April 21, 1964 R. CONNOR 3,129,531

REINFORCED BUILDING STRUCTURE

Filed Nov. 14, 1961 3 Sheets-Sheet 1

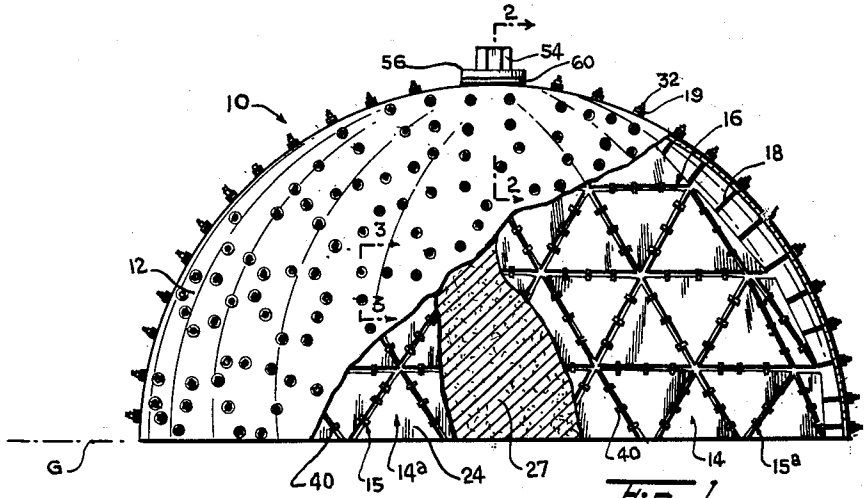


Fig. 1.

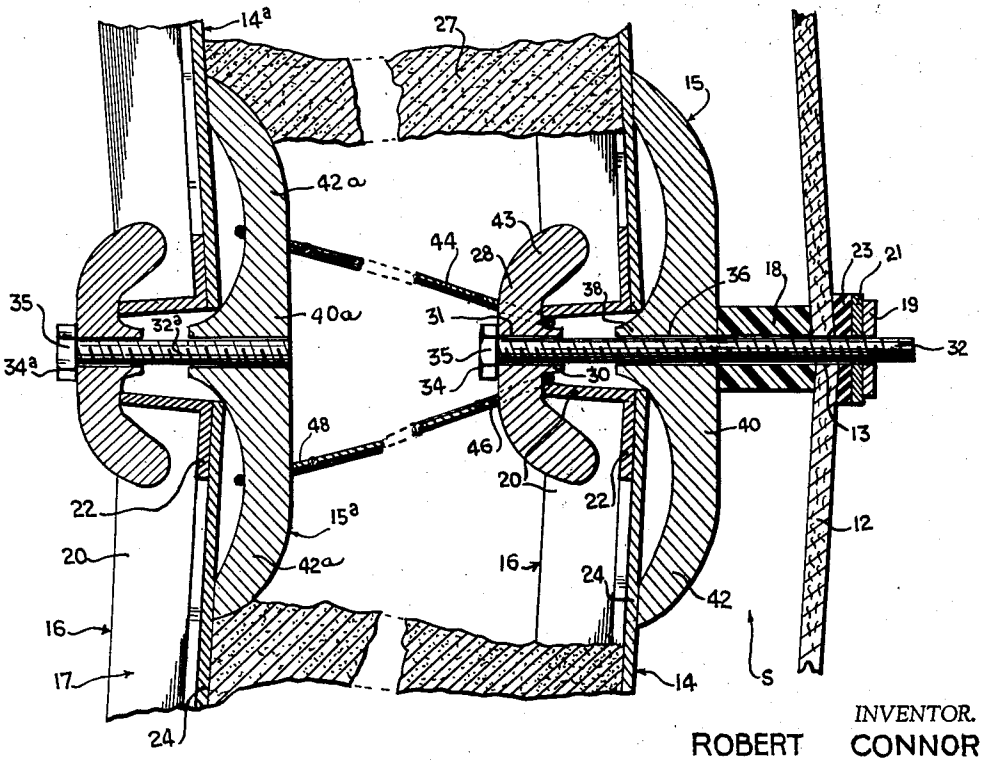


Fig. 3.

