US 20070151588A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2007/0151588 A1**

Yul et al. (43) **Pub. Date: Jul. 5, 2007**

(54) **APPARATUS AND METHOD FOR LIGHTING A COLLAPSIBLE STRUCTURE**

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(21) Appl. No.: **11/401,534**

(22) Filed: **Apr. 10, 2006**

(30) **Foreign Application Priority Data**

Dec. 29, 2005 (CN) 200520126787.2

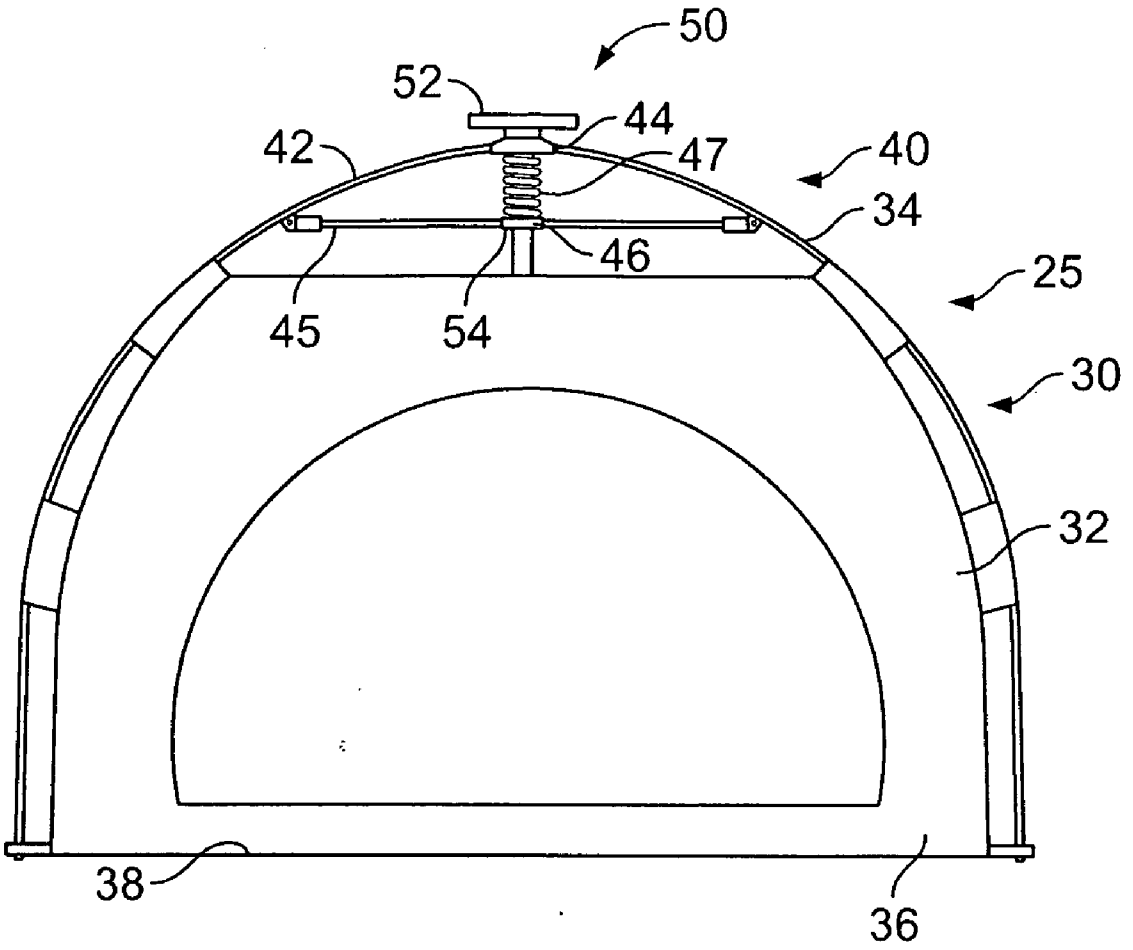
Publication Classification

(51) **Int. Cl.**
E04H 15/10 (2006.01)

(52) **U.S. Cl.** **135/91**; 135/135

(57) **ABSTRACT**

A solar power generator for a structure comprising a collapsible frame assembly is provided. The solar power generator includes a solar panel removably coupled to the collapsible frame assembly. The solar panel is configured to absorb solar energy from the sun. A power module is electrically coupled to the solar panel. The power module includes a power source that is configured to convert the solar energy absorbed by the solar panel to electrical energy. At least one power output is electrically coupled to the power source and configured to supply electrical energy to a coupled load device.



