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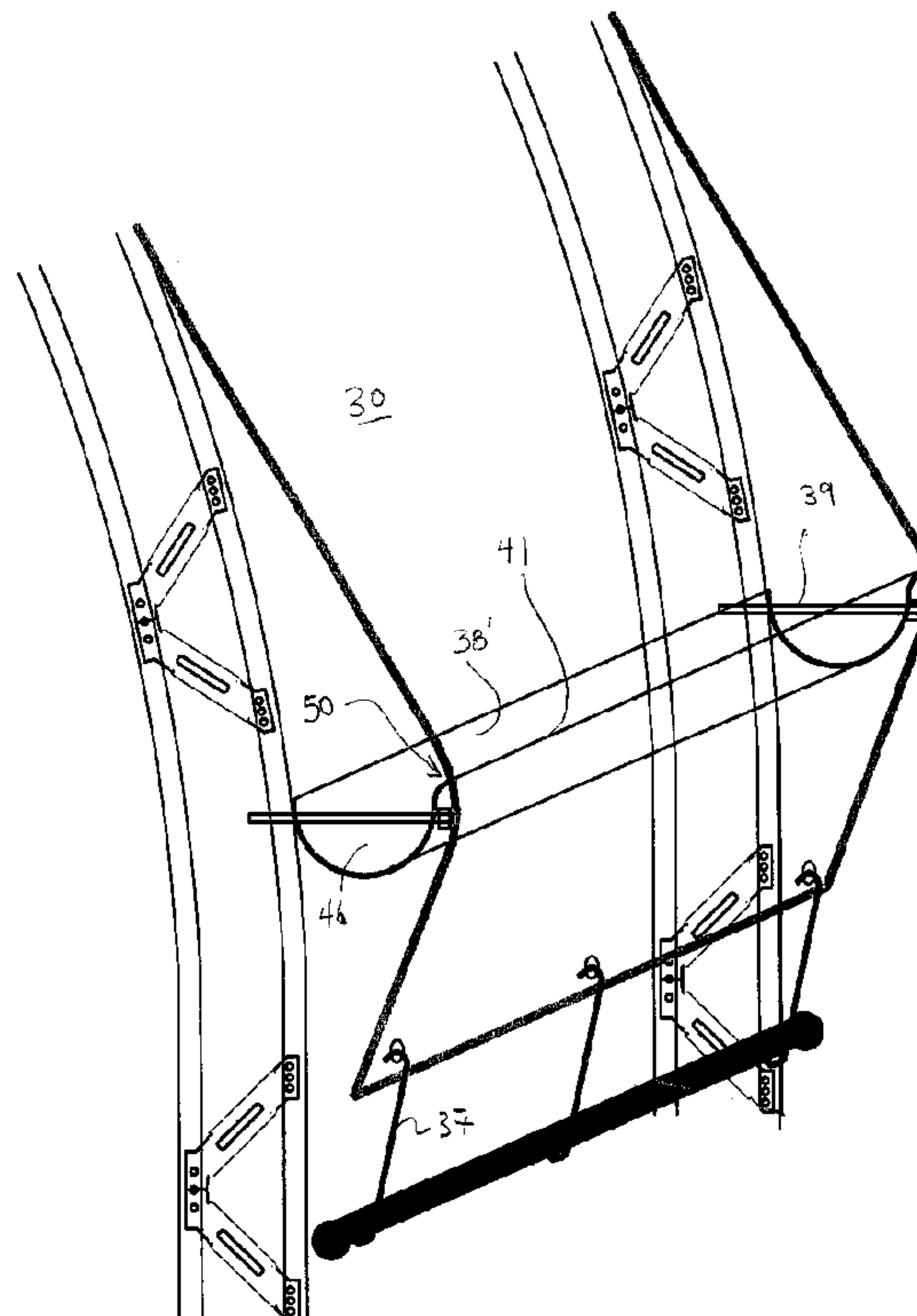
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(54) Titre : STRUCTURE ET PROCEDE DE COLLECTE D'UN FLUIDE EVAPORE  
(54) Title: STRUCTURE AND METHOD FOR THE COLLECTION OF AN EVAPORATED FLUID



(57) **Abrégé/Abstract:**

A structure for the collection of an evaporated fluid is disclosed. The structure may include a reservoir for holding a liquid. The reservoir may have an open end, and an enclosure mounted about the open end of the reservoir for entrapping a fluid evaporated from the reservoir. The enclosure may include a support structure, and a tensionable covering supported by the support structure. The structure also may include a collector for collecting condensate from the covering, the collector being mounted to the support structure, intermediate the support structure and the covering, and oriented to receive condensate moved by gravity along the covering. A tensioning apparatus may be employed for tensioning the covering about the collector to encourage the condensate to engage the collector. The condensate may then be transported within the collector to a desired location.

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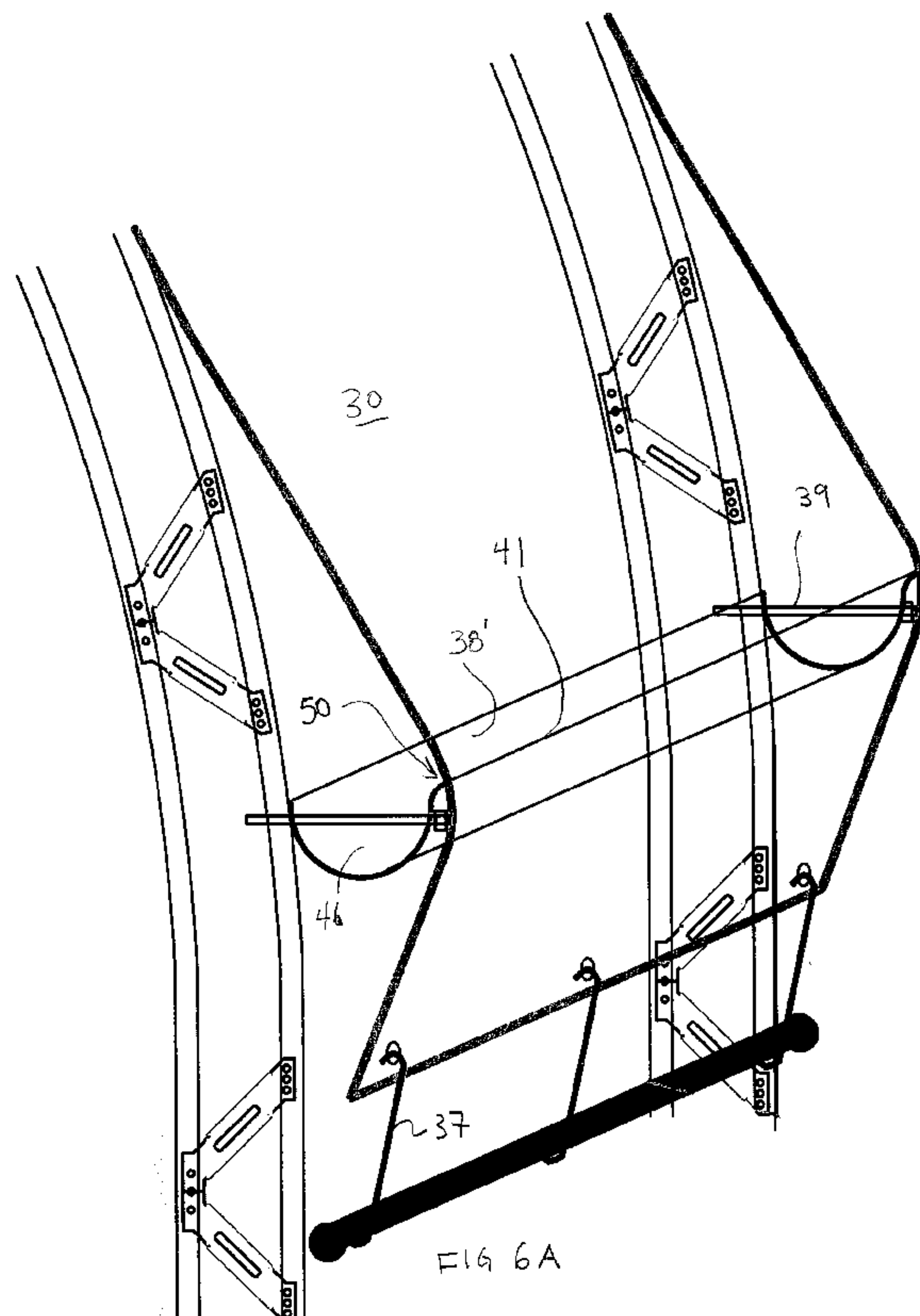
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(54) Title: STRUCTURE AND METHOD FOR THE COLLECTION OF AN EVAPORATED FLUID