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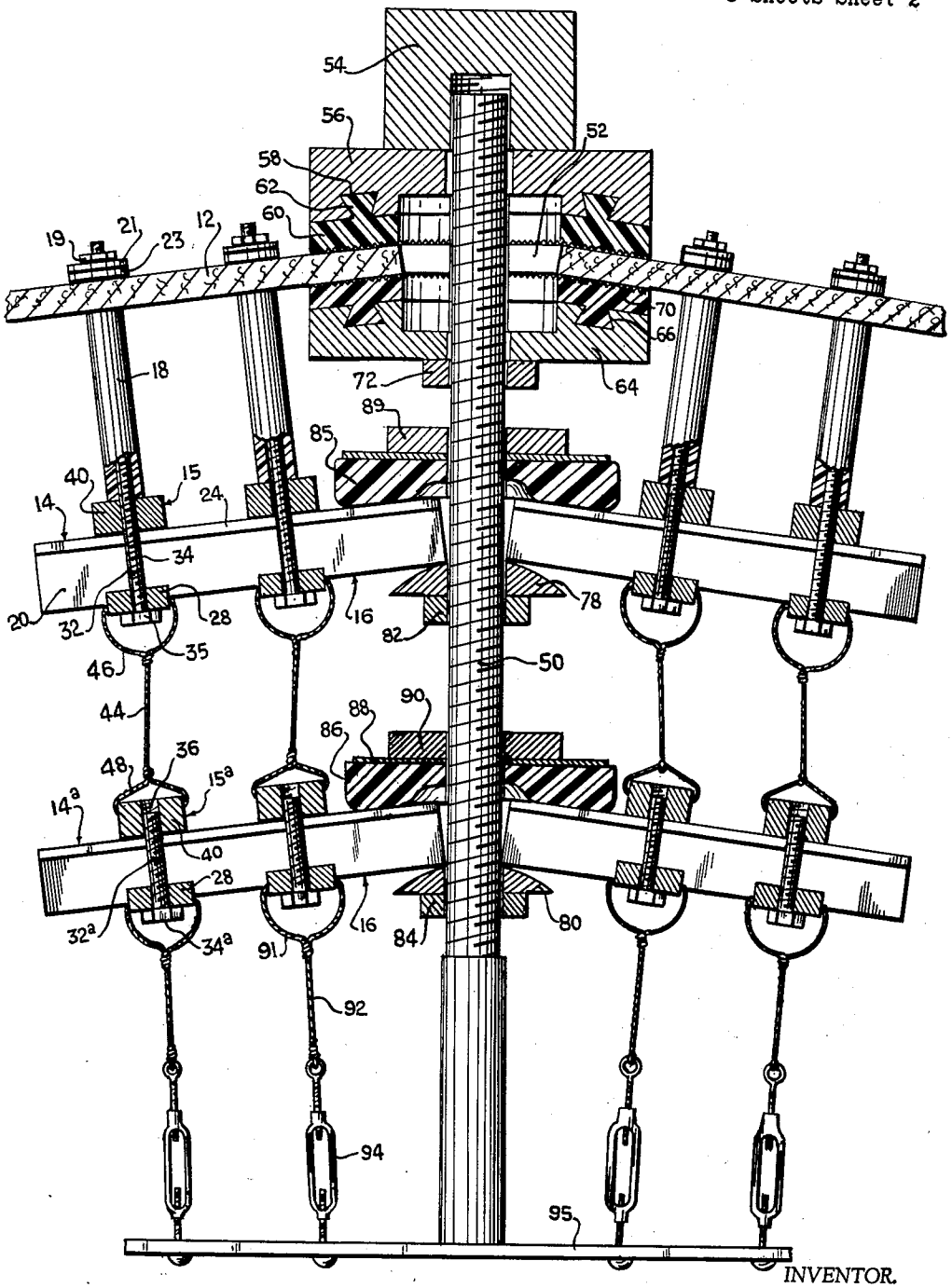


Fig. 2.

