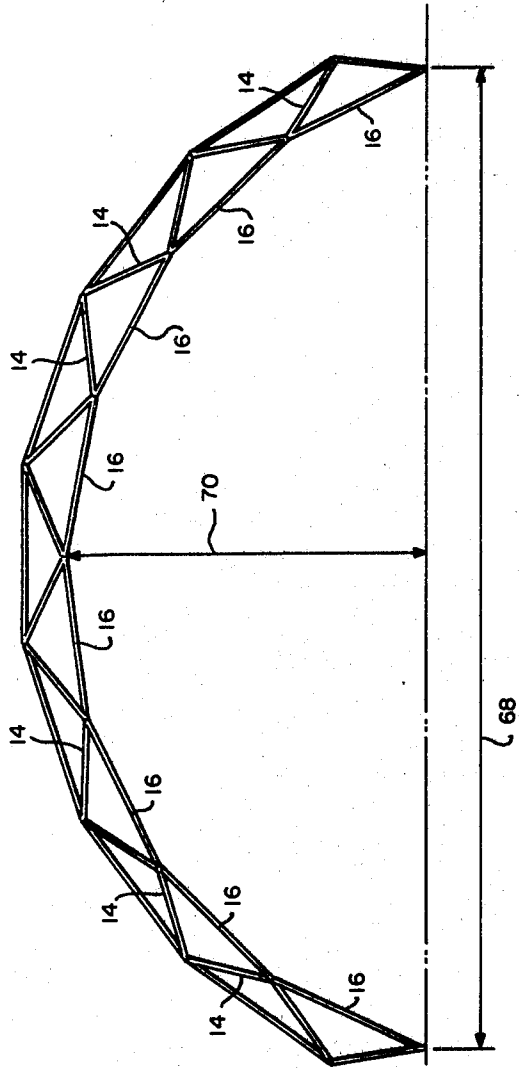


FIG. 17

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MODULAR STRUCTURE

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Int. Cl. E04b 1/32, 1/347

U.S. Cl. 52—86

2 Claims

ABSTRACT OF THE DISCLOSURE

A prefabricated modular enclosure comprising a plurality of repetitive tubular frame elements comprising only two sizes bolted together to form modular sections and secured to the ground to provide a sturdy frame of desired size and a flexible, plastic, waterproof covering stretched over the frame and secured thereto.

This invention relates to the building industry in general and more particularly to a new building structure of a permanent or semi-permanent type which affords extreme simplicity in design and which is quick and simple to assemble and disassemble.

A structure of this type could be used as an enclosure for swimming pools, for year 'round storage for private planes, and in general as an enclosure for any type of storage problem. The structure is so designed and arranged that its simplicity in erection makes possible a building that may be either permanent or seasonal.

Due to the high cost of construction of a permanent or semi-permanent type of building structure utilizing conventional types of building materials and usual methods of construction, present structures are not suitable in many instances for seasonal enclosures and low cost business operations.

The present invention now makes it economically feasible to provide low cost building structures which may be of a portable, semi-permanent, or permanent nature for any one of the aforesaid variety of activities. If desired, structures of the type herein disclosed could be economically removed and stored upon termination of a given activity.

The advantages of the invention are particularly pronounced when used as a temporary building structure due to its extreme simplicity of construction and the ease and speed of assembly and disassembly.

The instant disclosure teaches a system which contributes the best of design in useful structures for pleasure or utility. The weight of the finished structure is considerably lighter than buildings of equivalent size utilizing conventional materials. Field labor and erection time is also minimized when utilizing the principles of construction made possible by this invention.

The construction of the present invention is achieved by the use of but two different lengths of tubular members. Equal distribution of material about the central axis of a tube permits uniform resistance to stress by all portions of the shape when resisting compression loads. In direct axial compression, tubes show their greatest structural advantages. The most efficient cross section of a compression member is one with a constant radius of gyration about any axis through its center of gravity; and, therefore a round tube is the ideal section for the instant application.

Despite the obvious advantages of the circular cross sectional shape, it has found but limited use in structural applications in the past. The principal deterrent to the widespread development of tubular structures has been the difficult of joining tubes to other tubes when compared to joining angles, channels and shapes of other cross sections.

It is therefore an object of the present invention to provide an improved structure of the type set forth for obviating the above mentioned difficulties.

Another object is the provision of a building structure which can be easily assembled and disassembled.

A further object is to provide a building structure which is comprised of only two basic parts plus covering.

Still another object is the provision of a building structure which is assembled from two lengths of tubing and which provides high structural strength with a minimum of weight.

It is another object of this invention to provide a structure that is of the modular type utilizing materials that are designed for ready assembly and disassembled.

