June 16, 1964 N. H. NYE 3,137,371

BUILDING STRUCTURE

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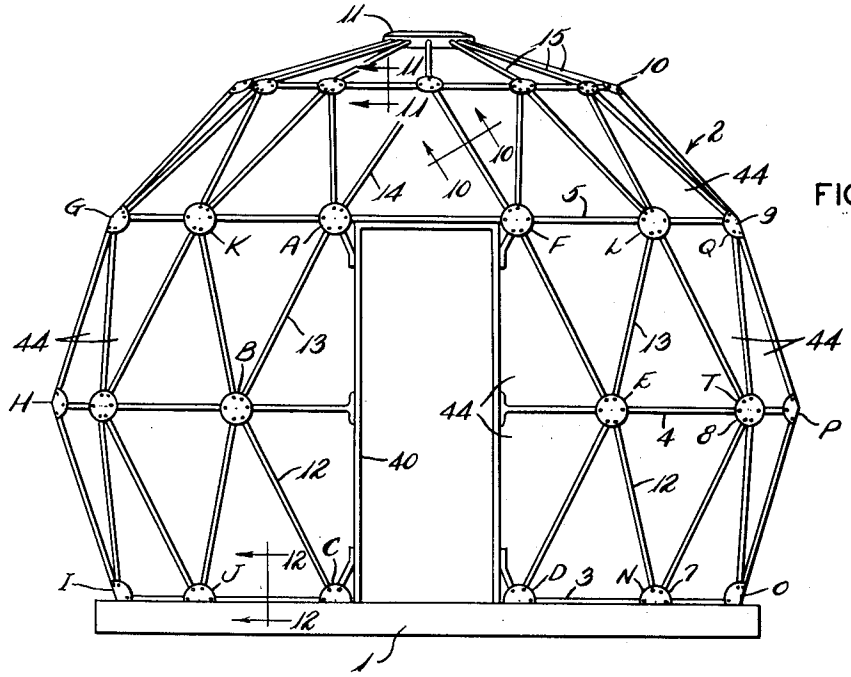

