April 16, 1963 J. W. WINSTON 3,085,365

BUILDING STRUCTURE

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Fig. 1

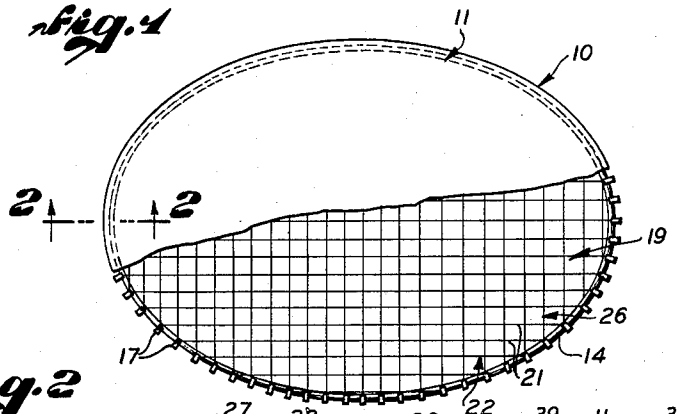
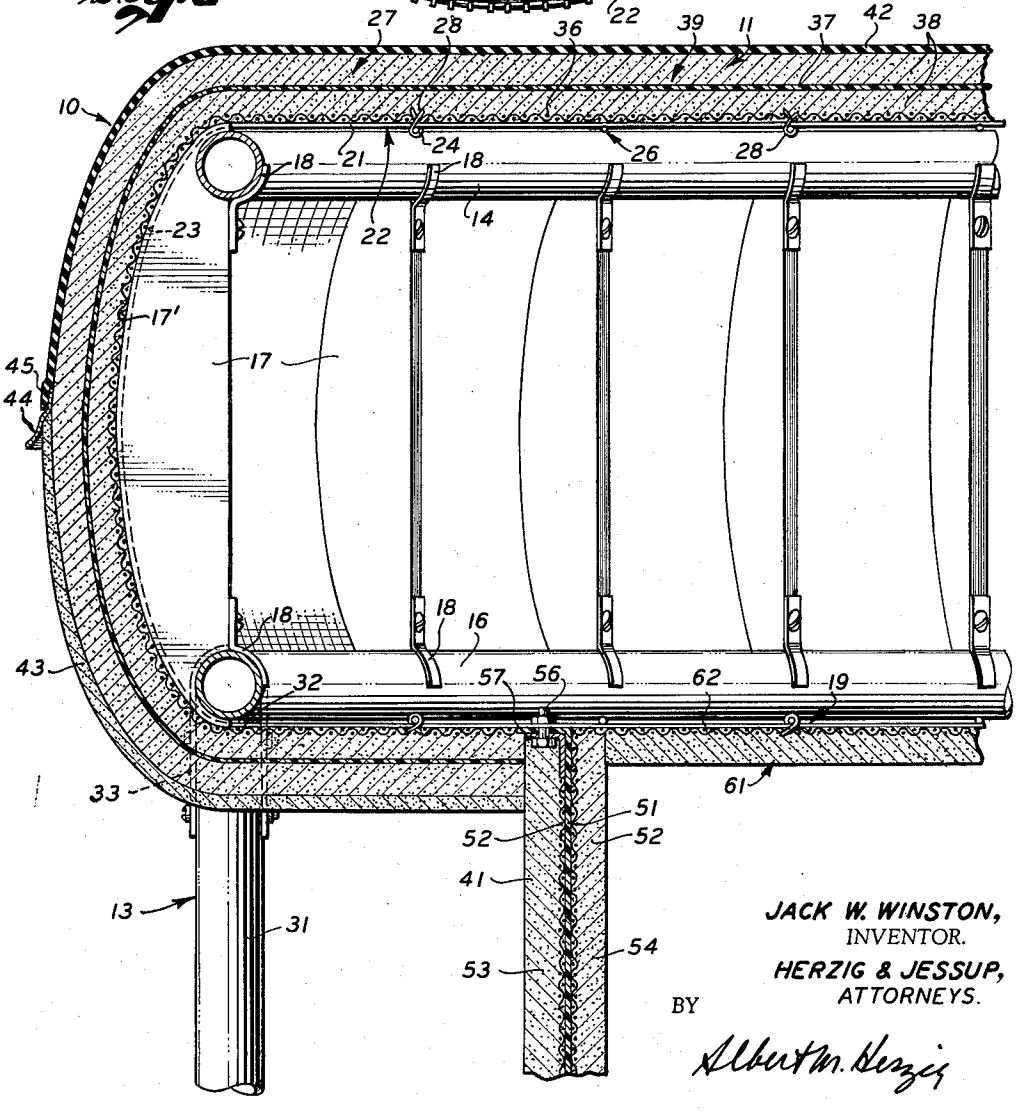