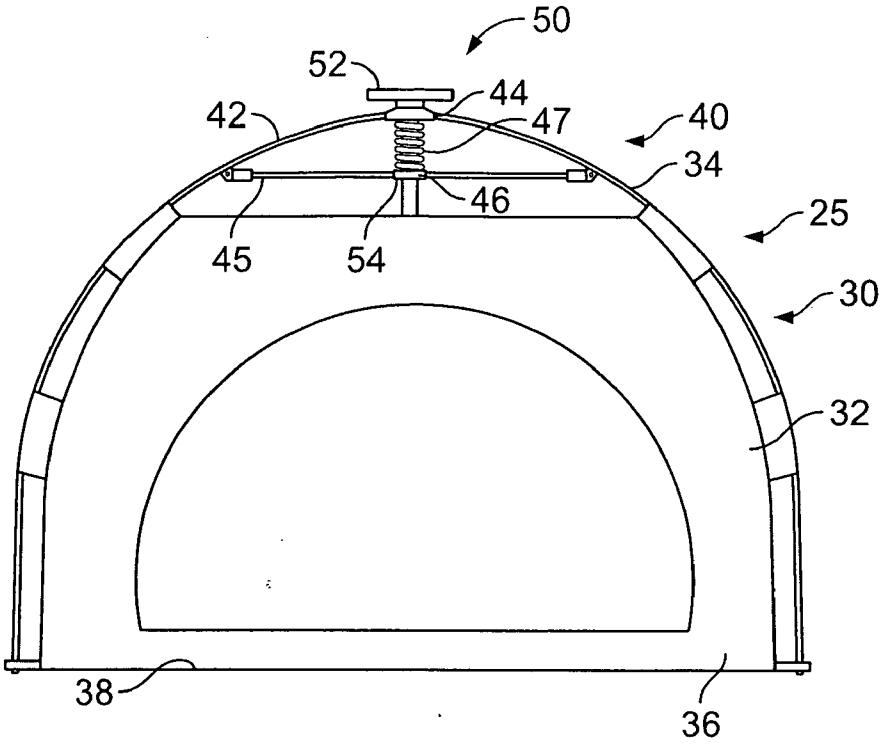

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FIG. 1

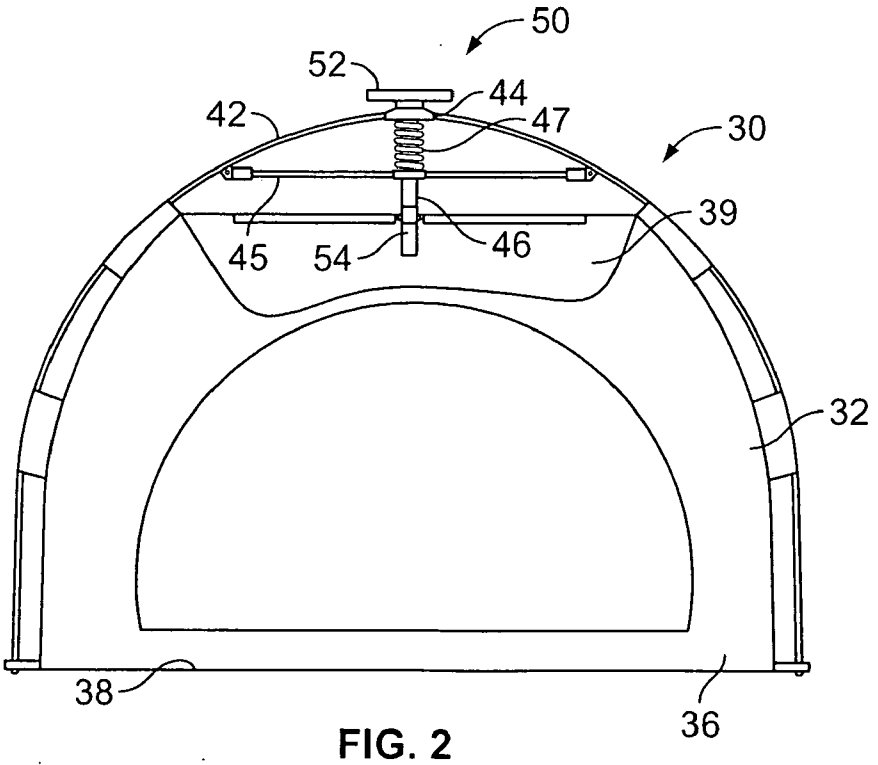
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FIG. 2

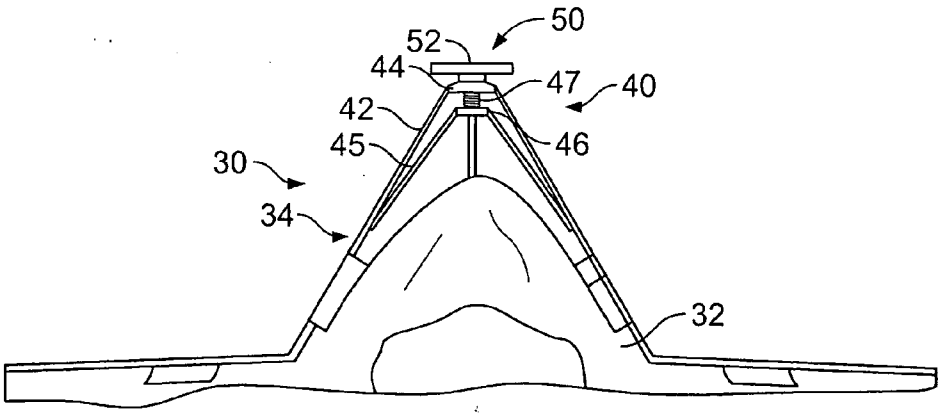
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FIG. 3