(57) Abstract: A structure for the collection of an evaporated fluid is disclosed. The structure may include a reservoir for holding a liquid. The reservoir may have an open end, and an enclosure mounted about the open end of the reservoir for entrapping a fluid evaporated from the reservoir. The enclosure may include a support structure, and a tensionable covering supported by the support structure. The structure also may include a collector for collecting condensate from the covering, the collector being mounted to the support structure, intermediate the support structure and the covering, and oriented to receive condensate moved by gravity along the covering. A tensioning apparatus may be employed for tensioning the covering about the collector to encourage the condensate to engage the collector. The condensate may then be transported within the collector to a desired location.

WO 2009/117801 A1

## STRUCTURE AND METHOD FOR THE COLLECTION OF AN EVAPORATED FLUID

### FIELD OF THE INVENTION

[0001] The invention relates to a structure and method for the collection of an evaporated fluid, and is concerned with treating fluids, for example by distillation, to make them potable or usable for the production of foodstuffs.

### BACKGROUND OF THE INVENTION

[0002] There may be an over abundance of carbon dioxide in some or all of the planet. For example, glaciers may be melting faster than desired with the possibility of world wide flooding in some coastal areas. Additionally, there may be water shortages for drinking and agricultural irrigation, and deforestation which may cause less carbon dioxide to be absorbed by vegetation. Further, a reduction in arable land may compound difficulties in food production. Similarly, overgrazing of existing land may in turn expands the desert area world wide.

[0003] Fluids, in particular water, have been processed and cleaned through a variety of known processes. For example, water has been purified or desalinated by the use of distillation.

[0004] Existing systems of treatment of water have tended to be expensive when large amounts of water are to be treated or collected. Difficulty has also been found in collecting any fluid that has been evaporated in an attempt to purify it.

[0005] Other systems that have been built may lack portability and/or the ability to locate such systems in unforgiving environments, such as in a desert.

[0006] Accordingly, there is a need for alternative structures and methods for the collection of an evaporated fluid.

### SUMMARY OF THE INVENTION

[0007] In accordance with a broad aspect of the present invention there is provided a structure and method for the collection of an evaporated fluid. The apparatus may include a structure for the collection of an evaporated fluid having a reservoir for holding a liquid, the

reservoir having an open end, and an enclosure mounted about the open end of the reservoir for entrapping a fluid evaporated from the reservoir. The enclosure may have a support structure; and a tensionable covering supported by said support structure. A collector for collecting condensate from the covering may also be included. The collector may be mounted to the support structure, intermediate the support structure and the covering, and oriented to receive condensate moved by gravity along the covering. A tensioning apparatus for tensioning the covering about the collector to encourage the condensate to engage the collector may be included as well.

[0008] In an embodiment, the collector may include at least one side defining a trough for receiving the condensate.

[0009] The collector may also include a mount attached to the at least one side, and the collector is made of a resilient material, wherein the collector may resiliently exert a force against the covering when the covering is tensioned against the collector by the tensioning apparatus.

[0010] Conveniently, the collector side defining a trough may be arcuate and may have at least one edge defining an opening for receiving the condensate, and the trough may be mounted to the support structure in an orientation to encourage the movement of condensate into the opening.

[0011] In an embodiment, a spacer may be included to inhibit significant movement of the arcuate trough when the tensioning apparatus is tensioned, and a portion of the edge may be encouraged to abut the tensionable covering to facilitate transmission of condensate from the covering into the collector.

[0012] In a further embodiment, the tensioning apparatus may be a ratchet and may be mounted to the support structure.

[0013] In an embodiment, the components of the structure may be collapsible.

[0014] In an embodiment, the structure may include at least one fan for encouraging formation of the condensate upon the covering.

[0015] In an embodiment, the structure may also include a movable sunlight concentrator mounted to the support structure on a side opposite to the covering.

[0016] In an embodiment, the reservoir has a depth, and the enclosure may be shaped to encourage condensate formed on an inside surface of the covering to move by gravity from an upper portion of the covering to a lower portion of the covering and into the collector which is positioned outside of the reservoir and below the depth of the reservoir.

[0017] In an embodiment, an inlet for introducing a fluid to the reservoir may be included, and the reservoir is made of a continuous membrane which does not permit the transmission of a fluid therethrough.

10 [0018] In an embodiment, the reservoir may be generally rectangular and the enclosure may be generally arcuate, spanning at least two opposite sides of the reservoir.

[0019] In an embodiment, the collector may include a protrusion located adjacent to the covering for encouraging condensate traversing the cover to enter the collector.

15 [0020] In an embodiment, the protrusion may be configured to extend to touch the covering.

[0021] In an embodiment, the protrusion may be configured to bias against the covering.

[0022] In an embodiment, the protrusion may form a lip that extends along an edge of the opening.

20 [0023] In an embodiment, the lip may curve away from the opening for engagement with the cover.

[0024] Other and further advantages and features of the invention will be apparent to those skilled in the art from the following detailed description of embodiments thereof, taken in conjunction with the accompanying drawings.

## BRIEF DESCRIPTION OF THE FIGURES

[0025] The present invention will be further understood from the following detailed description of embodiments of the invention, with reference to the drawings in which:

5 [0026] FIG. 1 illustrates in a perspective drawing, a structure for the collection of an evaporated fluid in accordance with an embodiment of the present invention;

[0027] FIG. 2 illustrates a cross-section of the building structure of FIG. 1 taken along the line 2-2;

[0028] FIG. 2A illustrates an alternative embodiment of the structure of FIG. 1;

10 [0029] FIG. 3 illustrates the building structure similar to that shown in FIG. 2, providing further detail of a reservoir;

[0030] FIG. 3A illustrates a foundation of the building;

[0031] FIG. 3B and C illustrate alternative arrangements for the foundation;

[0032] FIG. 4 illustrates a schematic view of the reservoir;

[0033] FIG. 5 illustrates an isolated isometric view of a fluid collection apparatus;

15 [0034] FIG. 5A illustrates an isolated side view of an alternative embodiment of the fluid collection apparatus of FIG. 5;

[0035] FIG. 6 illustrates an isolated side view of the fluid collection apparatus;

[0036] FIG. 6A illustrates an isolated isometric view of an alternative embodiment of the fluid collection apparatus of FIG. 6;

20 [0037] FIG. 7 illustrates an isolated isometric view of the fluid collection apparatus of FIG. 6; and

[0038] FIG. 8 illustrates an additional feature of the structure for encouraging the evaporation of liquid.

## DETAILED DESCRIPTION OF THE INVENTION

[0039] Similar references are used in different figures to denote similar components.

[0040] The disclosed structure may use energy, for example of the sun, to resolve the problem of the need for usable water by taking advantage of what occurs in nature to incur a limited or no detrimental effect to the environment.