Fig. 2



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Fig. 4

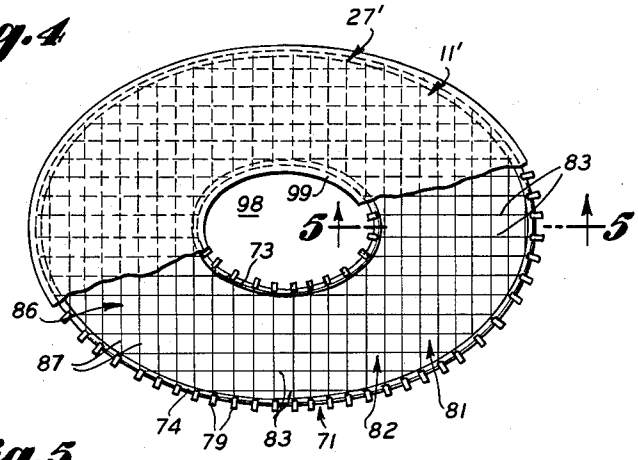


Fig. 5

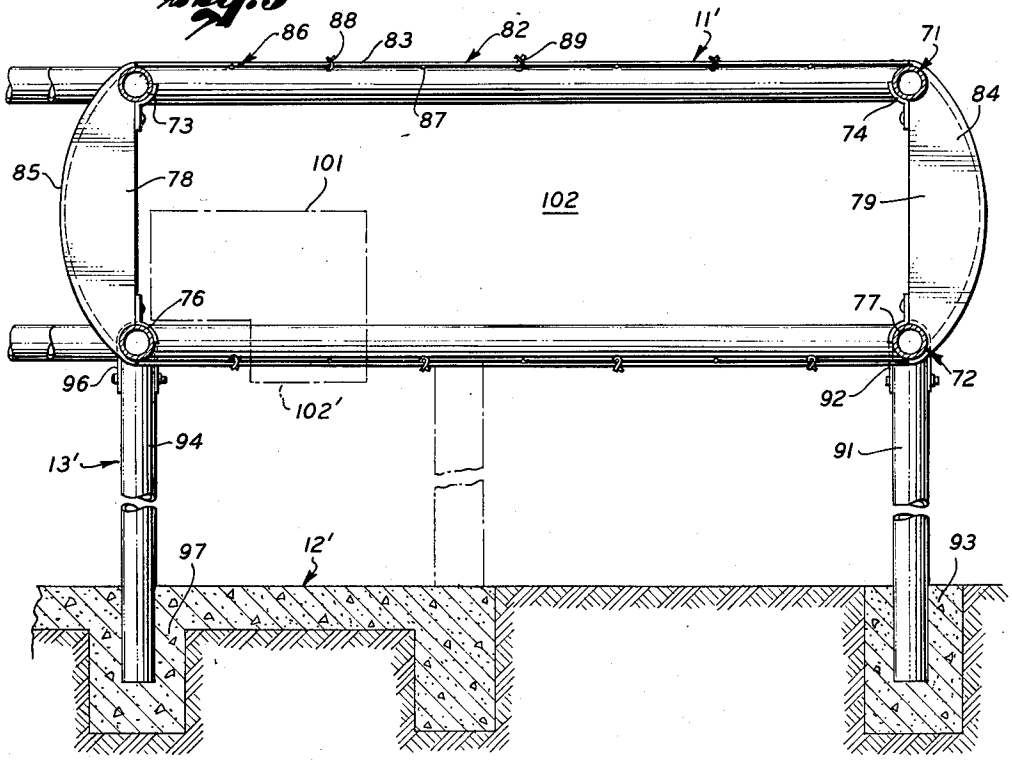
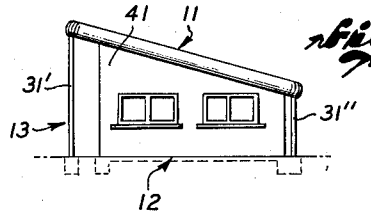