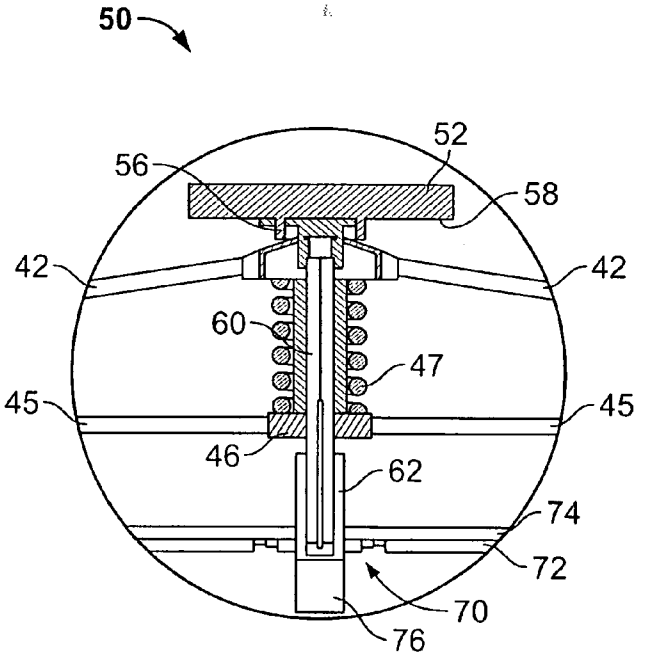
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FIG. 4

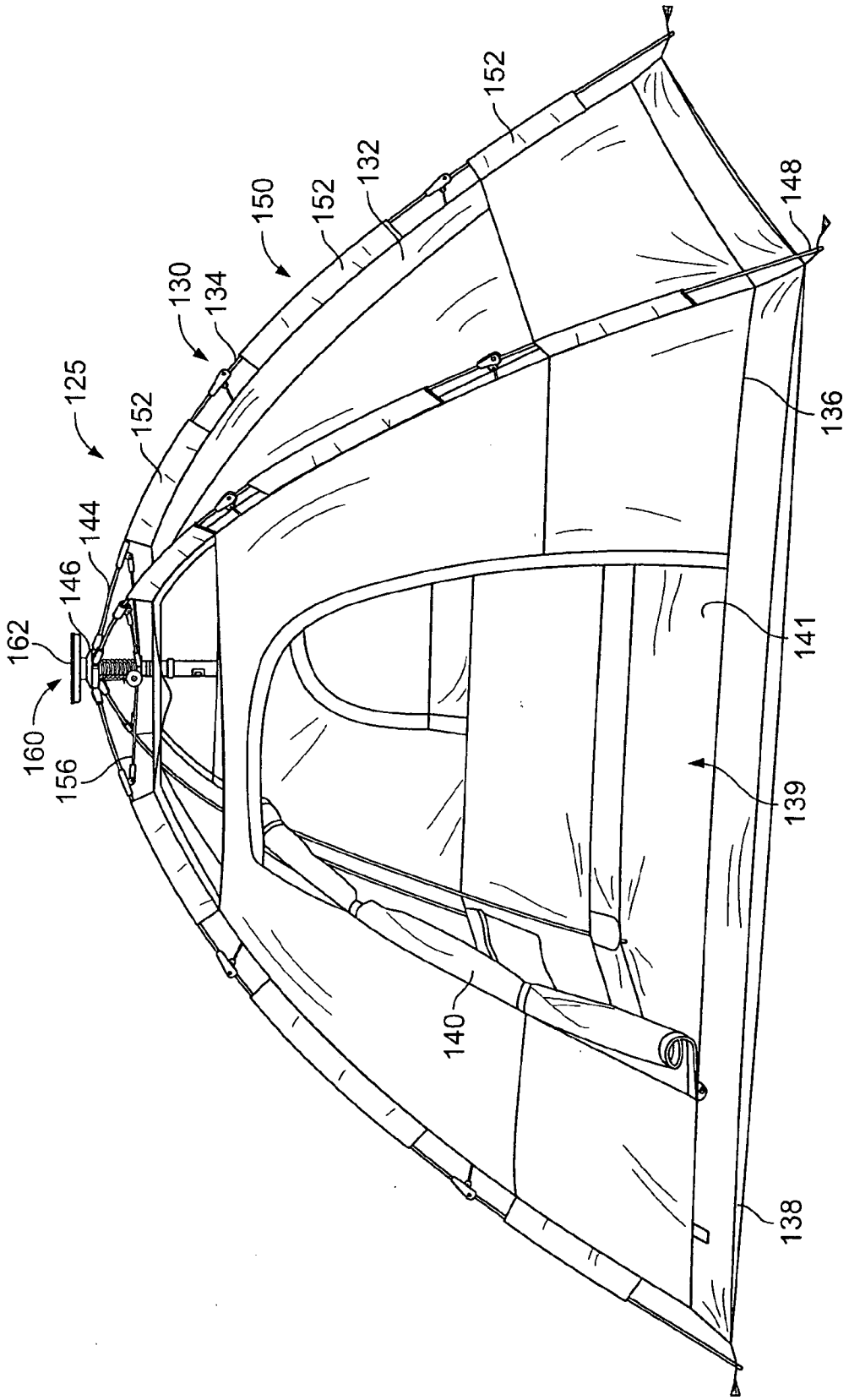
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FIG. 5