[0041] The present structure may be employed in a hot desert with proximity to salt or unusable water, and convert desert or poor land, to farm and/or forest land. Water collected through condensation may be captured by the structure canopy, and can be used to irrigate as well as produce potable water.

10 [0042] The structure may be positioned at an edge of a desert near a water source, and slowly recapture the desert land by converting unusable or poor water to usable water. Based on the vegetation chosen, once sustainable growth is achieved, the structure may be relocated to the next area for treatment.

15 [0043] For example, at a constant average temperature of 95 to 105 degrees Fahrenheit one structure measuring, for example, 30 by 100 feet may produce usable water for irrigation. It is hoped that enough water may be produced to irrigate at least one or more acres for growing of suitable vegetation for the area.

[0044] It is expected that the structure, if suitable materials are used, may have a life expectancy of up to 40 years, or more. In a preferred embodiment, the structure may easily be assembled and dismantled.

[0045] Ideally, more vegetation will absorb more carbon dioxide, and may in turn lower the effect of green house and global warming a more natural way. If ocean water is used, some of the excess water due to global warming might be reduced, and if used in mass production around the world might lower the possibility of flooding around costal areas.

[0046] Evaporation is a natural phenomenon. The disclosed structures may capture the vapor which turns into liquid when it comes in contact with a canopy, and/or it encounters a lower or colder temperature. In general, the structure may:

1. Capture water
- 5      2. Distil water
3. Capture salt (for example, in a salt pond to attempt to improve hygiene).
4. Accelerate the process of evaporation by creating a shallow area of water.
5. Accelerate the condensation process by introduction of fans in the structure.
6. Facilitate an increase in the air velocity over the surface of the water by agitation or by
- 10      fanning the water surface.
7. Increase the salinity of the water by leaving the accumulated sale solute in the tank to lower the latent heat of the solution and thus attempt increase the evaporation rate.
8. Increase the temperature of the water in the structure, for example, by using a darker or black tank.
- 15      9. Decrease the vapour pressure (dew point) by creating a cooling effect at the top of the structure. For example, by employing a double layer with air circulation between the layers.

[0047]  $W_q$  = evaporation rate of water, lb/h.

[0048]  $A_p$  = area of pool surface ft<sup>2</sup>.

20      [0049]  $C_1$  = 69.4 BTU(h\*ft<sup>2</sup>)\*in.Hg.

[0050]  $C_2$  = 30.8 BTU(h\*ft<sup>2</sup>)\*in.Hg.

[0051]  $V$  =air velocity over water surface, MPH.

[0052]  $Y$  = latent heat required to change water vapor at surface water temperature, BTU/lb

[0053]  $P_{dp}$  = saturation pressure at room air dew point, in HG

[0054]  $P_w$  = saturation vapor pressure taken at the surface water temperature, in Hg.

5 [0055] The above equation is a general formula to calculate the evaporation rate of water surface.

[0056] Figure 1 illustrates a structure for purifying a fluid. The structure is relatively easy to build, and is particularly suited to construction in remote locations, such as a desert. Accordingly, such structure typically does not require a foundation or any significant preparation prior to  
10 construction thereof. For example, a structure using the components disclosed in Canadian Patent No. 2,107,775 issued to Jack Slater on June 20, 2000 may be suitable (the entirety of this reference is herein incorporated by reference). Other structures and methods of construction embodying the principles and goals defined herein, may also be suitably employed.

[0057] Figure 1 shows a building structure 10 in the disclosed embodiment. Building  
15 structure 10 may be relatively large, for example, between about 20 and 100 feet long, or more. Larger and smaller structures may also be suitable. Building structure 10 is preferably made to be relatively water-tight to inhibit the uncontrolled escape of a fluid, or evaporated fluid contained therein.

[0058] Figure 2 is a cross-section of the building structure 10 of figure 1 taken along the line  
20 2-2. Figure 2 illustrates a general principle of operation of the subject structure for the collection of an evaporated fluid. Building structure 10 may contain a reservoir 12 (shown in greater detail in figure 3) which holds a liquid 14 to be processed. Liquid 14 may be evaporated by the introduction of energy. A energy source such as sunlight 16, or some other energy source such as a heater (not shown), or thermal energy from the ground. Preferably, sunlight is used due to its general  
25 abundance and low cost.

[0059] As the liquid 14 receives energy from an energy source, liquid 14 begins to evaporate, leaving undesirable particulates and solutes dissolved with fluid 14 behind in reservoir 12. Building

structure 10 may include a roof 18, canopy, or some other structure above reservoir 12 for capturing evaporated fluid 14.

[0060] Roof 18 is preferably constructed to be relatively impervious to the evaporated liquid 14. If sunlight 16 is used as an energy source, then roof 18 is preferably made to be transparent to the solar energy to enable the sunlight to be absorbed by fluid 14 in reservoir 12. Alternatively, translucent or even opaque coverings may be used to absorb the energy of the sun to increase the thermal content building structure 10, though this arrangement may make it more difficult for the evaporated fluid to condensate.

[0061] Roof 18 may include an internal surface 20 for permitting the condensation of any evaporated fluid 14. Internal surface of roof 20 is preferably made of a sheet of plastic or poly as may be used in a greenhouse. As fluid 14 evaporates it forms a condensate upon surface 20. Surface 20 is preferably shaped to encourage the condensate to move by gravity back towards reservoir 12. Accordingly, surface 20 preferably has a generally arcuate shape, and may bridge reservoir 12. Other shapes may be suitable for surface 20 provided that such shapes encourage movement of any condensate by operation of gravity.

[0062] To encourage formation of a condensate, a cooling apparatus, such as one or more fans 22 may be included within building structure 10. The cooling apparatus may serve to increase the volume of condensate which forms on surface 20 and/or the rate at which condensate forms. The area of internal surface 20 furthest from reservoir 12 is preferably cooler than the temperature of fluid 14 within reservoir 12. This difference in temperature may serve to increase the formation of a condensate on surface 20.

[0063] Reservoir 12 is preferably made to be about two to three feet deep. The extent roof 18 is preferably much greater relative to the depth of reservoir 12. For example, roof 18 may be 12 feet high above reservoir 12, but collection apparatus 38 is preferably lower relative to the full depth of reservoir 12. As noted, roof structure 18 is preferably gently sloped, so that any condensate forming will be encouraged slide along internal surface 20, and not form droplets that simply drop back into reservoir 12.

[0064] Figure 2A illustrates an alternative embodiment structure 10'. In particular, structure 10' may include a solar panel 21 which is movable in response to the position of the sun 16. Fluid source 23 in the nature of a hose or spray, may also be included to introduce a fluid to the reservoir and to encourage evaporation of the fluid. The reservoir may have a foundation 25 instead of  
5 membrane walls, with portions of roof 18 (or sidewall structures) providing the sides of reservoir 12. As shown in Figure 3A, foundation 25 may include sand. Plywood or other support 27 may be used to support a track 29 for receiving and retaining an end of building structure 10. Figures 3B and 3C illustrate alternative arrangements for the foundation, shown as foundation 25'

[0065] Figure 3 illustrates a building structure similar to that shown in figure 2, and provides  
10 further detail of reservoir 12. Reservoir 12 may include an internal membrane or liner 24. Liner 24 may be made of a dark or black material in order to encourage absorption of energy. Liner 24 may be snapped together or otherwise attached in sections, or it may be similar to liners used for swimming pools or other reservoir-type applications. For example, liner 24 may be made in sections  
15 (for example of one or several feet wide, such as twenty feet wide) of a rollable rubber or vinyl, and may be joined by adhesion on site. Reservoir 12 may also include an external liner 26. External liner 26 may provide additional support and/or protection, and may be rollable like carpet in sections (for example 10 to 40 foot sections). Fluid 14 may be introduced to reservoir 12 by any convenient means, such by using a pump (such as a solar-powered pump (not shown)), or by a series of trenches or canals so that fluid 14 is provided by a natural local water source.