Fig. 6



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Fig. 3

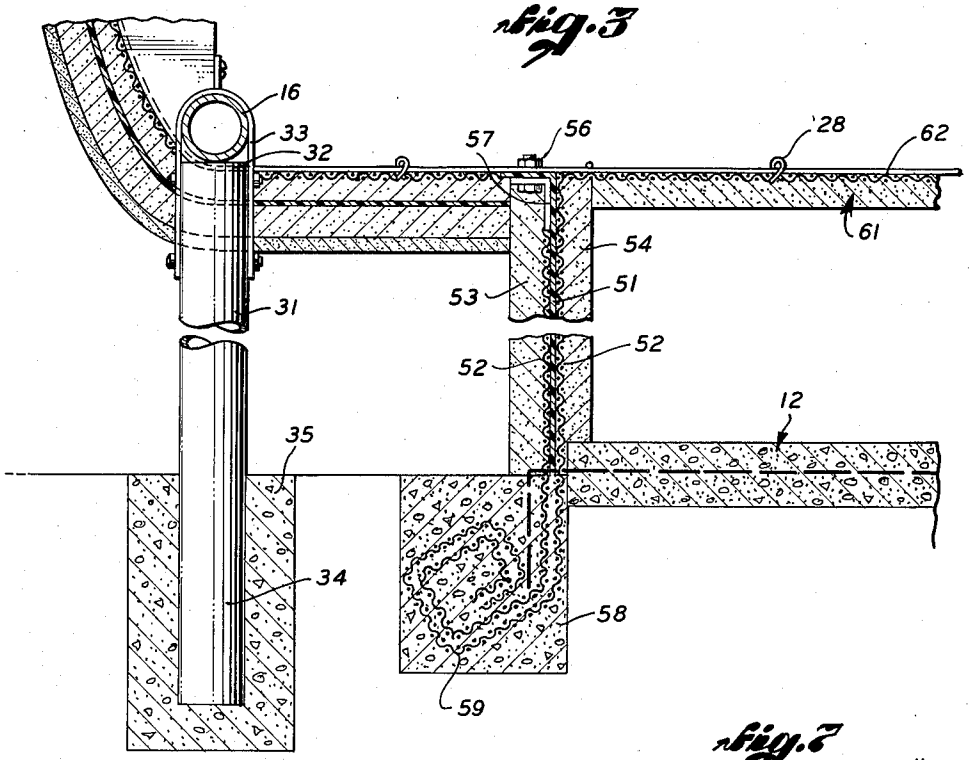


Fig. 8

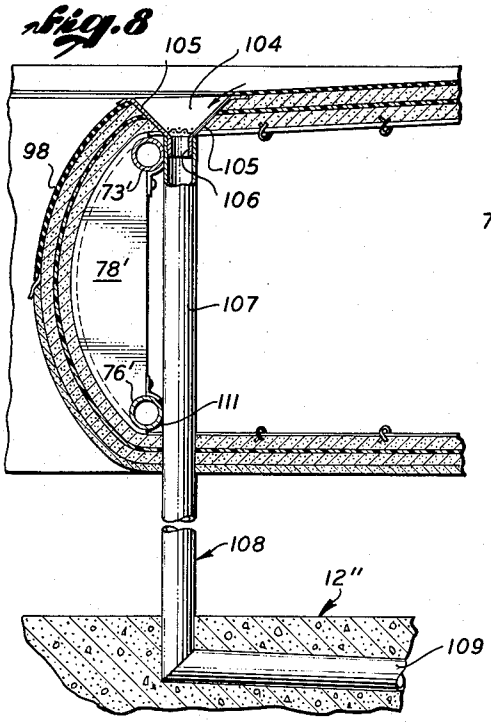


Fig. 7

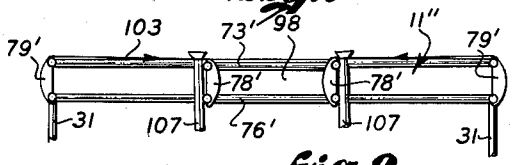
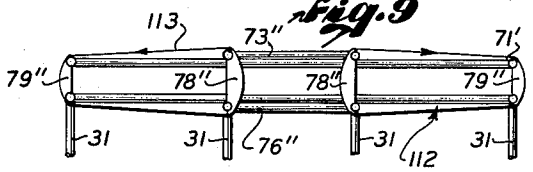


Fig. 9



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3,085,365

BUILDING STRUCTURE

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Filed Aug. 5, 1958, Ser. No. 753,261
4 Claims. (Cl. 50—16)

This invention relates to a building structure, and more particularly to a building structure having a substantially hollow, pre-formed roof which is supported by structural support means and which is adapted for attachment of non-bearing or non-structural partitions for forming an interior structure beneath the roof.

An object of this invention is to provide a new and improved building structure in which the roof structure may be easily and quickly pre-formed, is light in weight, is strong and may be easily and quickly erected at the site by securement to support means to form a permanent or non-permanent building structure.

It is another object of this invention to provide a new and improved building structure which is economical to manufacture, easily erected and major portions easily and quickly dismantlable if so desired.

Yet another object of this invention is to provide a new and improved roof structure of the character described which provides a hollow interior in which building accessories, such as wiring, conduits, or the like, may be housed, and which also provides an air conditioning plenum through the entire roof structure.

Still a further object of this invention is to provide a new and improved roof structure to which suitable roofing material for weather-proofing the structure may be conveniently applied.

Another object of this invention is to provide a new and improved building structure in which the slope of the roof may be easily altered to provide a desired pitch to the roof for drainage therefrom by providing annular frame means which are spaced by spacers whose lengths may be altered to impart a desired slope to the roof or by providing support means whose length may be varied whereby the roof structure is sloped in a desired direction.

A general object of this invention is to provide a new and improved building structure which overcomes disadvantages of prior means and methods heretofore intended to accomplish generally similar purpose.