FIG. 1

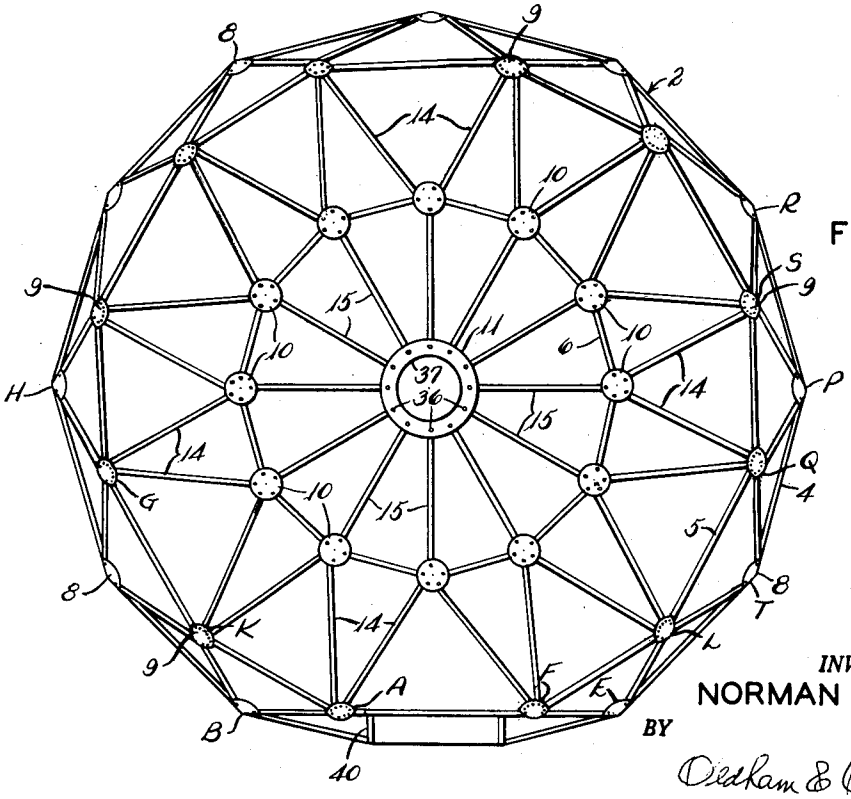

FIG. 2

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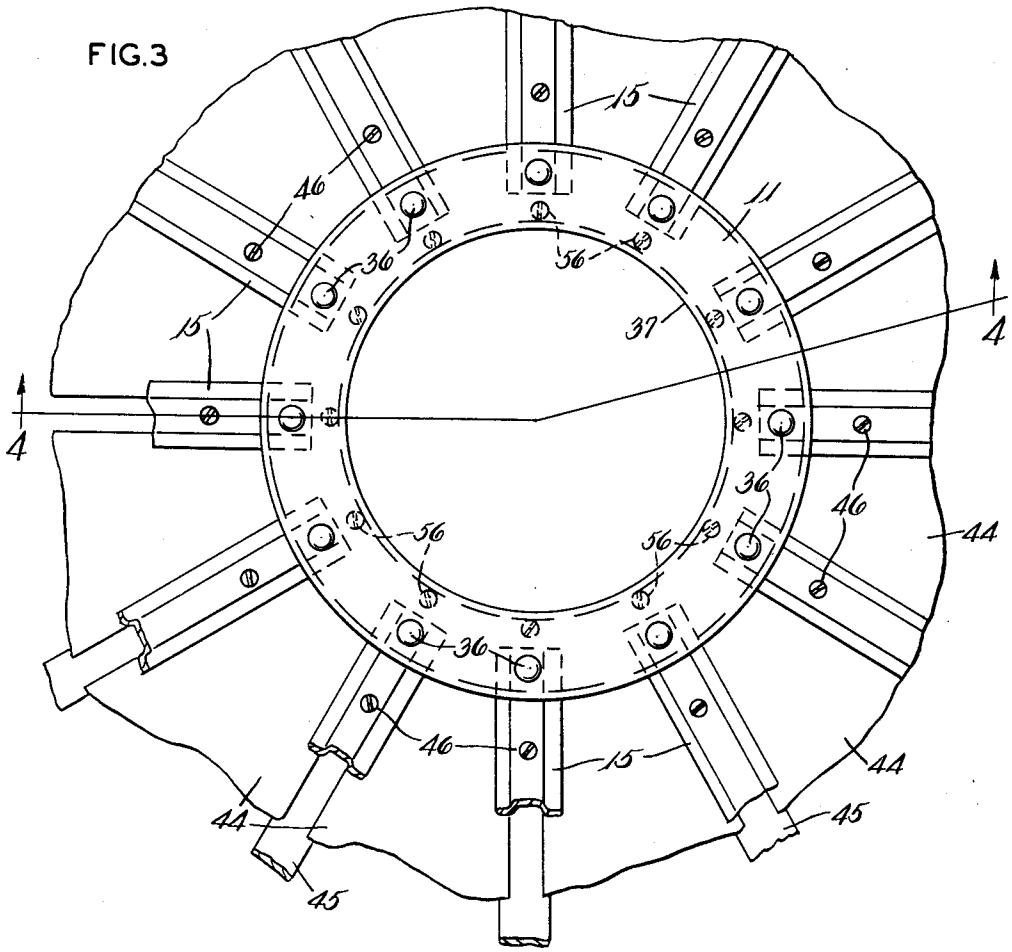
FIG. 3