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REINFORCED BUILDING STRUCTURE

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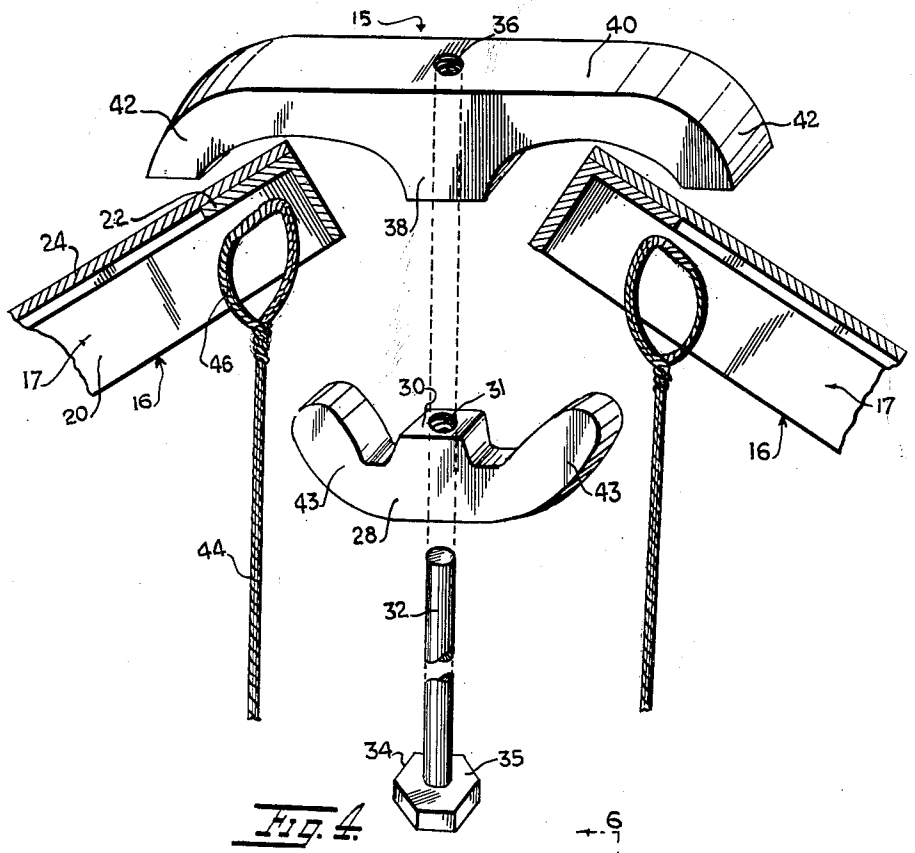


FIG. 4.

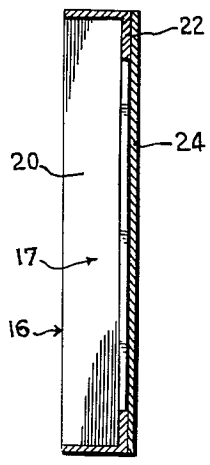


FIG. 6.

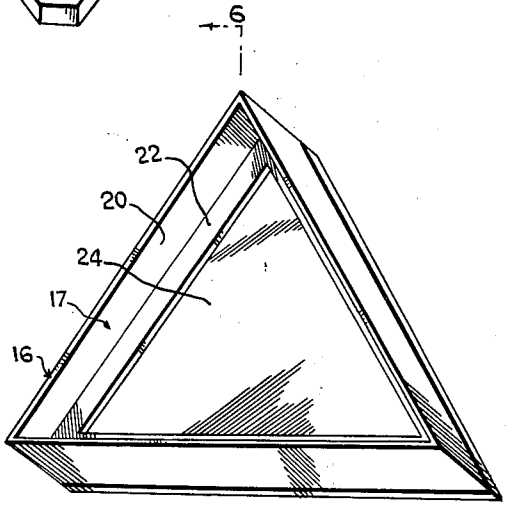


FIG. 5.

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3,129,531

REINFORCED BUILDING STRUCTURE

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5 Claims. (Cl. 50—52)

This invention concerns an improved bomb shelter structure or the like.

It is a particular object of the invention to provide a shelter structure of reinforced construction especially adapted for absorbing and withstanding unusually heavy shocks such as earthquakes, explosions, bombings and the like, without rupturing.

A further object is to provide a shelter of modular construction which can be fabricated readily from a few stock parts.