It is another object of the instant invention to provide a novel structure which may be easily erected by relatively unskilled workmen.

It is another object of the present invention to provide an improved structure so designed as to be easily expanded to enclose larger areas.

It is another object of the instant invention to provide an improved structure which may be quickly erected by using simple hand tools.

It is another object of the instant invention to provide an improved structure designed to enclose large areas at an extremely low cost basis per cubic foot of space enclosed.

It is another object of the instant invention to provide an improved structure of modular design whereby additional sections may be added or removed as required to cover a given area.

It is another object of the present invention to provide an improved structure incorporating a rigid frame and a weatherproof covering therefor.

It is another object of the present invention to provide an improved structure that is rugged in construction, simple in assembly and trouble-free when in use.

Other objects and a fuller understanding of the invention will be had by referring to the following description and claims of a preferred embodiment thereof, taken in conjunction with the accompanying drawing wherein like reference characters refer to similar parts throughout the several views and in which:

FIG. 1 is a perspective view of the invention including covering thereon.

FIG. 2 illustrates the two main tubes of the invention, prior to the connection thereof.

FIG. 3 illustrates an intermediate position of the long tubular members in the process of being assembled into a section.

FIG. 4 is a top plan view of part of a modular section, prior to arching into final position.

FIG. 5 illustrates an exploded view of the connection of the respective tubular members to each other.

FIG. 6 illustrates alternative methods of anchoring the invention in the ground.

FIG. 7 is an exploded view of the connection of the tubular members to an anchor.

FIG. 8 is an end elevational view of an assembled structure.

FIG. 9 is a partial top plan view of the structure.

FIG. 10 illustrates the bottom of the cover before being anchored to the ground.

FIG. 11 illustrates the bottom of the cover engaged to a ground anchor.

FIGS. 12-16 illustrates methods of assembly.

FIG. 17 is an end elevational view of a modified design which may be employed for larger structures.

Referring now to the drawings, there is shown in FIG. 1 a building structure 10 which is constructed of a series of shaped rods, tubes or members, namely, short tubular members 14 and long tubular members 16. The end por-

tions 18 of the long tubes 16 are flattened for connection purposes and are provided with bolt openings 50, 52 for erection purposes as will be hereinafter described. The end portions 20 of tubes 14 are also flat, as seen in FIG. 2, but are bent at a twenty-two and one-half degree angle from the axis of the tubes. The flat end portions 20 of the tubes 14 also are provided with bolt openings 54, 56 to facilitate erection of the structure.

In assembling a modular section 12, a plurality of long tubular members 16 are laid in a staggered relationship on the ground, in rows approximately two feet apart as shown in FIG. 3. Each successive tube or member in each row has its end portion 18 in an overlapping position with the end portion 18 of the next tube 16 in the same row. Tubes 14 are then placed between the end portions 18 of a pair of tubes in the outside rows and the end portion 18 of a pair of tubes in the next adjacent row. When all the end portions 18, 20 are in place, the respective holes 50, 52, 54, 56 are aligned and a bolt 22 is placed therethrough (see FIG. 5) and secured using a nut 24. When all the tubes 14 and 16 are secured together, the modular section 12 is completed (see FIG. 4) and is ready for erection. It should be noted in FIG. 5 that all tubes which touch extend in opposite directions.

When completing the structure 10, as seen in FIG. 1, it is necessary to combine a plurality of sections 12. The length of the structure may be readily varied by employing more or less sections 12. This is accomplished by securing the end portions 18 of the respective outside tubes 16 to the end portions 18 of outside tubes 16 of another section 12. When each section 12 is completed, the unit can be erected to an arched position by pulling up on the joints 58, 60, 62, 64 near the center of the section. When the unit is in the arched position, the legs should then be secured to the ground by the use of a plurality of anchors 26. The grip anchors 26 may be secured in the ground by screwing therein as shown on the right hand side of FIG. 6 or by setting in concrete 28 as shown on the left hand side of FIG. 6. In attaching the structure legs or tubes to the anchors (see FIG. 7) it is necessary to first remove the nut 24 and bolt 22 from each leg and align the head portion 30 of the anchor 26 with the openings in 50, 52, 54, 56 in the end portions of the tubes 14 and 16. With the openings aligned, the bolt 22 can be reinserted and the nut 24 applied to secure the structure to the ground.

If it is desired to close off the ends of the structure 10, a plurality of end supports 32 (see FIG. 8) can be secured to the structure and to the ground in the same manner as previously described.