These and other objects of this invention will be more apparent from the following drawings, detailed description, and appended claims.

This invention provides for a building structure having a roof means elevated from the floor of the structure, the roof means comprising a pair of substantially identical annular frame members in spaced relationship and having wrapped therearound a plurality of tension wires in criss-cross fashion spaced on parallel chords of the annular frame members thereby providing a grid of wires spanning the upper and lower members of the frame to support suitable roofing and sealing materials. The roof means is supported in spaced relationship from the floor by support means in the form of columns attached to the annular frame members at their upper ends and to the floor structure or foundation at their lower ends to support the roof at the periphery of the annular frame members. Walls forming interior rooms may be affixed at any desired location of the lower surface of the roof members, such walls and partitions being non-bearing walls, the bearing being wholly accomplished by the structural column support means.

In the drawings:

FIG. 1 is a plan view of a building structure designed and constructed in accordance with this invention, with parts broken away for greater clarity;

FIG. 2, is an enlarged fragmentary vertical cross-sectional view, as taken substantially along a line 2—2 of FIG. 1;

FIG. 3 is a fragmentary vertical cross-sectional view, somewhat similar to FIG. 2, illustrating the support means and wall means thereof;

FIG. 4 is a plan view, similar to FIG. 1, of another embodiment of a building structure in accordance with this invention;

FIG. 5 is an enlarged fragmentary vertical cross-sectional view, as taken substantially along a line 5—5 of FIG. 4, and omitting the roofing and ceiling material therefrom for greater clarity;

FIG. 6 is a side view, in elevation, of a completed building structure illustrating, schematically, the roof structure being constructed in inclined relationship to the floor structure to effect a slope to the roof;

FIG. 7 is a reduced vertical, cross-sectional view, in schematic form, showing a means of effecting one form of slope to the embodiment illustrated in FIGS. 4 and 5;

FIG. 8 is an enlarged, vertical, cross-sectional view illustrating the structure of FIG. 7 in greater detail; and

FIG. 9 is a reduced, vertical, cross-sectional view illustrating another form of obtaining a slope to the roof structure.