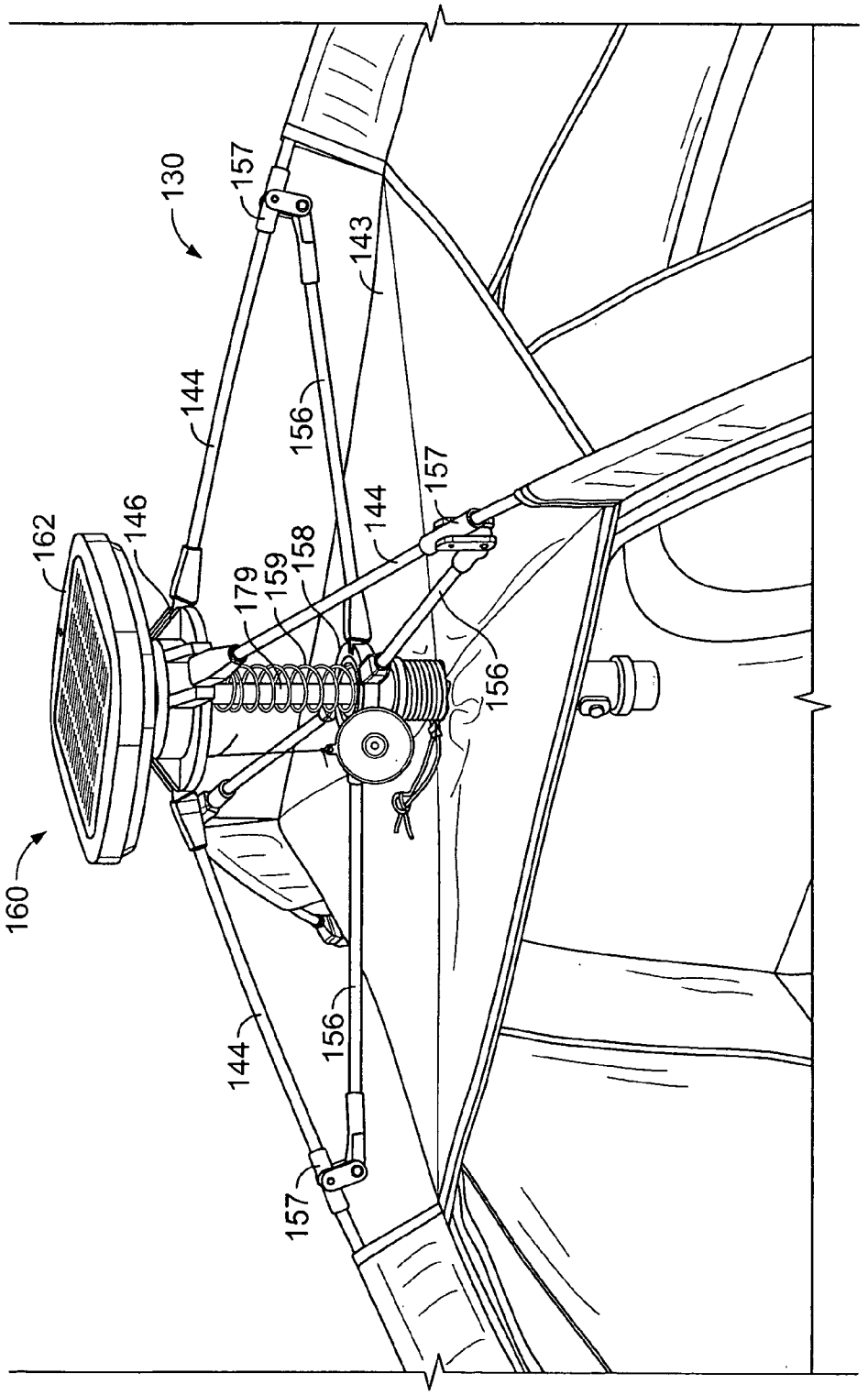
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FIG. 6