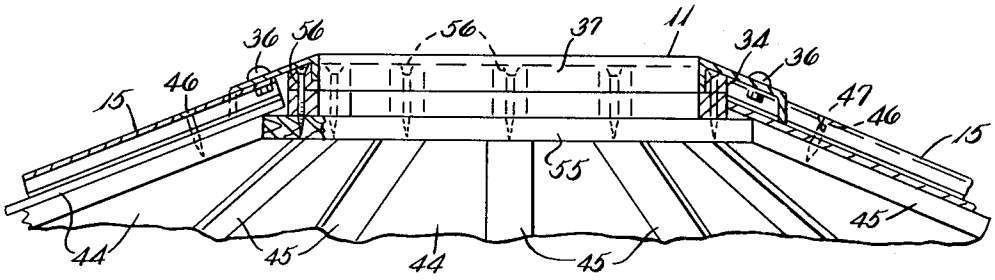


FIG. 4

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BUILDING STRUCTURE

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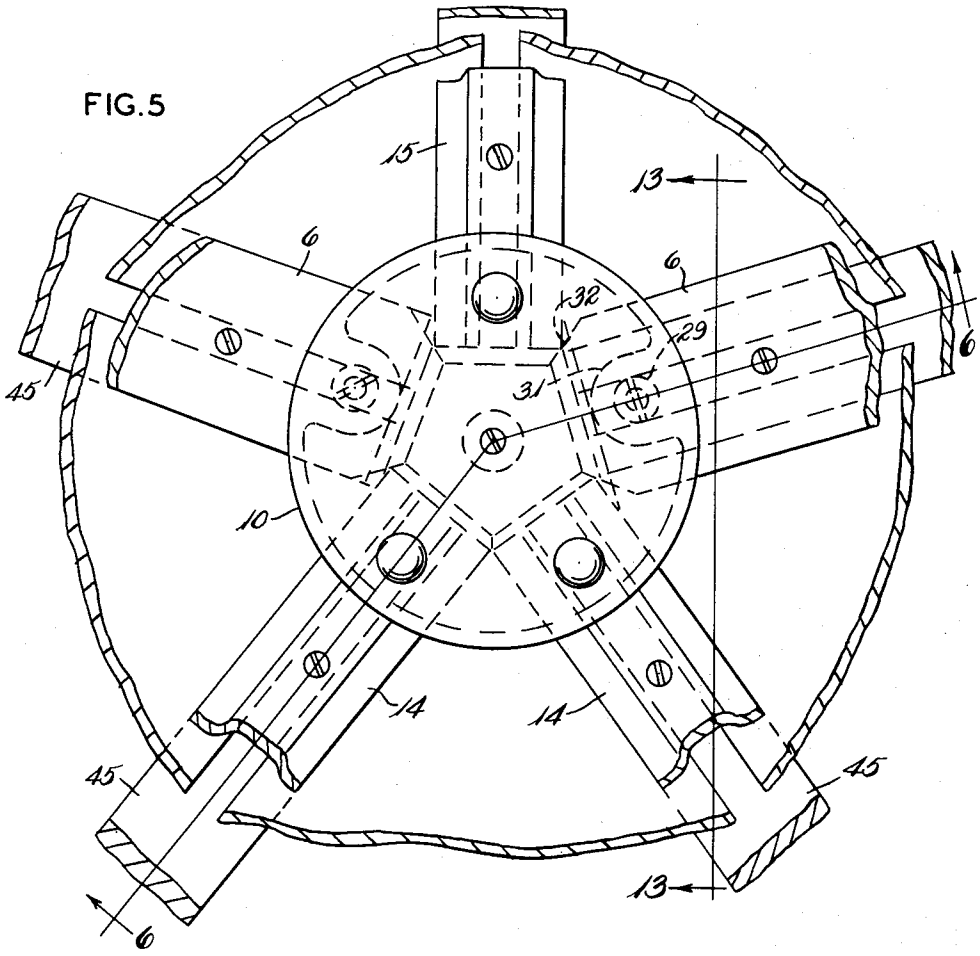
FIG.5