Referring more particularly to the drawings, there is shown by way of illustration, but not of limitation, in FIGS. 1–3, a building structure generally designated by the numeral **10**, having a roof means **11**, of a generally hollow construction, supported and elevated from a floor structure **12** by support means **13**.

The roof structure **11** of the building structure **10** comprises a pair of substantially identical upper and lower annular frame members, **14** and **16**, respectively, which are vertically spaced by relatively rigid spacer members **17** which are peripherally spaced between the annular members **14**, **16** and secured thereto as by clips **18**. The annular frame members **14** and **16** may be of any desired configuration, such as the elliptical configuration illustrated in FIG. 1, circular, or non-circular, as desired. It is preferred, however, that the annular configuration range from a circle to an ellipse for greater strength and economy. The members **14**, **16** may be tubular, as illustrated, or may be formed of solid rods, however, the tubular members illustrated are preferred whereby a lighter weight may be achieved to facilitate handling and erection thereof.

In order to provide means for supporting a roofing material, spanning the roof **11**, the frame members **14** and **16** are wrapped therearound by a plurality of wires, in tension, to provide a grid, generally referred to by the numeral **19**. The grid **19** comprises a set **22** of high tensile wire, wires **21** of a first set extending transversely across the frame members **14** and **16** in spaced parallel relationship, and lying on spaced parallel chords of the frame members.

The spacers **17** are preferably provided with arcuate outer edges **17'** which are provided with grooves **23** in which the wires **21** of the set of wire means **22** reside. The grooves **23** are preferably of a width sufficient to receive a pair of wires, the wires **21** and a wire **24** of a second set of wire means **26** at peripheral points of the frame members **14** and **16** where the wires **21** and **22** intersect. The groove **23** prevents slippage of the wires **22** and **24** on the curved portions of the frame members **14** and **16**. The wires **24** of the set of wire means **26** are wrapped around the frame members **14** and **16** similarly to the wires **21** of the wire means **22**, but laid along spaced chords of the annular members trans-

versely to the wires 21 of the wire means 22, thereby forming a criss-cross grid across the annular members 14 and 16 in perpendicular relationship. Each wire 21 and 24 is wrapped in high tension to form a very tight and rigid grid 19 capable of supporting roofing material 27 with a minimum of sagging.

The grid 19 is preferably reinforced by securing wires 21 of the wire means 22 to wires 24 of the wire means 26 as by wire clips or hog rings 28 at predetermined intersection points of the wire. The frame members 14 and 16, being rigidly secured and tightly wrapped by the tension wire means 22 and 26, may be supported in elevated relationship from the floor 12 by the support means 13 to form the bearing structure of the building structure 10. The support means 13 comprises a plurality of elongated columns 31 having upper ends 32 secured at peripherally spaced points of the lower frame member 16 as by straps or clamps 33, and lower ends 34 being embedded in suitable piers or foundation 35. If preferred, the columns 31 may be welded to the frame member 16, or otherwise secured.

The roofing material 27 preferably comprises a layer of lath 36 which overlies the upper portion of the grid 19, over the frame member 14, and preferably extends around the periphery of the roof structure, terminating on the under surface of the lower frame member 16. The lath 36 may be secured to the grid 19 as by the hog rings or wire clips 28, or by other means. Secured to the outer surface of the lath is a laminate of high impact styrene, or other suitable plastics material, sandwiched between a pair of relatively thick layers of a porous material 38, such as gypsum, or the like. In practice, it has been found practical to apply the porous material 38 in a relatively thick layer on the lath 36 to which it readily adheres, following with a layer of the high impact plastics material 37 and then adding another layer of the porous material 38. This laminate 39 comprising the porous material 38 and the plastics material 37 preferably extends around the edge of the roof and terminates beneath the frame 16 adjacent a non-bearing wall or partition 41 to be hereinafter described.