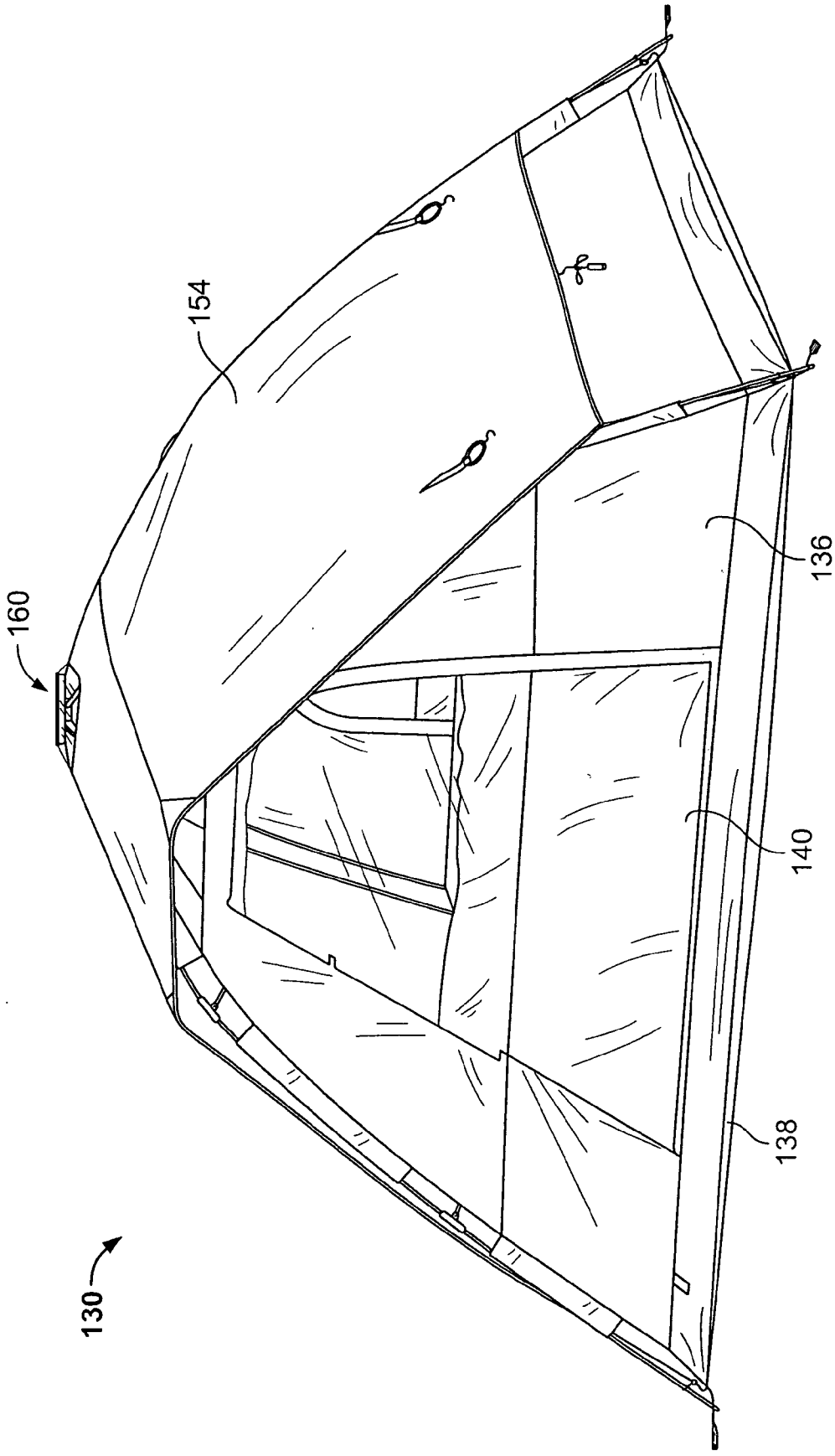

FIG. 7

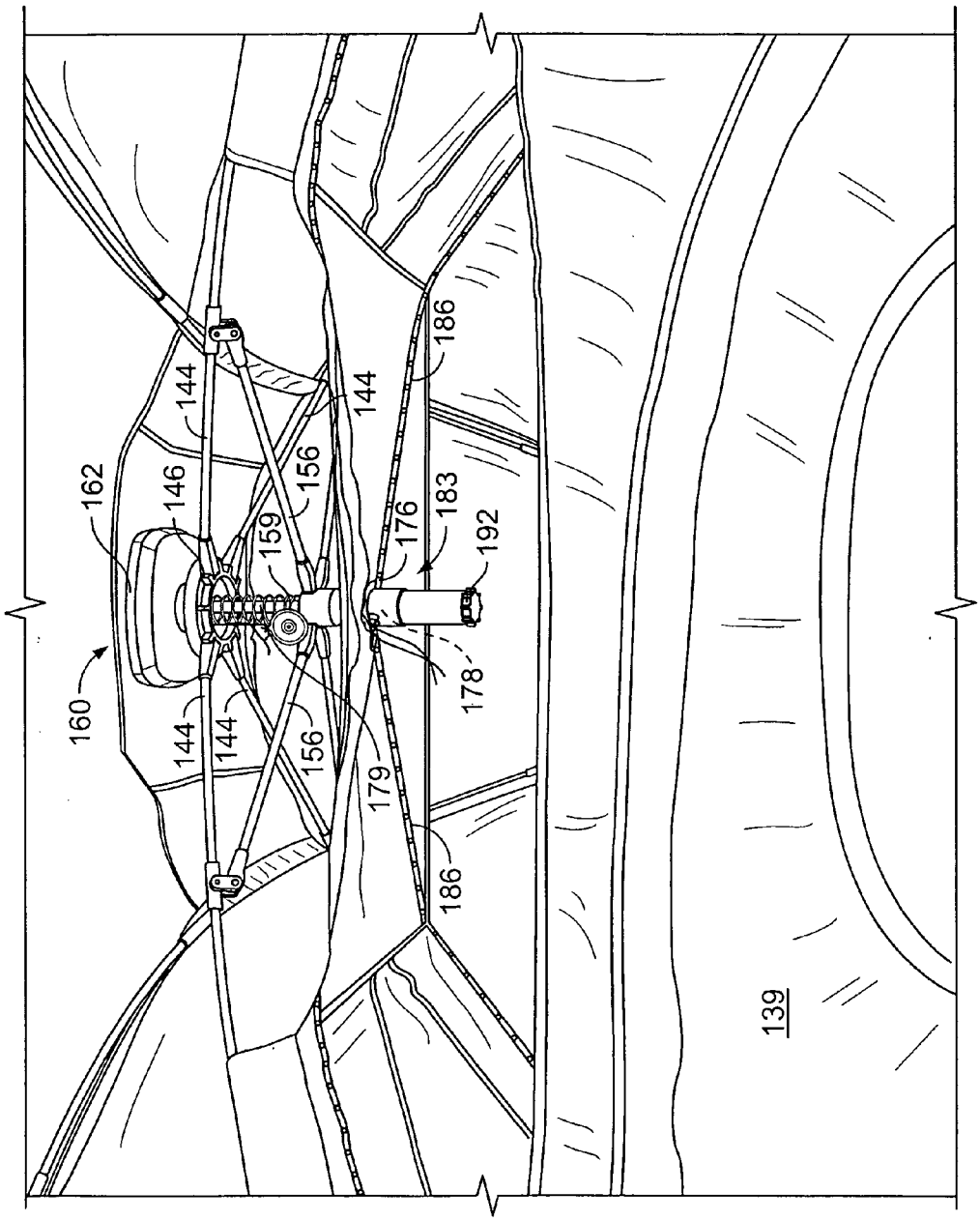
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FIG. 8