20 [0066] Figure 4 provides a schematic view of reservoir 12, showing that it may be constructed in sections of about 20 feet each. This may permit the convenient transportation of the components of building structure 10. One or more tension cables 15 may be employed to strengthen or to provide rigidity to reservoir 12. Of course, other dimensions may be suitably employed.

[0067] Figure 5 illustrates an isolated perspective view of a fluid collection apparatus 28 for  
25 collecting the condensate. Figure 6 illustrates an isolated side-view of the fluid collection apparatus. (Fluid collection apparatus 28 is also shown in figure 2.)

[0068] Referring primarily to figures 5 and 6, fluid collection apparatus 28 may include a roof cover 30 of which internal surface 20 forms a part thereof. Cover 30 preferably traverses a

portion of roof 18 and preferably most of roof 18. Building 10 is preferably sealed so that condensate does not escape to the external environment.

[0069] In the present embodiment, cover 30 bridges reservoir 12, originating at or about the ends of roof portion 18 at a meeting point with sidewalls 32. It should be noted that sidewalls 32 may be minimized or eliminated, permitting roof 18 to form the sidewalls as well, for example, as one continuous arch.

[0070] Cover 30 is preferably taught over roof frame members 34 to permit any condensate to slide thereupon. Accordingly, hard, smooth-surfaced materials, such as plastics may be used. Alternatively, pliable and/or stretchable materials such as a vinyl or other plastic may also be used. If a stretchable plastic is employed, a tensioning apparatus 36 may be employed to stretch cover 30 over roof frame members 34 to encourage cover 30 to become smooth. Tensioning of cover 30 may also be done by using ropes and braces (not shown). Pulleys and/or ratchet mechanisms (not shown in detail) may also be used in conjunction with ropes to tension cover 30 about roof frame members 34. Figure 6A illustrates tensioning straps 37 which may also be employed to tension cover 30.

[0071] A collector 38 may be mounted to one or more frame members 34. Collector 38 may be orientated to trap any condensate traversing internal surface 20.

[0072] Figure 5A illustrates a spacer 39 placed, bolted or otherwise secured to collector 38. Spacer 39 may optionally be employed control or limit the amount of deflection of collector 38 when tensioned by cover 30.

[0073] Referring additionally to figure 7, collector 38 is shown in isolation. Collector 38 preferably has a mount 40 for attaching collector 38 to frame members 34 and/or support members 42. Mount 40 may be in the nature of a brace having one or more mounting features such as holes 44 for receiving a fastener bracket (not shown).

[0074] Collector 38 may include a receptacle 46 for receiving, and preferably transporting, any condensate. Receptacle 46 may be integrally formed with mount 40, or may be attached separately. Receptacle 46 may be generally arcuate, but may also be squared or rectilinear, provided that it is capable of receiving condensate transported along internal surface 20 of cover 30. As

explained below, receptacle 46 is preferably made of a resilient or springy material, such as a plastic as is used for green houses, even flexible metal may be employed.

[0075] Referring in particular to figure 6, collector 38 may be mounted to one or more frame members 34 and/or 42 so that it is orientated in abutting relationship with internal surface 20 of cover 30. Receptacle 46 may include a mouth 48 for permitting passage of condensate from surface 20 either by dripping from surface 20, or by flow from surface 20 directly to receptacle 46.

[0076] To encourage passage of condensate from surface 20 through mouth 48 and into receptacle 46, surface 20 is preferably mounted upon receptacle 46 and adjacent mouth 48. Mouth 48 therefore is preferably orientated generally upwards, but need not be level. For example, receptacle 46 may be mounted on an incline to permit further transportation of the condensate to a desired location. For example, a series of receptacles 46 may be aligned and inclined to encourage transportation of condensate under gravity to flow to a desired location for collection of the now purified fluid. Alternatively, one or both ends 50 of receptacle 46 may be closed so that receptacle 46 simply contains all of the collected condensate. The condensate may then be emptied or removed by other means, such as manually or by a tap or other feature mounted to receptacle 46 (not shown).

[0077] In order to encourage flow of the condensate from internal surface 20 to receptacle 46, cover 30 may be tensioned against collector 38 to the extent that collector 38 is flexible and/or resilient, it will resile against tensioned cover 30 to at least partially seal the interface between cover 30 and collector 38 at or about interface 50. In this arrangement, condensate may flow along surface 20 to interface 50, and then drip or flow into receptacle 46.

[0078] Figures 5A and 6A illustrate a variation of collector 38, labeled 38'. Collector 38' includes a extension or protrusion in the nature of a lip 41 at or adjacent to interface 50. Lip 41 may extend or protrude towards or against cover 30. In the illustrated embodiment, lip 41 curves away from receptacle 46. This arrangement is intended to encourage lip 41 to be proximate to, to the extent that it may touch, cover 30. Condensate traversing cover 30 may thereby be encouraged to enter receptacle 46. Other variations of lip 41 may be employed. For example, lip 41 may simply be angled relative to receptacle 46. Lip 41 may also be integral with collector 38 or it may be an added feature such as in the form of a foam or a flexible plastic.

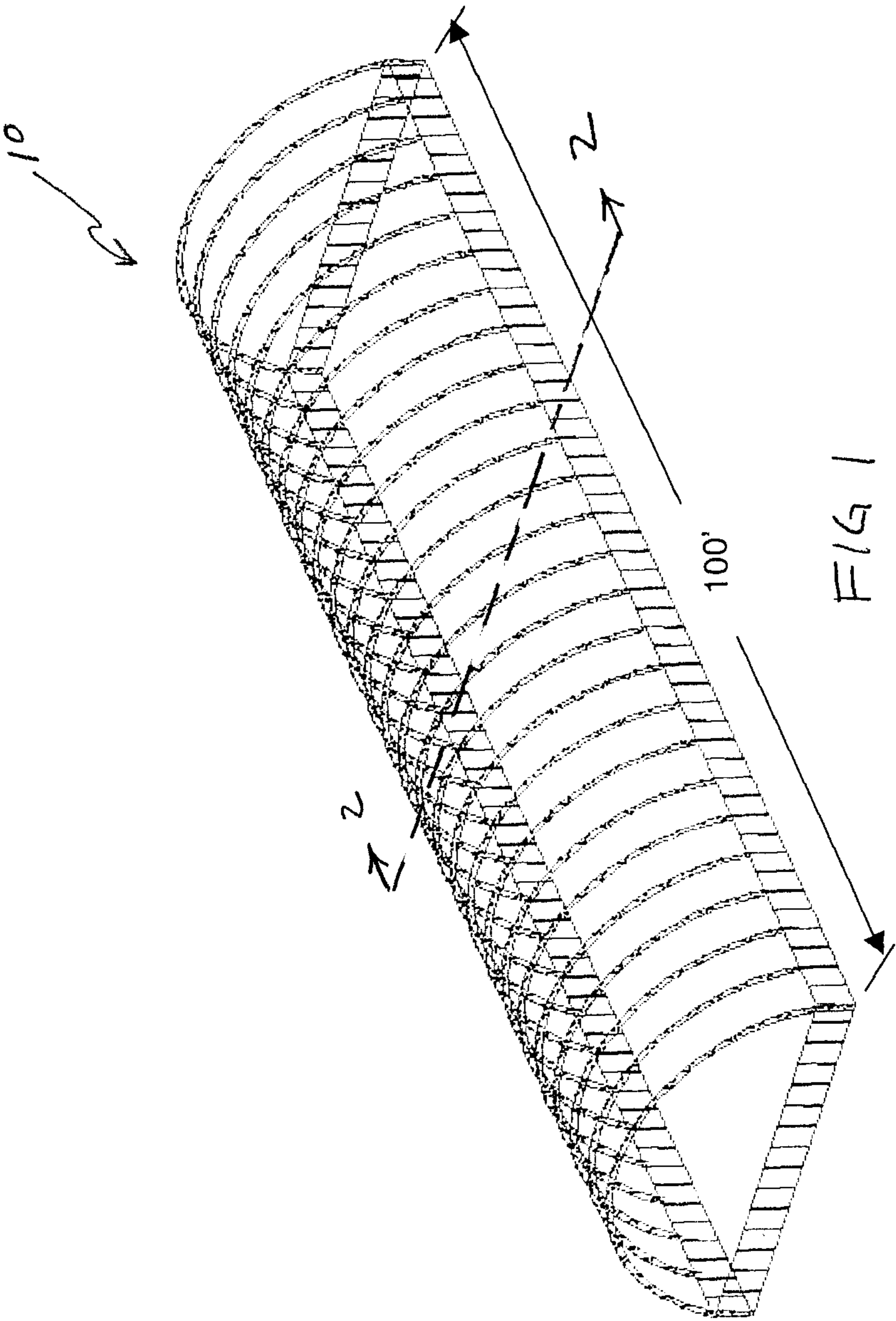
[0079] The present arrangement avoids or limits the need for any sealant such as a caulk along or about interface 50. It also minimizes the requirement for fasteners to connect the various components of this assembly.