In order to complete the roofing, and thereby supply a weather-proof layer to the exterior of the roof, a layer 42 of a water-proof roofing material is applied over the laminate 39 and preferably terminates at the side of the roof means and an exterior plaster or stucco 43 applied to the remaining portion of the laminate 39 and terminating at the wall 41. An angular strip of metal, or the like, 44 may be provided having one end 45 positioned below the lower edge of the roofing material 42 and overlying a portion of the exterior plaster material 43 to cause a run-off of rain, or the like, at the periphery of the roof.

The walls or partitions 41 are of non-structural relationship to the roof means 11 and therefore can be arranged in any particular arrangement desired. The external wall, shown in FIGS. 2 and 3, comprises a lamination of a high impact plastics material 51 which is water and weather proof sandwiched between a pair of layers 52 of suitable mortar-holding material such as lath to which an outer layer of exterior plaster or stucco 53 and an interior layer of plaster 54, or the like, may be applied. The laminate 51, 52 is secured at its upper end as by a bolt and nut 56 and reinforced as by an angle clip 57. The wall 41 is secured at its lower end to the floor structure 12 by embedding the laminate 51, 52 in a footing 58. The laminate may be hooked or otherwise deformed as at 59 to provide a better gripping force.

It will now be more apparent from the preceding description that the roof structure 11 may be preformed, that is, the frame members 14 and 16 spaced by the spacer 17 may be preformed by securing the spacer 17 to the frame members 14 and 16 and wrapping with the sets of wire means 22 and 26 to provide a very rigid roof skeleton member which may be installed on the support means 13 by securement to the columns 31 embedded in the foundation 35. The frame may then be covered by the roofing material 27 and the partitions 41 placed in a suitable arrangement. The ceiling 61 may be applied to the lower surface of frame member 16 by securing a wire mesh 62 to the grid 19 as by the hog rings 28 or by other means, after which a layer of suitable ceiling material, such as a porous plaster, may be applied.

If it is desired that the roof 11 be sloped to provide drainage for precipitation, the columns 31 of the support means 13 may be provided in varying lengths such as long columns 31' and short columns 31'', illustrated in FIG. 6, to provide an angular relationship between the roof means 11 and the floor structure 12 in any desired direction to provide drainage from the roof means. The walls 41 may then be suitably formed to correspond to the angular relationship.

Referring to FIGS. 4 and 5, there is shown another embodiment of this invention wherein the roof means 11' is formed of a pair of upper and lower substantially identical annular frame members 71 and 72, respectively, in vertically spaced relationship. Each annular frame member 71, 72 comprises a pair of inner and outer annular frame members 73 and 74, respectively, in the upper frame member 71 and inner and outer annular frame members 76, 77, respectively, in the lower frame member 72.

The inner annular frame members 73 and 76 are vertically spaced as by externally grooved relatively rigid spacers 78 spaced along the inner periphery of the annular members 73 and 76. The outer annular frame members 74 and 77 are vertically spaced as by a plurality of rigid externally grooved spacers 79.