Another object is to provide a shelter construction including spaced panels each formed of triangular plates clamped together, the panels being joined by flexible cables, and with a shock resistant filler disposed between the panels.

Still another object is to provide a shelter which is generally hemispherical in form with an outer, thin covering and with spaced inner walls formed of triangular plates or frames flexibly clamped together, the spaces between the walls being filled with sand, earth, or other sound absorbing, shock resistant material, specifically insulated against radioactive fallout.

For further comprehension of the invention, and of the objects and advantages thereof, reference will be had to the following description and accompanying drawings, and to the appended claims in which the various novel features of the invention are more particularly set forth.

In the accompanying drawings forming a material part of this disclosure:

FIG. 1 is a side elevational view of a shelter embodying the invention, parts of the walls thereof being broken away to show internal parts.

FIG. 2 and FIG. 3 are fragmentary sectional views on enlarged scales taken on lines 2—2 and 3—3, respectively, of FIG. 1.

FIG. 4 is an exploded perspective view on an enlarged scale of parts of a clamp employed in the shelter for securing panel plates or frames together.

FIG. 5 is an oblique view of a single triangular panel member employed in fabricating the shelter.

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

Referring first to FIGS. 1–3, there is shown a hemispherical structure 10 which has an outer hemispherical wall 12 formed of metal, tempered fiberboard, plywood or other sheet material. This wall serves as an exterior cover, and can be painted or decorated as may be desired. It has a substantially smooth outer surface. The wall 12 can be formed in one piece or may be fabricated from individual panels or sheets. Disposed within the outer wall 12 is another generally hemispherical intermediate wall 14 formed of a plurality of triangular box-like members 16. Between the walls 12 and 14 may be a thermal insulating air space S. The spacing of the walls 12 and 14 is maintained by cylindrical spacers 18 associated with clamp assemblies 15.

Each of the triangular members 16 is a box-like structure with a frame formed by triangularly arranged angle bars 17; see FIGS. 5 and 6. Side walls 20 of the bars define an endless triangular frame. Adjacent bottom walls 22 are perpendicular to walls 20 and are coplanar. Secured to the triangularly arranged coplanar walls 22 is a triangular plate 24 of metal or other rigid material.

The clamp assemblies 15, shown in FIGS. 3 and 4, include a generally U-shaped bar 28 having a central boss 30 in which is a central aperture 31. Through this aperture passes the shank 32 of a bolt 34. The head 35 of the bolt bears on the outer or underside of the bar 28 when the shank is screwed in a threaded hole 36 formed in a boss 38 of another clamping bar 40. Bar 40 is formed with curved ends 42 in which seat lateral edges of triangular plates 24. The curved arms 43 of bar 28 engage inside walls 20 of adjacent wall members 16. When the bolt 34 is screwed tight, the adjacent wall members 16 are held in angular disposition as shown in FIG. 3. The cylindrical spacers 18 fit on portions of bolt shanks 32 which extend outwardly of wall 14 through holes 13 formed in wall 12. A nut 19 is threaded on the outer end of each bolt shank 32. A metal washer 21 and a resilient washer 23 are also provided on the outer end of shank 32.

Disposed within the structure 10 and spaced from wall 14 is another inner wall 14^a also formed of triangular members 16. Clamp assemblies 15^a secure the several members 16 together in wall 14^a to define a hemispherical array. Bolts 34^a may have shanks 32^a which are shorter than shanks 32 since it is not necessary to mount spacer members thereon. The clamping assemblies 15 are respectively connected to the clamping assemblies 15^a by flexible cables 44. These cables have loops 46, 48 at opposite ends and engage around the curved arms 43 of bars 28 in wall 14 and around the curved ends 42^a of bars 40^a in wall 14^a. If desired, turnbuckles may be interposed in the cables 44 to tighten them.

The space between walls 14 and 14^a is filled with packed earth, sand, plastic granules, or other shock absorbing material 27, indicated in FIGS. 1 and 3. The filler 27 is omitted from FIG. 2.