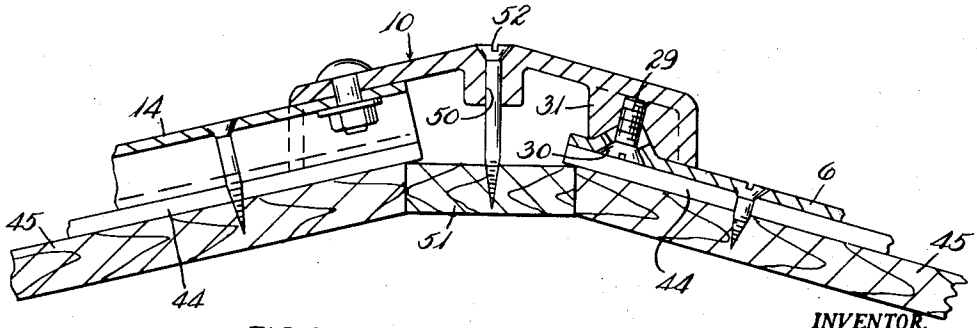


FIG.6

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BUILDING STRUCTURE

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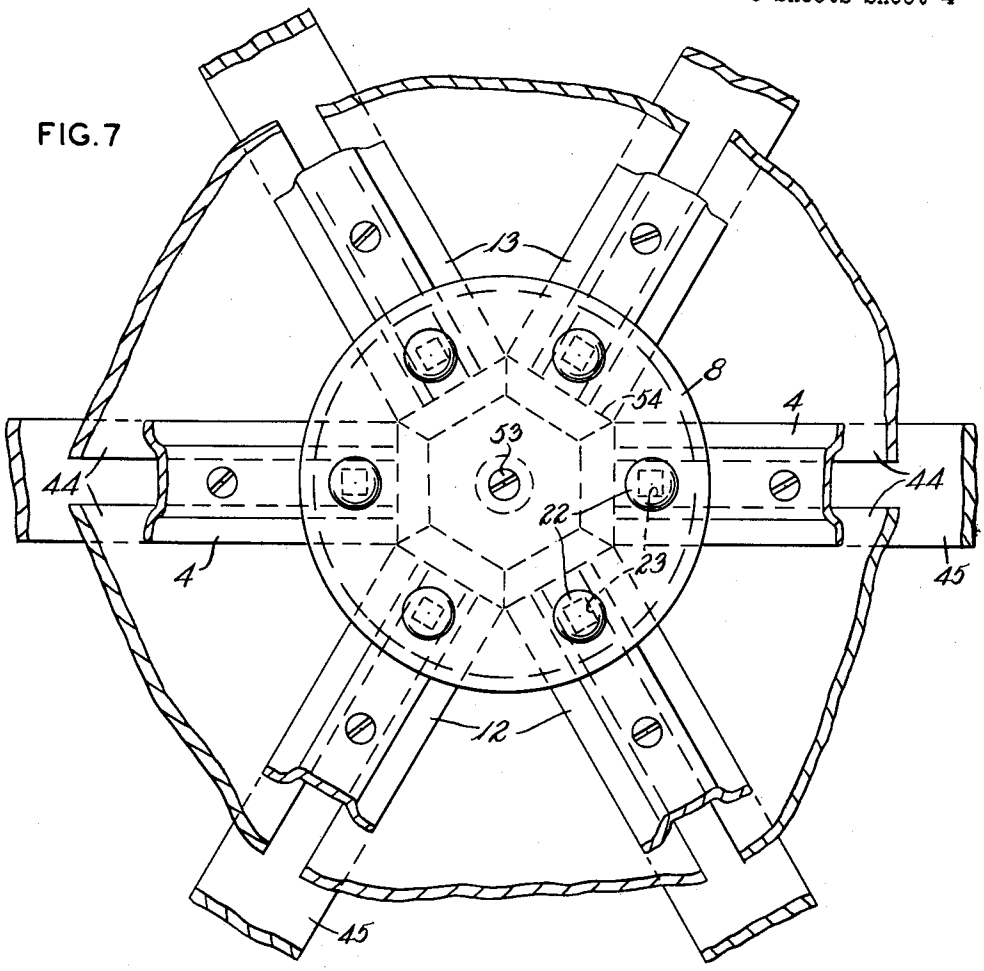
FIG. 7