A grid 81 of high tensile wire sets are wrapped around the annular frame members 71 and 72 similarly to the construction of the grid 19 in the first embodiment. The grid 81 includes a first tension wire means 82, each wire 83 of which is wrapped around the inner and outer frame members, 73, 76, and 74, 77 as indicated in FIGS. 4 and 5 on spaced parallel chords of the outer frame members 71 and 72, the wires residing at the outer and inner sides 84 and 85, respectively, in the external grooves of the spacers 78 and 70. The wires 83 are stretched across the frame member extending to the outer periphery of the outer frame members 74 and 76 except that at the proximity of the inner annular frame members 73 and 76, the wires 83 connect adjacent portions of the inner annular frame members 73 and 76 to the outer annular frame members 74 and 76 as best seen in FIG. 4. A second set of tension wire means 86 is similarly wrapped around the roof means 11', transversely to the first wire tension means 82, the wires 87 of the wire means 86 intersecting the wires 83 of the wire means 82 at substantially right angles. The wires 83 are secured to the wires 86 similarly as in the first embodiment, by wire fastening means or hog rings 88 at predetermined intersection points thereof. The roof means 11', of the instant embodiment, is similarly spaced from the floor structure 12' by support means 13' which includes columns 91 secured as by straps or clamps 92 to the lower outer frame member 77 and embedded in a suitable foundation 93, and if desired, additionally includes columns 94 secured to the lower inner annular frame member 76 as by straps or clamps at the upper ends thereof and in reinforced portions 97 of the floor structure 12'.

A roofing means 27' may be provided to the exterior of the roof structure 11' as previously described in the first embodiment, illustrated in FIGS. 1–3, with the exception that the roofing material 27' does not span the roof structure 11' completely. An open space 98 is provided within the inner annular frame members 73 and 76 extending through the roof means 11'. The roofing material 27', in this instance, extends around the inner edge 99 of the opening 98 in the manner described for the exterior edge of the roof structure 11 of the first embodiment.

In both the embodiments herein described, the interior of the roof structure particularly is well adapted to be used to house ducts, as shown in broken lines **101** in FIG. 5, which may be extended in any manner desired through the enclosed area **102** of the roof construction, and may be provided with openings such as indicated at **102** in the same figure. The space between the high tensile wires is usable as a complete air conditioning plenum room; area blocks and controls may be inserted if desired to control and direct cold air. Reverse cycle heat is also employed in the same manner; cold air returns are from the floor line to the units.

The second embodiment described and illustrated in FIGS. 4 and 5 is particularly adaptable to varied pitches and drains. As seen in FIG. 7, the inner spacers **78'** may be shorter in height than the outer spacer member **79**, whereby the outer surface **103** slopes downwardly towards the opening **98** of the roof structure **11'**, forming a conical upper surface **103**. In order to collect the precipitation draining from the upper surface of the roof structure and thereby prevent drainage through the opening **98**, an annular trough **104** having converging walls **105** is preferably provided adjacent the opening **98** and includes depending tubular extensions. The extensions **106** telescope within tubular column members **107** of a support means **108** which communicates with an outlet, pipe or conduit **109** which may be located beneath the surface of the floor structure **12''**. The inner annular frame members **73'** and **76'** may be secured to the column **107** as by welding **111**, or by other means such as a strap, bracket, or the like.

If it is desired to drain precipitation from the roof structure towards the outer periphery thereof, as seen in FIG. 9, the roof structure **112** may be provided with inner spacer members **78''** which are substantially longer in height than outer spacer members **79''**, the spacers **78'** supporting inner annular frame members **73''** and **76''** in spaced relationship whereby the annular frame member **73''** is substantially higher than the outer upper frame member **71'**, thereby sloping the upper surface **112**, comprised of the criss-cross tension wire members and roofing material previously described, downwardly towards the outer periphery of the roof means **112**.

It will therefore clearly be seen that this invention provides for a very versatile building structure which may be prefabricated in parts thereof and quickly and easily assembled at the location of the building. The roof structure thereof may be easily and quickly installed in place providing a plenum area suitable for air conditioning or other purposes and may be sloped as desired to provide the most practical drainage suitable for the user's purpose. The building structure in accordance with this invention is particularly adaptable to non-permanent construction such as temporary school rooms, office buildings, or the like, where partitions or outer walls thereof may be desired to be relocated. The structure is equally useful as a permanent building, inasmuch as the roof structure is capable of supporting any weight that it may be subjected to, such as a build-up of snow or heavy rain. The structure of the roof requires no further insulation from the external heat or cold and is quickly adaptable to the requirements of air conditioning of heat ducting and housing of wiring, conduits, or pipe, or other accessories required to complete the building.