FIGS. 1 and 2 illustrate a preferred support at the top of the shelter 10. A central, vertical post 50 is provided with a threaded portion which passes upwardly between the wall members 16 of walls 14 and 14^a, respectively. The post extends through a hole 52 in the top of wall 12. On the top of post 50 is screwed a cap nut 54. This nut bears on a circular metal washer 56. The underside of this washer is formed with an annular dovetail groove 58. A resilient ring washer 60 has a dovetail portion 62 engaged in groove 58. The lower end of ring 60 bears on top of the wall 12. At the underside of wall 12 is another rigid washer 64 having an annular dovetail groove 66 in which is engaged a resilient ring washer 70. Washer 70 bears on the underside of wall 12. Nut 72 at the underside of washer 64 presses washer 70 up against wall 12. The top of wall 12 is thus clamped between the washers 60 and 70.

Nuts 78 and 80 with rounded tops are located just below the apices of the wall members 16 located at the tops of walls 14 and 14^a. Locknuts 82, 84 under nuts 78 and 80 secure these nuts in position on the post. Resilient washers 85, 86 bear on the tops of the wall members 16 and are secured by flat washers 88 and nuts 89, 90. At the bottom of the post 50 is a flat circular plate 95 which serves as an anchoring means for cables 92 secured via turnbuckles 94 to the plate. The upper looped ends 91 of cables 92 are secured to the bars 28 of the lower clamp assemblies 15^a. Cables 44 are secured between the bars 40^a of lower clamp assemblies 15^a and the lower bars 28 of upper clamp assemblies 15.

The structure of the walls 14, 14^a of the shelter is such that there are no continuous joints between the several wall members 16. The clamps 15, 15^a yield to permit the wall members to shift angularly with respect to each other. I this way the shelter structure can absorb rather violent shocks without rupturing. The shelter can be located above ground G as indicated in FIG. 1 or it can be constructed underground. It will

serve as an above ground or underground atomic bomb shelter, atomic radiation fallout, a storeroom for explosives, or other structure requiring great resistance to sudden stresses and strains and insulation from radiation. Access to the inside of the shelter may be provided by underground passageways.

The modular structure of the several walls 14, 14a permits them to be built up from just triangular frame members and clamps. Only wrenches are required as tools to assemble the walls. The walls can be quickly assembled and disassembled. The several triangular wall members and clamp parts can be mass produced economically. Unskilled labor can be used to assemble the shelter. This greatly reduces the cost of construction. The shelter structure can, of course, be built in various sizes with different sizes of triangular wall members and clamping assemblies.

While I have illustrated and described the preferred embodiment of my invention, it is to be understood that I do not limit myself to the precise construction herein disclosed and that various changes and modifications may be made within the scope of the invention as defined in the appended claims.

Having thus described my invention, what I claim as new, and desire to secure by United States Letters Patent is:

1. A shelter construction comprising outer, intermediate and inner generally hemispherical walls disposed concentrically one within the other and spaced from each other, each of said intermediate and inner walls comprising a plurality of triangular box-like members, each of said members including a triangular plate, a triangular frame formed of angle bars joined at their ends, said plate being secured to coplanar sides of said bars with other sides of said bars defining side walls of said member, said members being disposed in a generally hemispherical array, flexible clamping assemblies joining the several members together, cables joining the clamping assemblies in the intermediate wall to respective flexible clamping assemblies in the inner wall, each of said clamping assemblies including a first bar with curved ends engaging adjacent side walls of adjacent triangular box-like members, a second bar having curved ends engaging the triangular plates of said adjacent members, a bolt joining the first and second bars at aligned portions between said adjacent side walls, a filler of granular shock absorbent and insulating to radioactivity material disposed between the intermediate and inner walls, said outer wall being made of sheet material concentrically surrounding the intermediate wall, and spacer means interposed between the intermediate and outer walls, said clamping assemblies being arranged to absorb vertical, horizontal and in-between shocks.

2. A shelter construction comprising outer, intermediate and inner generally hemispherical walls disposed concentrically one within the other and spaced from each other, each of said intermediate and inner walls comprising a plurality of triangular box-like members, each of said members including a triangular plate, a triangular frame formed of angle bars joined at their ends, said plate being secured to coplanar sides of said bars with other sides of said bars defining side walls of said member, said members being disposed in a generally hemispherical array, clamping assemblies joining the several members together, cables joining the clamping assemblies in the intermediate wall to respective flexible clamping assemblies in the inner wall, a third hemispherical wall made of sheet material concentrically surrounding the first wall, and spacer means securing the first and third walls together, said clamping assemblies being arranged to absorb vertical, horizontal and in-between shocks.