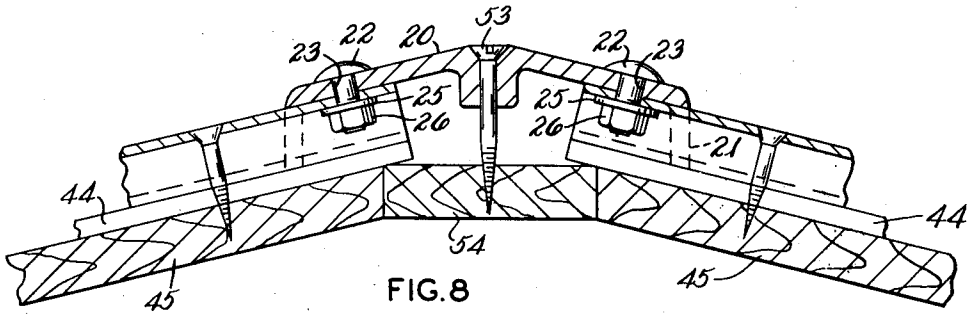


FIG. 8

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FIG.9

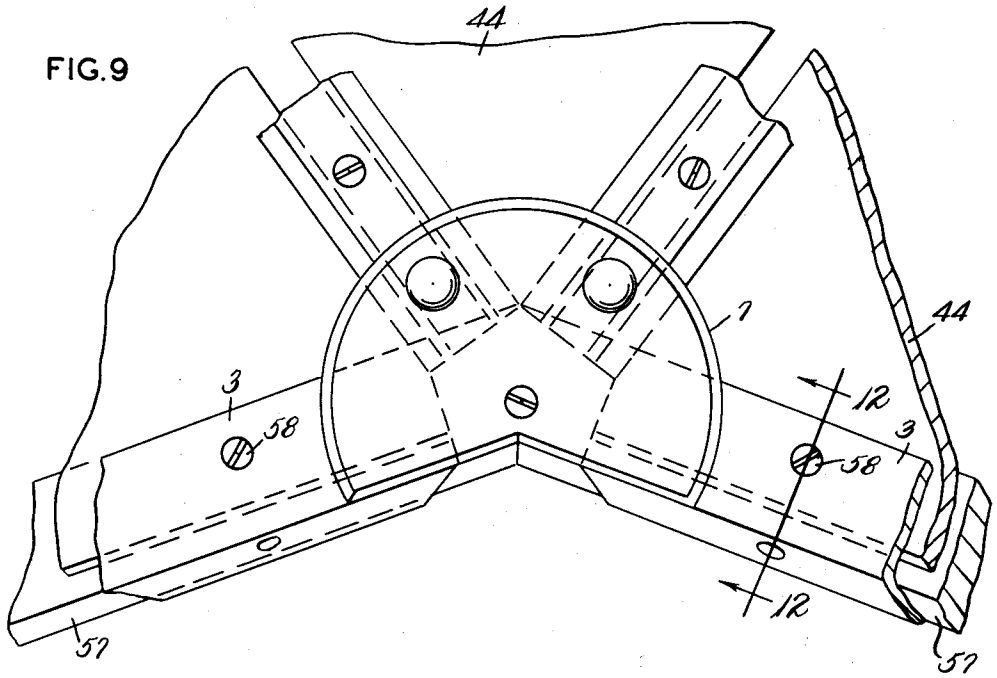


FIG.13

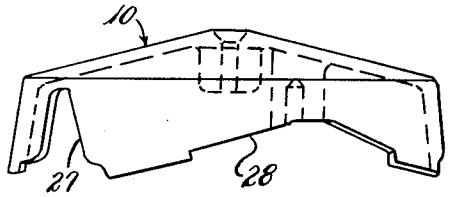
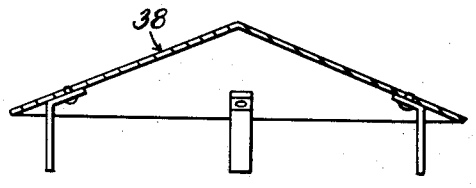


FIG.14



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BUILDING STRUCTURE

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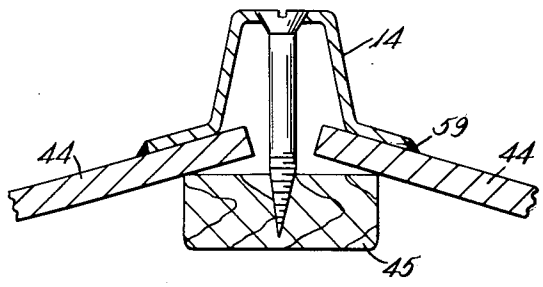

FIG.10

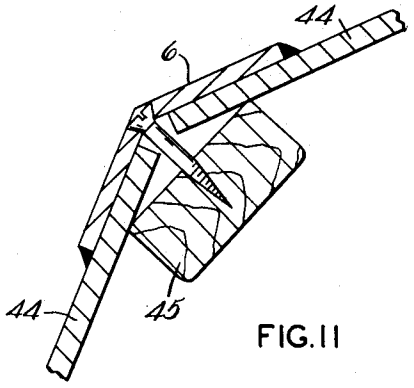

FIG.11

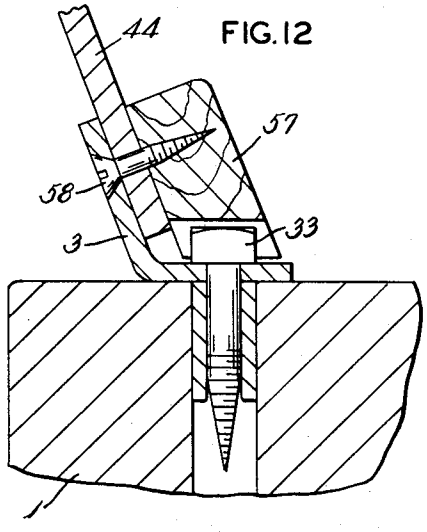

FIG.12

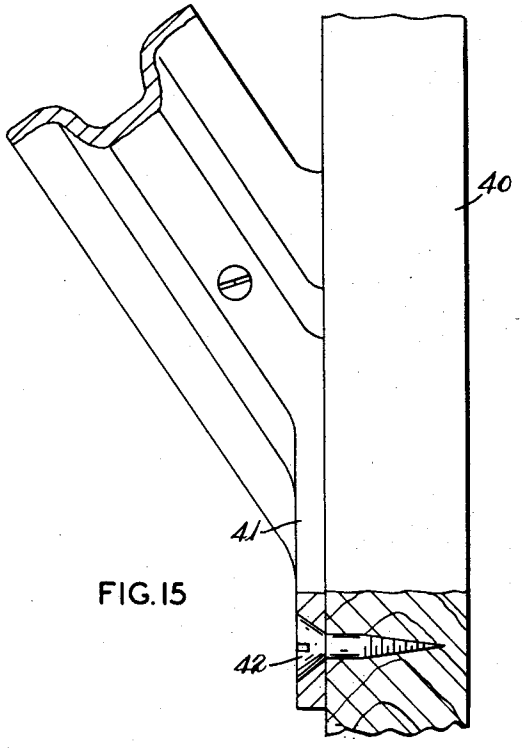

FIG.15

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United States Patent Office 3,137,371 Patented June 16, 1964

3,137,371

BUILDING STRUCTURE

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Filed Nov. 20, 1961, Ser. No. 155,232
4 Claims. (Cl. 189—2)

This invention relates to building structures and is particularly useful where a strong, lightweight, easily assembled enclosure is desired.

It is an object of the present invention to provide a strong, lightweight polyhedron enclosure which may be quickly assembled from prefabricated frame members and panels to provide a domed structure requiring no internal columns or bracing and which may provide a permanent shelter.

Another object is to provide such a structure in which the enclosed space is substantially spherical so as to require a minimum of material to enclose a maximum amount of space.