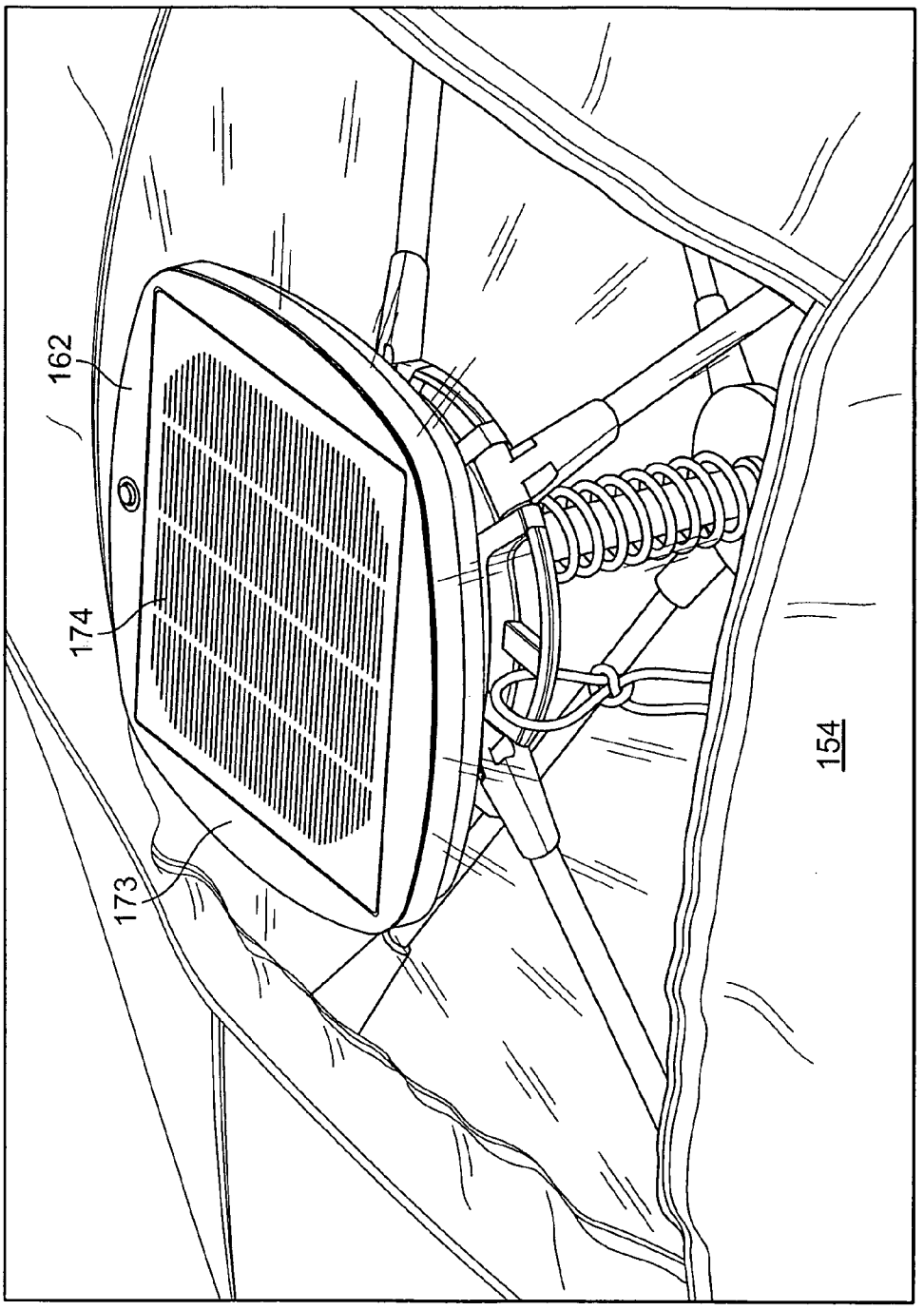

FIG. 9