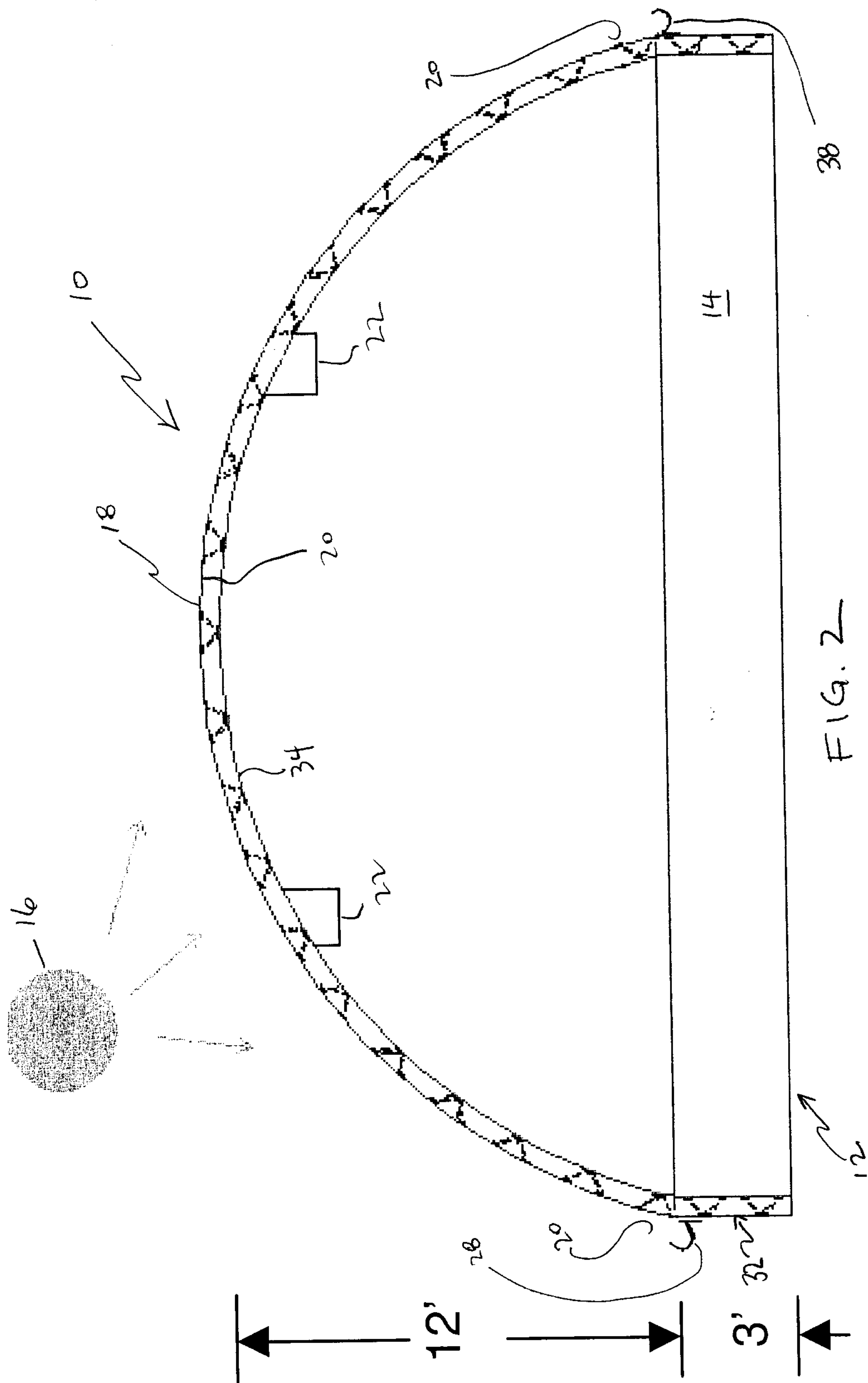
[0080] Figure 8 illustrates an additional feature of building 10 for encouraging the  
5 evaporation of liquid 14. An energy magnifier 52, such as a magnifying glass may be mounted to an inside or outside portion of roof 18. In the present embodiment, magnifying glass 52 is slidingly mounted to the inside of roof 18. Glass magnifying lens 52 may be automatically or manually moved to align with sunlight 16 to encourage evaporation.