A further object is to provide a domed structure in which vertically spaced polygonal bands of horizontally disposed frame members sustain the vertical thrust loads in tension.

A still further object is to provide a structure of any desired space by grouping of similar structures adjacent one another without substantial alteration of the component structures.

A further object is to provide such a structure in which all bolts and screws are concealed from the inside of the structure and the inner surfaces are of finished wood construction providing heat insulation and freedom from frost deposit on the interior.

A further object is to provide for ventilation at the top of the dome.

Further objects are to provide a structure in which a metal frame is self-supporting and in which triangular panels are secured to the frame members by wooden finish strips which clamp the panels in place.

These and other objects will appear from the following description and the accompanying drawings.

Of the drawings:

FIG. 1 is an elevation of a building structure constructed in accordance with and embodying the invention.

FIG. 2 is a plan view thereof.

FIG. 3 is an enlarged plan view showing the center of the dome, the dome connector ring and portions of the dome frame members and panels, other portions being broken away.

FIG. 4 is a sectional view taken on line **4**—**4** of FIG. 3.

FIG. 5 is a detail face view of one of the connecting members in the uppermost horizontal belt of frame members looking axially thereof, portions of the frame members, the panels and interior finish being shown, other portions being broken away.

FIG. 6 is a sectional view taken on line **6**—**6** of FIG. 5.

FIG. 7 is a detail face view of one of the connecting members in the second and third horizontal belts of frame members looking axially thereof, portions of the frame members, the panels and the interior finish being shown, other portions being broken away.

FIG. 8 is a sectional view taken on line **8**—**8** of FIG. 7.

FIG. 9 is a detail of one of the connecting members in the foundation belt of frame members looking axially thereof.

FIG. 10 is a cross-sectional view taken on line **10**—**10** of FIG. 1 showing one of the U-shaped frame members, one of the wood finish strips and portions of the adjacent panels, parts being broken away.

FIG. 11 is a sectional view, taken on line **11**—**11** of FIG. 1 showing one of the angle frame members at the uppermost belt of frame members, the wood finish strip and portions of adjacent panels, portions being broken away.

FIG. 12 is a cross-sectional view, taken on line **12**—**12** of FIG. 9, and also on line **12**—**12** of FIG. 1, showing one of the angle frame and anchoring members adjacent the foundation, the base board strip and a portion of the adjacent panel and foundation, other portions being broken away.

FIG. 13 is a side view of one of the frame connector members employed in the uppermost belt of frame members looking in the direction of the section line **13**—**13** of FIG. 5.

FIG. 14 is a cross-sectional view of a rain cap which may be employed for covering the dome opening.

FIG. 15 is a detail view of a modification of one of the U-shaped frame members to accommodate a door casing, a portion of the casing being shown, other portions being broken away.

Referring to the drawings, the numeral **1** designates a foundation preferably of slab form on which rests a substantially truncated spherical enclosure **2**. The frame of the enclosure generally comprises four twelve-sided polygonal belts of straight frame members **3**, **4**, **5** or **6** arranged to extend horizontally and, except for door or other casings, connected to one another in the respective belts by connector members **7**, **8**, **9** or **10**, a dome ring **11**, and angularly inclined straight frame members **12**, **13**, **14**, and **15** which connect the connector members of the respective horizontal belts to the adjacent horizontal belts and the dome ring. For convenience the belts of frame members may be designated the foundation belt, second belt, third belt, and fourth belt as indicated in FIG. 1.

The belts of horizontal frame members have the centers of their connector members spaced equally thereabout substantially at the surface of a sphere, there being in the embodiment shown twelve connector members in each belt, assuming that no door opening is provided, and the connector members of each belt are staggered with respect to those of adjacent belts.

The inclined frame members **12** extend upwardly from the connector members **7** of the foundation belt to two connector members of the second belt to space the second belt therefrom parallel thereto and to define isosceles triangular spaces therebetween. The second belt of horizontal frame members is at the largest circumference of the sphere.

Likewise the inclined frame members **13** extend upwardly from each of the connector members **8** to adjacent connector members **9** of the third belt to define isosceles triangular spaces therebetween, the third belt being of the same circumference as the foundation belt and its connector members being vertically above those of the foundation belt. In like manner, the inclined frame members **14** extend from connectors **9** of the third belt to connectors **10** of the fourth belt defining isosceles triangular spaces therebetween.

The dome ring **11** is connected to the connector members **10** of the fourth belt by one radial frame member **15** from each connector **10**, the center of the dome ring being at the surface of the defining sphere and the frame members defining a series of isosceles triangular spaces between them.