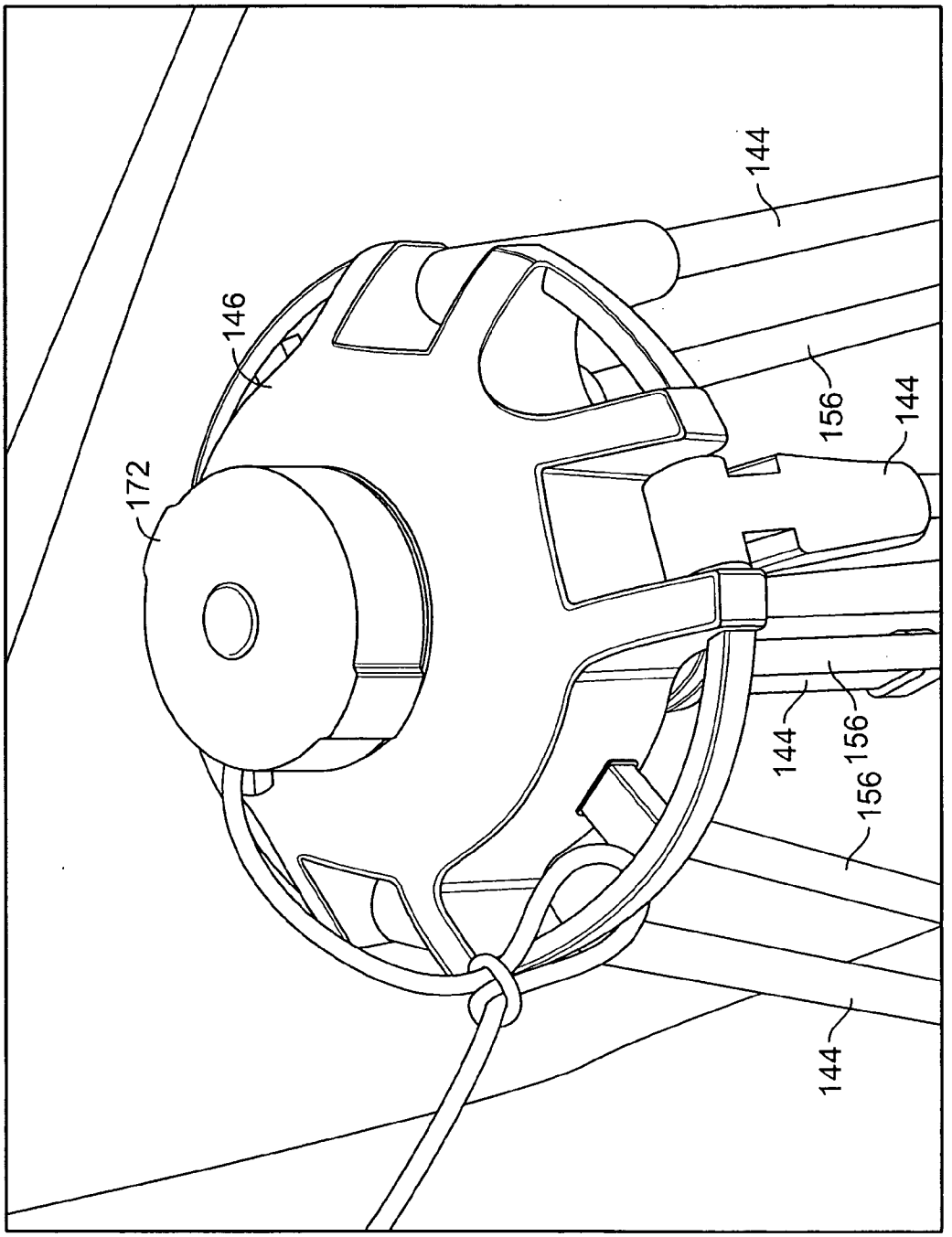

FIG. 10

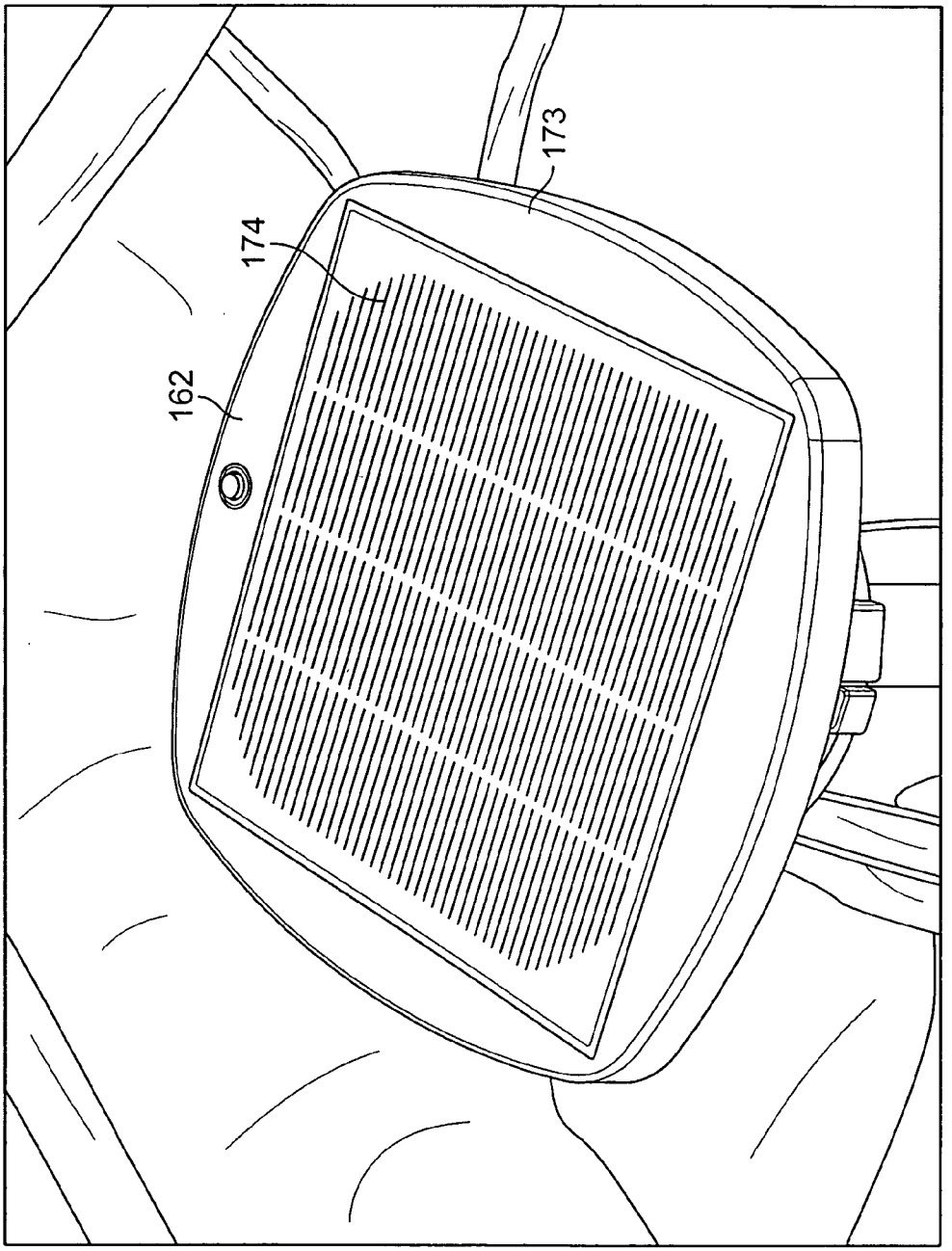