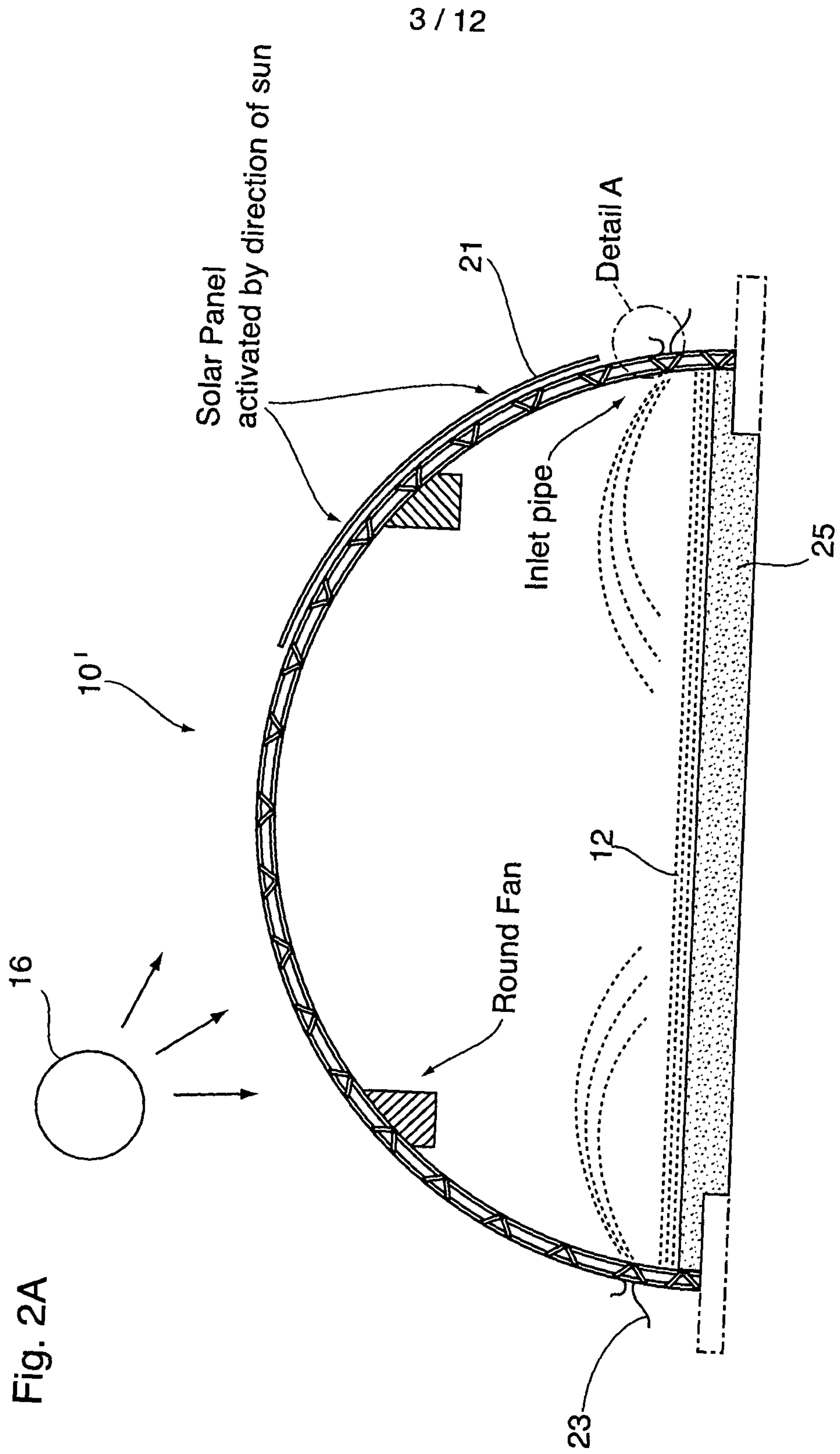
## CLAIMS

1. A structure for the collection of an evaporated fluid, the structure comprising:
  - a reservoir for holding a liquid, the reservoir having an open end;
  - an enclosure mounted about the open end of the reservoir for entrapping a fluid evaporated
  - 5 from the reservoir, the enclosure including:
    - a support structure; and
    - a tensionable covering supported by said support structure;
  - a collector for collecting condensate from the covering, the collector being mounted to the
  - support structure, intermediate the support structure and the covering, and oriented to
  - 10 receive condensate moved by gravity along the covering; and
  - a tensioning apparatus for tensioning the covering about the collector to encourage the
  - condensate to engage the collector.
2. The structure of claim 1, wherein the collector includes at least one side defining a trough for receiving the condensate.
- 15 3. The structure of claim 2, wherein the collector includes a mount attached to the at least one side, and the collector is made of a resilient material, the collector resiliently exerting a force against the covering when the covering is tensioned against the collector by the tensioning apparatus.
4. The structure of claim 3, wherein the collector side defining a trough is arcuate and has at least one edge defining an opening for receiving the condensate, and the trough is mounted to the support
- 20 structure in an orientation to encourage the movement of condensate into the opening.
5. The structure of claim 4, further comprising a spacer to inhibit significant movement of the arcuate trough when the tensioning apparatus is tensioned, and a portion of the edge is encouraged to abut the tensionable covering to facilitate transmission of condensate from the covering into the collector.