After erection and anchoring to the ground, a modularly fabricated cover 34, (see FIG. 1) which could be made of a vinyl fabric can be applied over the entire frame. The cover 34 is placed over the sections 12 and secured as in FIGS. 10 and 11. The cover 34 is provided with a hem 36 along the bottom 66 thereof and a tube or pipe 38 inserts into hems 36. A plurality of anchors 40, having partially opened heads 42 are secured into the ground approximately four inches outside of the sections 12 and removably grip the hem 36 with the pipe 38 therein, as seen in FIG. 11.

To seal the bottom of the cover 34, dirt, sod or sand 44 may be placed on the flap 46, as shown in FIG. 11.

To protect the cover 34 from abrasion on the edges of the tubes 14 and 16, plastic pads of suitable design (not shown) could be affixed at each bolted junction in any well-known manner.

In FIGS. 12-16, an alternate method of construction is provided. FIG. 12 shows a plurality of sections 12' bolted together in the same manner as in FIG. 4 except that the rods 14' and 16' at areas A are not secured by nuts and bolts. The areas B, C and D are marked to help identify the same tubes when shown in the next position as seen in FIGS. 13 and 14. The left hand section (FIG. 13) shows the section of FIG. 12 in its intermediary position. The right hand section (FIG. 14), with its areas in-

dicated as A', B', C', and D', is also shown in an intermediary position ready to be connected to the left hand section (FIG. 13).

In connecting the two sections 12' and 12'' (FIGS. 13 and 14) it is necessary to utilize an extra length tube 48, see FIG. 15, to connect the areas A and A''. The areas C and C' are jointed together (see arrows) and the complete structure 10' is then ready for covering. By utilizing the design shown, a structure having a width of thirty feet and a clearance height of eleven feet six inches can be provided.

Obviously many modifications and variations of the present invention are possible in light of the above teachings. It is therefore to be understood, that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

In FIG. 17, I show a modified design wherein the same principles as hereinbefore set forth may be employed in the construction of a much larger enclosure. In this instance, eight large tubular members 16 are employed end to end 18 to form the arch of the structure. The angular shorter members 14 interconnect with the rods 16 at the joints in the manner hereinbefore described and the bolts and nuts 22, 24 secure the members in the usual manner. By arranging the rods 14, 16 in this manner, the width 68 of the structure can be increased to sixty feet, feet, six inches.

It is thus seen that by employing tubular members of only two distinct lengths, and arranged in angular relation of twenty-two and one-half degrees from each other, a unique, extremely light, strong structure can be erected with simple tools in a minimum of time. The angular relation of exactly twenty-two and one-half degrees results in each joint 58, 60, 62, 64 being raised upwardly and outwardly for maximum structural strength at each point of tubular member intersection. In this manner, the two foot distance between rows of adjacent tubular members 16 is maintained for modular construction and ultimate strength is assured.

Although I have described my invention with a certain degree of particularity, it is understood that the present disclosure has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and scope of the invention as hereafter claimed.

What is claimed is:

1. In a module comprising only a plurality of first and second tubular members as part of a series of similar modules joined together in side by side relationship to form an enclosing arched structure of variable height, the combination of:

(A) a plurality of first tubular members arranged in end to end juxtaposition to form a plurality of transverse, parallel, equally spaced rows,

(1) each first tubular member being of equal size and length,

(a) each said member terminating outwardly in similar joint forming ends,

(2) each row being longitudinally offset from the next adjacent row by a distance equal to one-half the length of a first tubular member,

(a) the adjacent ends of the said juxtaposed first tubular members being connected to form a plurality of transverse, equally spaced joints, the said joints on adjacent rows being longitudinally respectively offset from one another a distance equal to one-half the length of a first tubular member, and

(B) a plurality of second tubular members respectively joining the first tubular members,

(1) each second tubular member being of equal size and shorter in length than the said first tubular members,

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- (a) each said member terminating outwardly in joint forming ends,
- (2) the second tubular members being respectively angularly disposed between adjacent rows of the first tubular members,
 - (a) the angular disposition between the second tubular members and the rows of first tubular members being twenty-two and one-half degrees,
 - (b) the joint ends of the second tubular members being bolted to the first tubular members at the joints thereof, a second tubular member extending from each joint on one row to the nearest joints on the adjacent rows, each joint on said one row being adjustably positioned an equal perpendicular distance above an associated plane drawn through the adjacent first tubular members in the rows on either side of each joint on said one row, whereby the spring of the said arched structure may be varied by increasing or decreasing the

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- perpendicular distance from each said joint on said one row to its said associated plane.
- 2. The invention of claim 1 wherein the said rows are spaced two feet apart.

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U.S. Cl. X.R.

35-1, 4; 52-665