While I have herein shown and described my invention in what I have conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom within the scope of my invention, which is not to be limited to the details disclosed herein but is to be accorded the full scope of the claims so as to embrace any and all equivalent devices and methods.

What I claim as new and desire to secure by Letters Patent is:

1. A building structure comprising: a hollow roof having upper and lower substantially identical, relatively flat annular frame members each defining an opening, said frame members being positioned substantially horizontally in vertically aligned relationship and positively spaced by a plurality of rigid, upright spacer members disposed therebetween, each spacer member being secured at the ends thereof to opposed points on the respective frame members, said spacer members and said frame members defining an internally open, relatively shallow, cylindrical configuration free of structural members therewithin, each of said spacer members having an outer surface provided with an outwardly facing groove, a plurality of longitudinal tension wires disposed above the upper frame member and below the lower frame member in spaced parallel relationship, a plurality of transverse tension wires disposed above the upper frame member and below the lower frame member in spaced parallel relationship forming a criss-cross pattern with said plurality of longitudinal tension wires to define substantially flat and parallel upper and lower surfaces spanning the openings of the respective frame members, each of said wires spanning the respective opening in a substantially straight line between spaced points on the respective frame members coinciding with said opposed points, the tension wires disposed above the upper frame member being received in the grooves of corresponding spacer members and connected with the wires below said lower frame members at the lower end of said grooves, lath means mounted on said tension wires in surrounding relation with respect to said frame members and said tension wires, a laminate of high impact plastic sandwiched between layers of porous material applied exteriorly of said lath means, said porous material being adhered to and supported by said lath means, and a sheet of weatherproof material overlying the upper surface of said laminate; and a plurality of legs depending from the lower frame member and anchored on a supporting base to support the roof in an elevated position.

2. A building structure comprising: roof means having upper and lower substantially identical, relatively flat, annular outer frame members positioned substantially horizontally in vertically aligned relationship, upper and lower substantially identical, relatively flat annular inner frame members positioned substantially horizontally in vertically aligned relationship, said inner frame members being substantially co-planar with the respective outer frame members and inwardly spaced therefrom to provide openings therebetween, rigid spacer means positively spacing said inner and outer frame members, respectively, said spacer members being disposed between the upper and lower inner frame members and between the upper and lower outer frame members with the ends of the spacer members secured to opposed points on the respective frame members, said frame members and spacer members defining a configuration of shallow cylindrical outline that is internally open and free of structural members between the inner and outer frame members and inwardly of the inner frame members, said spacer members disposed between the inner frame members having inwardly facing vertical grooves and said spacer members disposed between the outer frame members having outwardly facing vertical grooves, longitudinal and transverse sets of spaced parallel tension wires disposed above the upper ones of said frame members and below the lower ones of said frame members in a criss-cross pattern and spanning the openings between the respective inner and outer frame members, said tension wires spanning the respective openings in substantially straight lines between spaced points on the respective outer frame members and spaced points on the respective inner and outer frame members coinciding with said opposed points, the tension wires above the upper ones of said frames spanning the space between the respective spaced points in a substantially straight line and being received in the grooves of respective spacer members and being connected with the wires below said lower frame members at the lower ends of said grooves,

lath means mounted on said tension wires in surrounding relation with respect to said frame members and said tension wires, a laminate of high impact plastic sandwiched between layers of porous material applied exteriorly of said latch means, said porous material being adhered to and supported by said lath means, and a sheet of weatherproof material overlying the upper surface of said laminate; and a plurality of legs depending from the lower ones of said frame members and anchored on a supporting base to support the roof in an elevated position.

3. A structure in accordance with claim 2 wherein the spacer members disposed between the upper and lower inner frame members are longer than the spacer members disposed between the upper and lower outer frame members, whereby the surfaces formed by the sheet of weatherproof material are inclined outwardly.

4. A building structure in accordance with claim 2 wherein the spacer members disposed between the upper and lower outer frame members are longer than the

spacer members disposed between the upper and lower inner frame members whereby the surfaces formed by the sheet of weatherproof material are inclined inwardly.

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