3. A shelter construction comprising outer intermediate and inner generally hemispherical walls disposed concentrically one within the other and spaced from each other, each of said intermediate and inner walls comprising a plurality of triangular box-like members, each of said members including a triangular plate, a triangular frame formed of angle bars joined at their ends, said plate being secured to coplanar sides of said bars with other sides of said bars defining side walls of said member, said members being disposed in a generally hemispherical array, flexible clamping assemblies joining the several members together, cables joining the clamping assemblies in the intermediate wall to respective flexible clamping assemblies in the inner wall, said outer wall being made of sheet material concentrically surrounding the intermediate wall, spacer means associated with the clamping assemblies in the intermediate wall spacing said outer wall from the intermediate wall, a vertical post passing through the top of the outer wall, supporting elements on said post for adjacent members of the intermediate and inner walls, and further supporting elements on said post for the outer wall, said supporting elements including nuts threaded on the post and resilient washers bearing on said adjacent members and said outer wall, said clamping assemblies being arranged to absorb vertical, horizontal and in-between shocks.

4. A shelter construction comprising outer, intermediate and inner generally hemispherical walls disposed concentrically one within the other and spaced from each other, each of said intermediate and inner walls comprising a plurality of triangular box-like members, each of said members including a triangular plate, a triangular frame formed of angle bars joined at their ends, said plate being secured to coplanar sides of said bars with other sides of said bars defining side walls of said member, said members being disposed in a generally hemispherical array, flexible clamping assemblies joining the several members together, cables joining the clamping assemblies in the intermediate wall to respective flexible clamping assemblies in the inner wall, said outer wall being made of sheet material concentrically surrounding the intermediate wall, spacer means associated with the clamping assemblies in the intermediate wall spacing said outer wall from the intermediate wall, a vertical post passing through the top of the outer wall, supporting elements on said post for adjacent members of the intermediate and inner walls, further supporting elements on said post for the outer wall, said supporting elements including nuts threaded on the post and resilient washers bearing on said adjacent members and said outer wall, each of said clamping assemblies including a first bar with curved ends engaging adjacent side walls of adjacent triangular box-like members, a second bar having curved ends engaging the triangular plates of said adjacent members, and a bolt joining the first and second bars at aligned portions between said adjacent side walls, said clamping assemblies being arranged to absorb vertical, horizontal and in-between shocks.

5. A shelter construction comprising outer, intermediate and inner generally hemispherical walls disposed concentrically one within the other and spaced from each other, each of said intermediate and inner walls comprising a plurality of triangular box-like members, each of said members including a triangular plate, a triangular frame formed of angle bars joined at their ends, said plate being secured to coplanar sides of said bars with other sides of said bars defining side walls of said member, said members being disposed in a generally hemispherical array, flexible clamping assemblies joining the several members together, cables joining the clamping assemblies in the intermediate wall to respective flexible clamping assemblies in the inner wall, said outer wall being made of sheet material concentrically surrounding the intermediate wall, spacer means associated with the clamping assemblies in the intermediate wall spacing said outer wall from the first wall, a vertical post passing through the top of the outer wall, supporting elements on said post for adjacent members of the intermediate and

inner walls, further supporting elements on said post for the outer wall, said supporting elements including nuts threaded on the post and resilient washers bearing on said adjacent members and said outer wall, each of said clamping assemblies including a first bar with curved ends engaging adjacent side walls of adjacent triangular box-like members, a second bar having curved ends engaging the triangular plates of said adjacent members, a bolt joining the first and second bars at aligned portions between said adjacent side walls, anchoring means at the bottom of said post, further cables joining clamping assemblies of the inner wall to said anchoring means, and a filler of granular shock absorbent and radioactivity-proof material disposed between the intermediate and inner walls, said clamping assemblies being arranged to absorb vertical, horizontal and in-between shocks.

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