The structure of the invention can be further described by stating that six equal hexagons are present between the foundation belt **3** and the third belt **5**. More specifically, looking at FIG. 1, there is present hexagon GHIJBK. Next to this first hexagon and to the right is hexagon ABCDEF. Next to the right is hexagon LENOPQ. Three similar hexagons appear on the far side of FIG. 1. The sides of each hexagon, of course, are equal, and lie in the same vertical plane. This latter fact greatly simplifies the installation of the door frame

40 in any hexagon. For example, points BAFE of FIG. 2 all lie in the same plane. It can be said that the six hexagons around the periphery of the structure define six vertical planes which planes intersect at the most laterally extending corners of the hexagons.

It should be noted that with the sides of the hexagons all equal that GK=AF=LQ=IJ=CD=NO to name a few. But that other portions of the structure not forming part of the hexagons but connecting the hexagons together, such as KA=JC=FL=DN, but with these distances being slightly longer than each side of the six hexagons. Thus while points BAFE all lie in the same plane and form in plan view a straight line, points RSQT in plan view, FIG. 2, do not lie in the same plan and do not form a straight line.

All of the straight frame members except those in the fourth horizontal belt and the foundation belt are U-shaped in cross section as shown in FIG. 10 and their ends enter correspondingly shaped notches in the connector members and are secured thereto. The frame members 4 and 5 are also connected to the connectors in the same manner.

At the fourth horizontal belt, due to the low slope of the dome thereabove, better drainage may be made possible by the use of horizontal frame members 6 of angular cross section, as shown in FIG. 11, and at the foundation belt, horizontal frame members 3 also of angular cross section but more nearly L-shaped extend from one connector member 7 to another and are connected thereto.

The connector members of the second and third horizontal belts each are similar and are connected to six U-shaped frame members radiating therefrom in equally spaced directions, and are shown in FIGS. 7 and 8 where the connector 8 is pan-shaped and comprises a conical disc 20 having a dependent skirt 21 having notches for receiving the U-shaped frame members which are secured by carriage bolts 22 passing through squared openings 23 in the disc 20 and aligned openings 24 in the frame members held in place by washers 25 and nuts 26.

In the fourth belt the connector members 10 are of generally similar construction but as shown in FIGS. 5 and 6 have provision for five frame members radiating therefrom in equally spaced directions. Of these the frame members 6 are of angle cross section and are located in the fourth horizontal belt whereas the frame members 14 and 15 are of U-shape in cross section so that connector 10 shown in FIG. 13 has three deep notches 27 therein for receiving the U-shaped frame members and two shallow notches 28 for receiving the angle-shaped frame members 6. Also whereas the frame members 14 and 15 are bolted to the connector in the same manner as in FIGS. 7 and 8, the angular frame members 6 are secured to connector by countersunk head screws 29 passing through openings 30 in the frame member and entering threaded openings in bosses 31 of the connector. The frame members 6 are wider than the U-shaped frame members and the corners of the members may be clipped off as shown at 32 in FIG. 5. The corners of the U-shaped frame members may also be mitered or clipped so as to clear each other within the connector.

In the foundation belt, the connectors 7 may be the same construction as shown in FIGS. 5 and 6 where the connector projecting below the foundation belt is not objectionable as where the foundation is poured level with the foundation belt of frame members and the connector may serve as an anchorage. It is preferred, however, to trim the connector level with the bottom of the frame members 3 as shown in FIG. 7 and anchorage is provided by lag screws 33 or other fastening means engaging the members 3 and the foundation 1.

The dome ring 11 is of channel form open downwardly in cross section with a cone-shaped upper wall 34. The outer skirt 35 thereof is notched at regular intervals to receive ends of the U-shaped frame members 15 which are secured thereto by carriage bolts 36. The ring 11 has a large central opening 37 which is provided for ventilation and may be closed by a conical cover 38 shown in FIG. 14 if desired. In the embodiment shown the ring has twelve equally spaced notches for receiving the U-shaped frame members of the dome.

Where a door opening is desired, such frame members as would extend across the opening are cut short of the door frame 40 and are provided as shown in FIG. 15 with a flange 41 welded thereto which meets the frame and is secured thereto by screws 42. The interfering frame members of the second horizontal belt are cut off and similarly terminated for attachment to the frame.

It will be noted that the complete frame is self-supporting and provides a lightweight, strong structure.

The walls of the structure are of thin panels 44 of any suitable sheet material such as plywood, fiberglass, or wire screen and are of triangular shape. They are so cut that their margins are spaced from each other but underlie the margins of the frame members as seen in FIGS. 3, 5, 7, 9, 10 and 11. For holding the panels in place, wooden finish strips 45 are laid over the opposite margins of the panels 44 and wood screws 46 extending through openings 47 in the frame members are screwed into the finish strips to clamp the panels in place. The connector members of the fourth belt, as seen in FIGS. 5 and 6, have a central screw opening 50. A pentagonal block of wood 51 is placed inside the ends of the panels and a wood screw 52 is screwed into the center of the block to additionally clamp the panels. The finish strips abut against the flat sides of the pentagonal block as shown in FIG. 6. The connector members of the second and third belts also have a central opening through which a screw 53 extends into a hexagonal block 54 of finish wood as shown in FIGS. 7 and 8 and the finish strips are butted against the flat sides of the block.