6. The structure according to claim 3, wherein the tensioning apparatus is a ratchet and is mounted to the support structure.
7. The structure of claim 1, wherein the components of the structure are collapsible.
8. The structure of claim 1, further comprising at least one fan for encouraging formation of the condensate upon the covering.  
5
9. The structure of claim 1, further comprising a movable sunlight concentrator mounted to the support structure on a side opposite to the covering.
10. The structure of claim 1, wherein the reservoir has a depth, the enclosure is shaped to encourage condensate formed on an inside surface of the covering to move by gravity from an upper portion of the covering to a lower portion of the covering and into the collector which is positioned outside of the reservoir and below the depth of the reservoir.  
10
11. The structure of claim 1, further comprising an inlet for introducing a fluid to the reservoir, and the reservoir is made of a continuous membrane which does not permit the transmission of a fluid therethrough.
12. The structure of claim 1, wherein the reservoir is generally rectangular and the enclosure is generally arcuate, spanning at least two opposite sides of the reservoir.  
15
13. The structure of claim 2, wherein the collector includes a protrusion located adjacent to the covering for encouraging condensate traversing the cover to enter the collector.
14. The structure of claim 13, wherein the protrusion is configured to extend to touch the covering.  
20
15. The structure of claim 14, wherein the protrusion is configured to bias against the covering.
16. The structure of claim 14, wherein the protrusion forms a lip that extends along an edge of the opening.
17. The structure of claim 16, wherein the lip curves away from the opening for engagement with the cover.  
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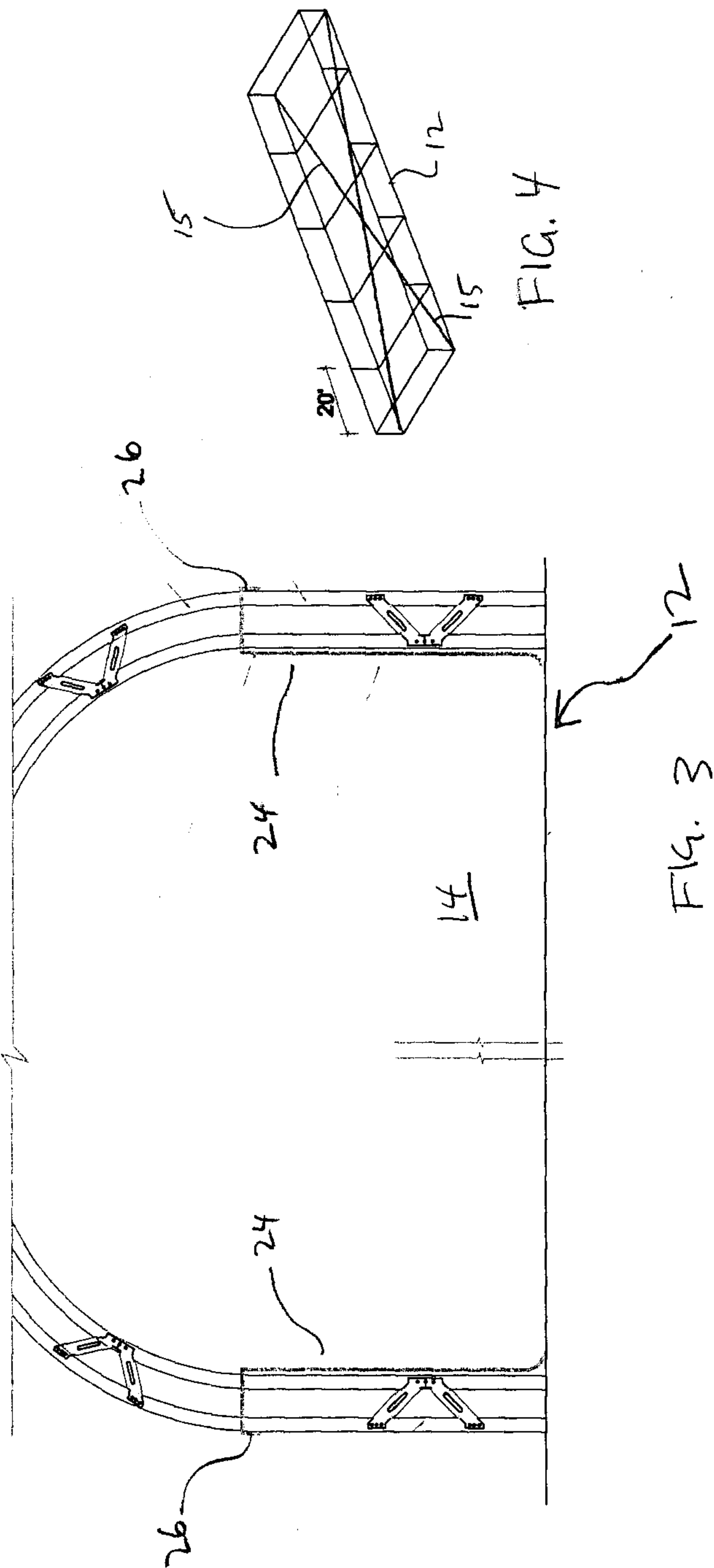
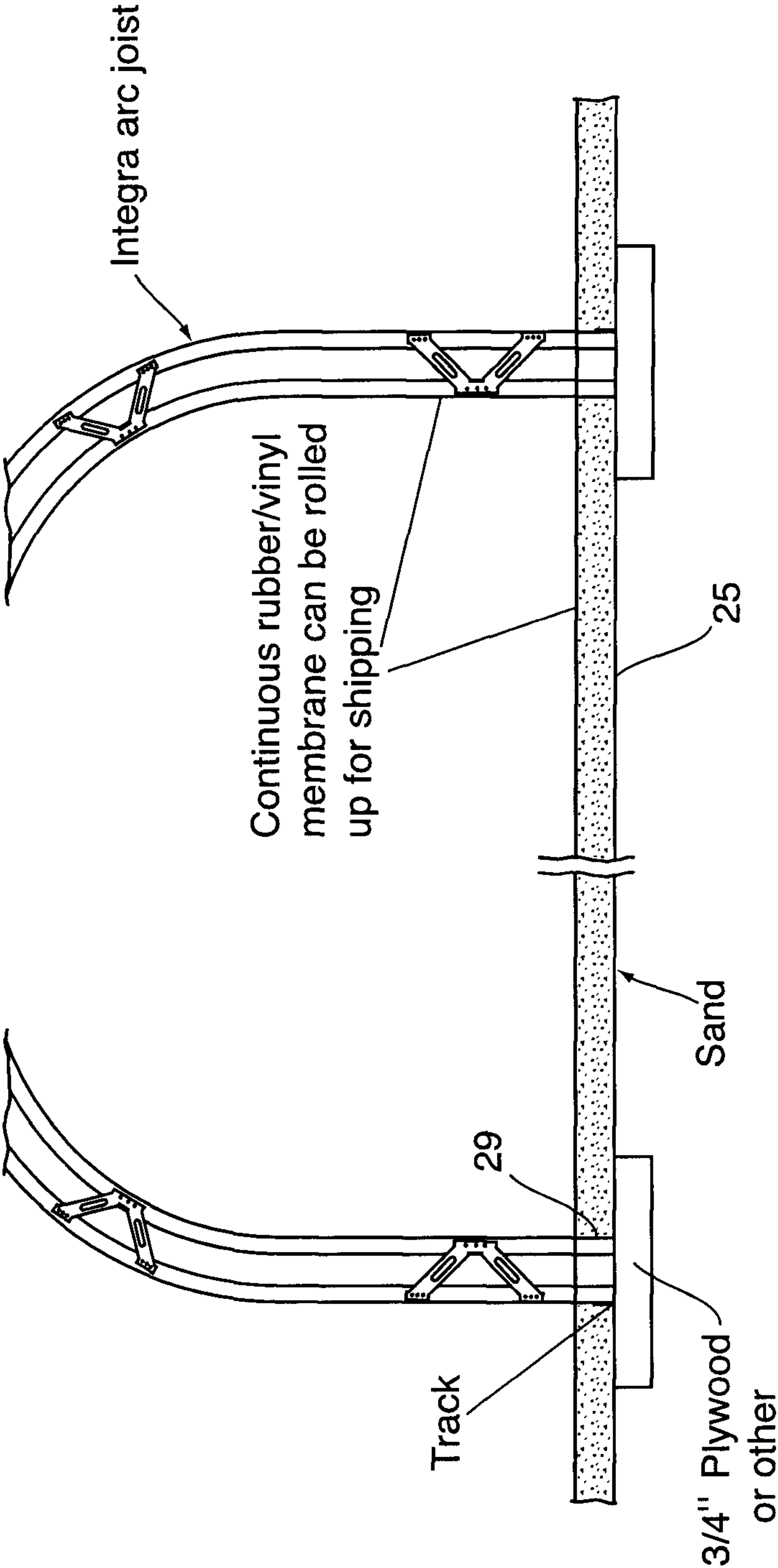
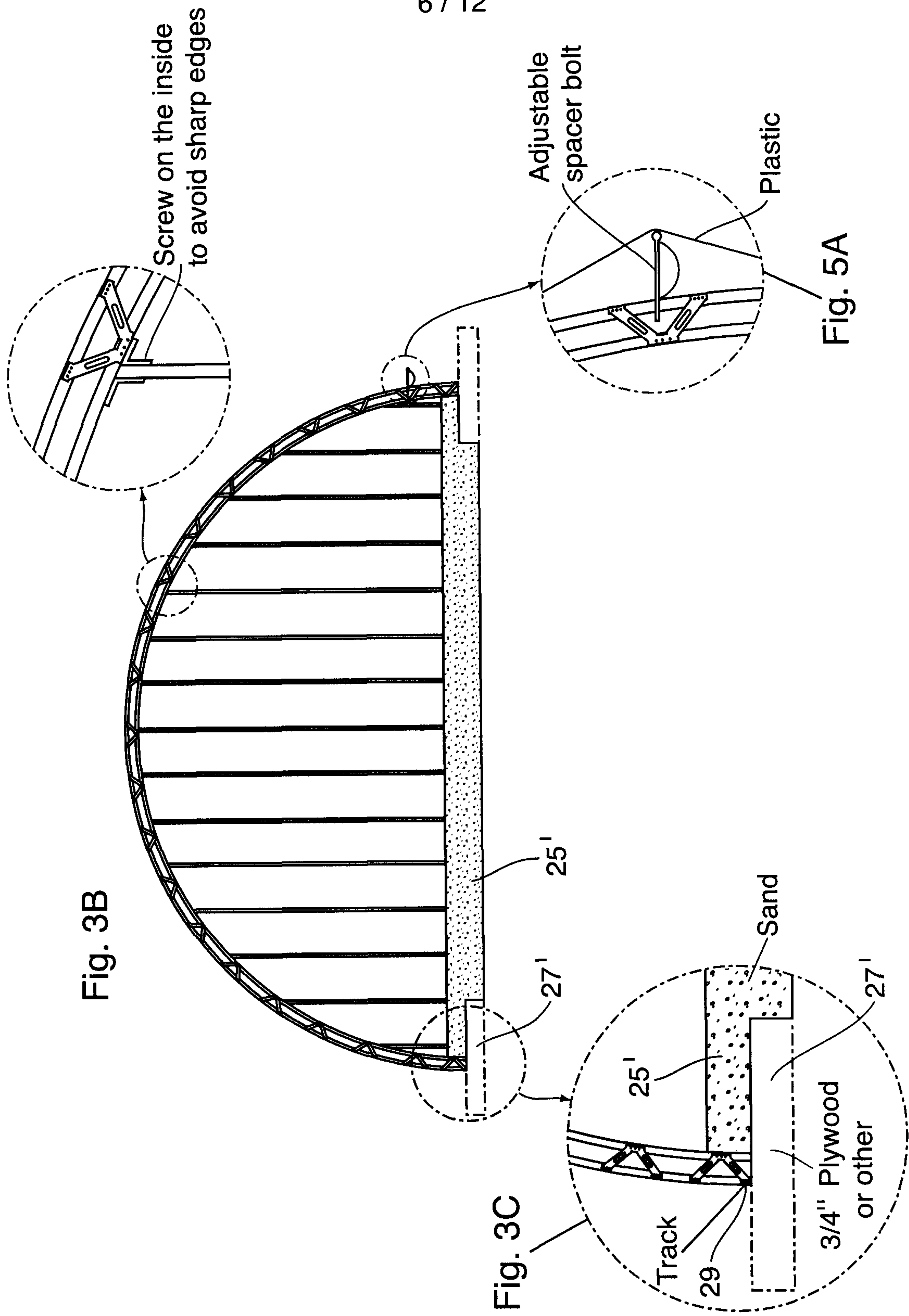
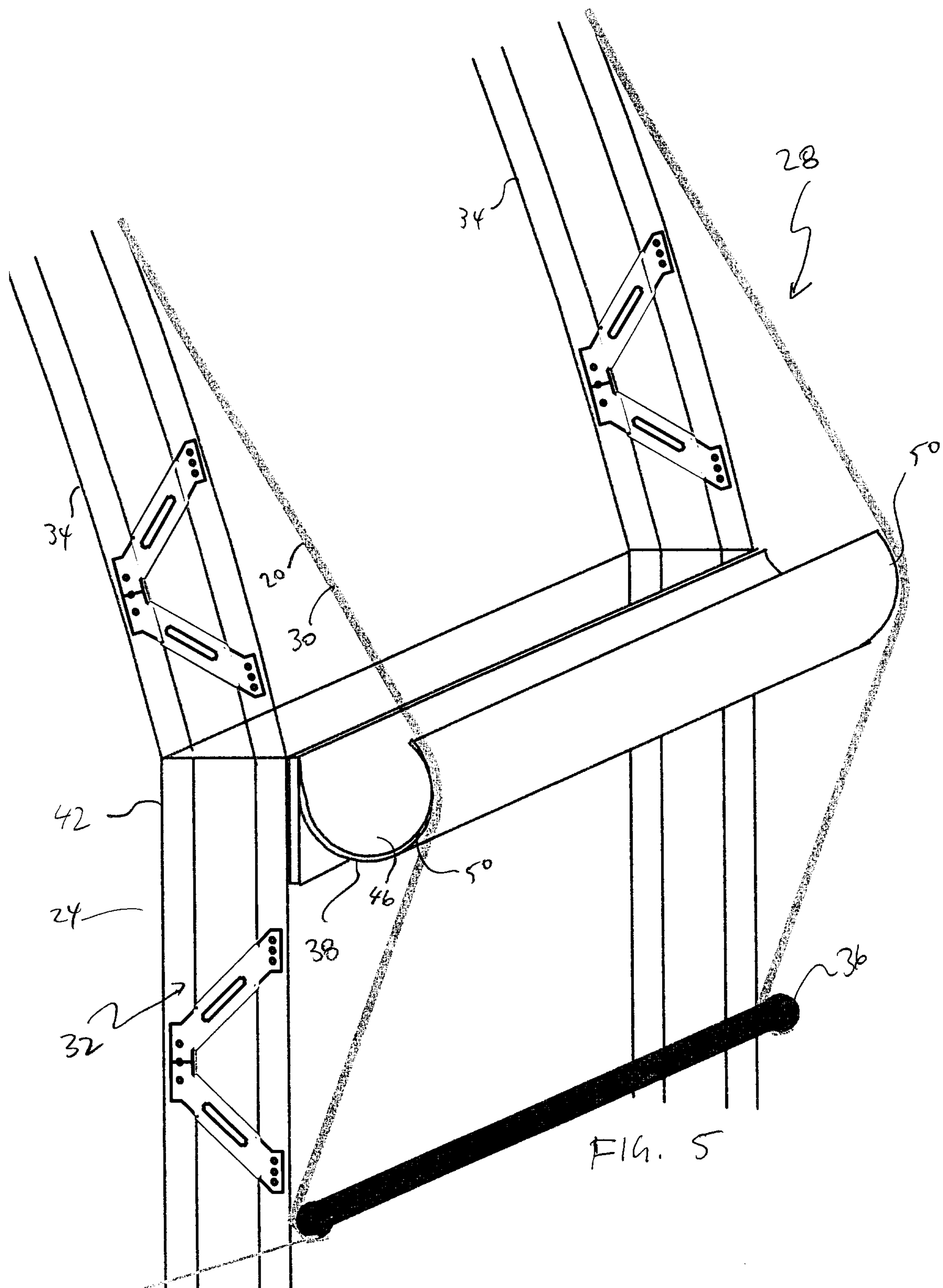