At the dome ring, as seen in FIGS. 3 and 4, a large circular disc 55 of finish wood is secured by screws 56 extending through the ring and entering the wood. The finish strips of wood radiating therefrom are butted thereto. Where a ventilating opening is desired an annular ring of wood would replace the disc 55 or the disc may be perforated with openings therethrough.

At the foundation belt, a finish strip 57 of wood is secured over the inner faces of the panels by screws 58 extending through the frame members 3.

All of the pan-shaped connector members are contoured at the margin of the skirt to fit snugly against the panels, as for example shown in FIG. 9 and all seams between the connectors, the frame members and the panels are sealed by a fillet 59 of caulking material as seen in FIG. 10.

It will be observed that the metal frame is not only self-supporting but is located entirely outside the panel walls and that the entire inner face of the structure is of wood or other non-metallic material with no bolts, screws or nails exposed on the inner face so that no frost collects on the inner surfaces which are insulated by the panels and finish material.

While only a single room structure has been shown in the drawings, it will be apparent that a plurality of such structures may be joined together as by assembling two such structures with the door casings facing each other and secured together either directly or by an extended passageway. Where windows are desired, panels of transparent glass, sheet plastic material or fiberglass may be employed in the desired triangular spaces between the frame members.

This application is a continuation-in-part of the co-pending abandoned application bearing the same title, filed June 14, 1960, under Serial No. 35,953.

While a certain representative embodiment and details have been shown for the purpose of illustrating the invention, it will be apparent to those skilled in the art that various changes and modifications may be made

therein without departing from the scope of the invention as it is defined by the following claims:

What is claimed is:

1. A building structure comprising a polyhedron frame of straight metal frame members and pan-shaped connector members defining a plurality of polygonal horizontal belts spaced at intervals of elevation, each belt being formed of an equal number of frame and connector members and at least twelve frame members, straight metal frame members extending between connector members of adjacent belts to define triangular spaces between the belts, the frame members connecting the base belt, the second belt and the third belt together with frame members in the base belt and third belt defining around the complete periphery of the structure a plurality of hexagons, at least six in number, each having a base side formed by a frame member in the base belt, a top side vertically above the base side and formed by a frame member in the third belt, the four other sides of each hexagon being formed by two frame members connecting the base belt with the second belt and by two frame members connecting the second belt with the third belt, and with all six corners of a hexagon lying in the same vertical plane whereby a plurality of vertical planes are produced around the structure which planes intersect at the most laterally extended corners of the hexagons thereby simplifying the construction of openings into the structure, the frame members in the base belt and the third belt forming a part of each hexagon being equal in length but all other frame members in the base belt and third belt being shorter but of equal length.

2. A building structure comprising a polyhedron frame of straight metal frame members and pan-shaped connector members defining a plurality of polygonal horizontal belts spaced at intervals of elevation, each belt being formed of at least twelve frame members, straight metal frame members extending between connector members of adjacent belts to define triangular spaces between the belts, the frame members connecting the base belt, the second belt and the third belt together with frame members in the base belt and third belt defining around

the complete periphery of the structure a plurality of hexagons, at least six in number, each having a base side formed by a frame member in the base belt, a top side vertically above the base side and formed by a frame member in the third belt, the four other sides of each hexagon being formed by two frame members connecting the base belt with the second belt and by two frame members connecting the second belt with the third belt, and with all six corners of a hexagon lying in the same vertical plane whereby a plurality of vertical planes are produced around the structure which planes intersect at the most laterally extended corners of the hexagons thereby simplifying the construction of openings into the structure.

3. A building srtucture including a plurality of shallow hexagonal pyramids positioned to form the sides of the building with the vertices of the pyramids outwardly and the bases of the pyramids vertical, one edge of each pyramid base being adapted to engage a foundation, or the like, means joining the pyramids together at the adjacent corners of their bases, means filling the spaces between the pyramids, roof forming means enclosing the top of the structure, said roof-forming means being secured to the top edges of each pyramid base opposite the edges adapted to engage a foundation, and at least one frame defining an opening into the structure, said frame being positioned so that the plane of one side of the frame substantially coincides with the vertical plane of the base of one of the hexagonal pyramids.

4. The combination defined in claim 3 wherein the edges of each pyramid base adapted to engage the foundation define a polygonal base belt which is parallel to, vertically beneath, and of the same size and shape as a polygonal belt defined by the top edges of each pyramid base which engage with the roof forming means.

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