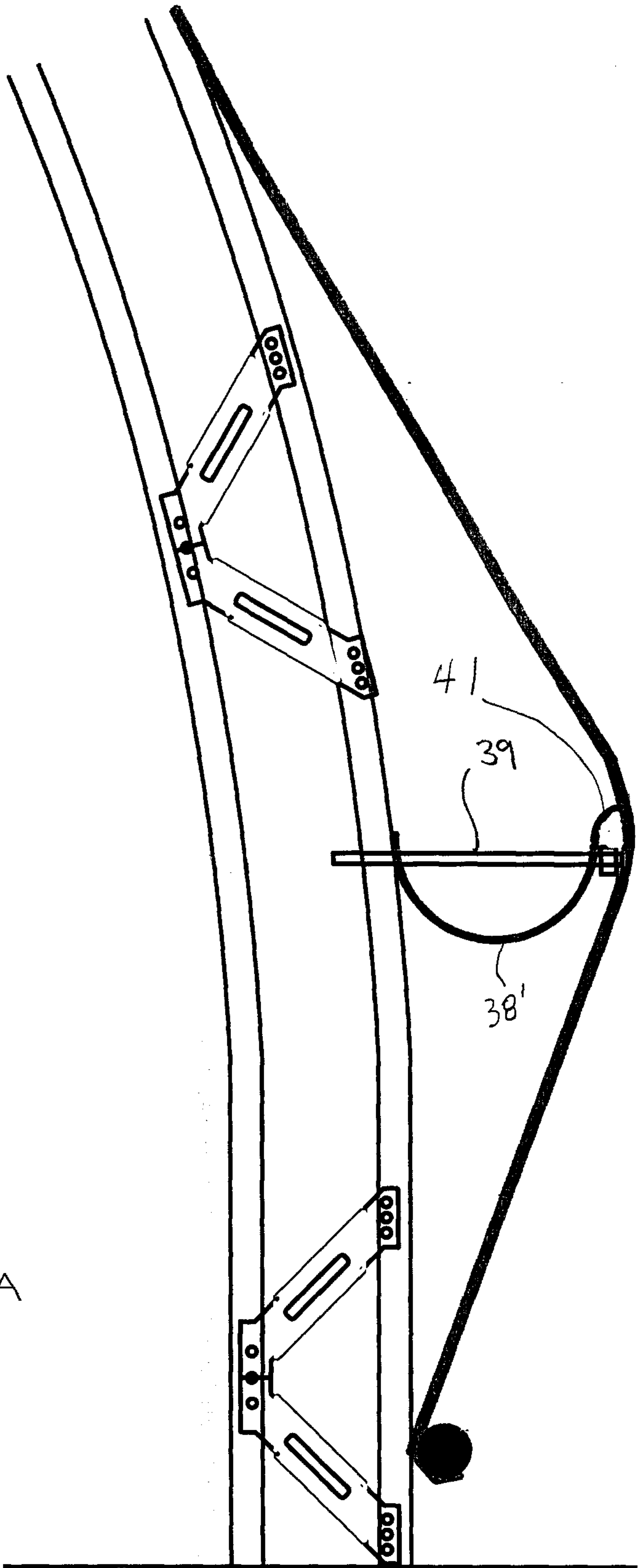
Fig. 3A





7/12





9/12