FIG. 11

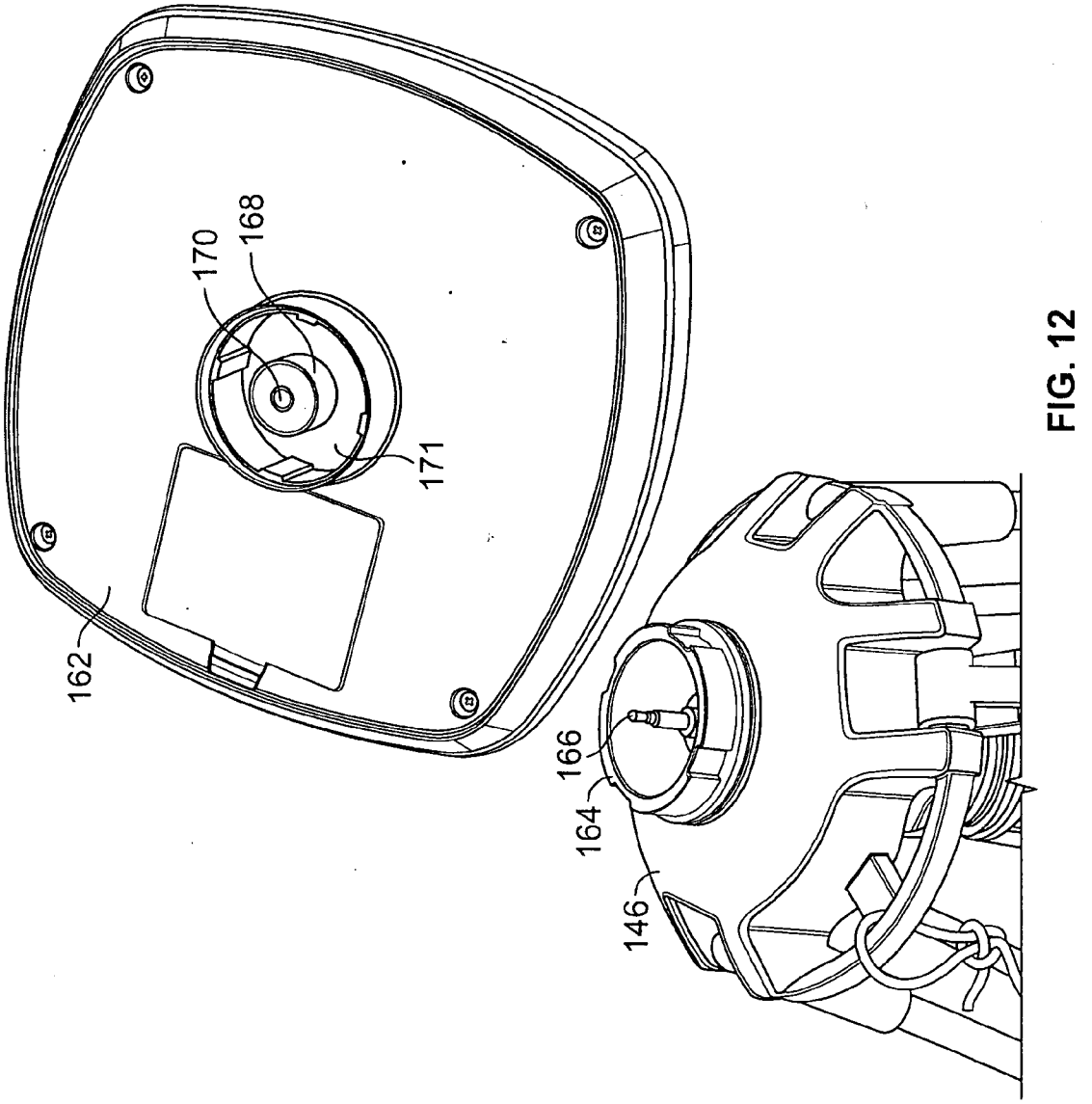

FIG. 12

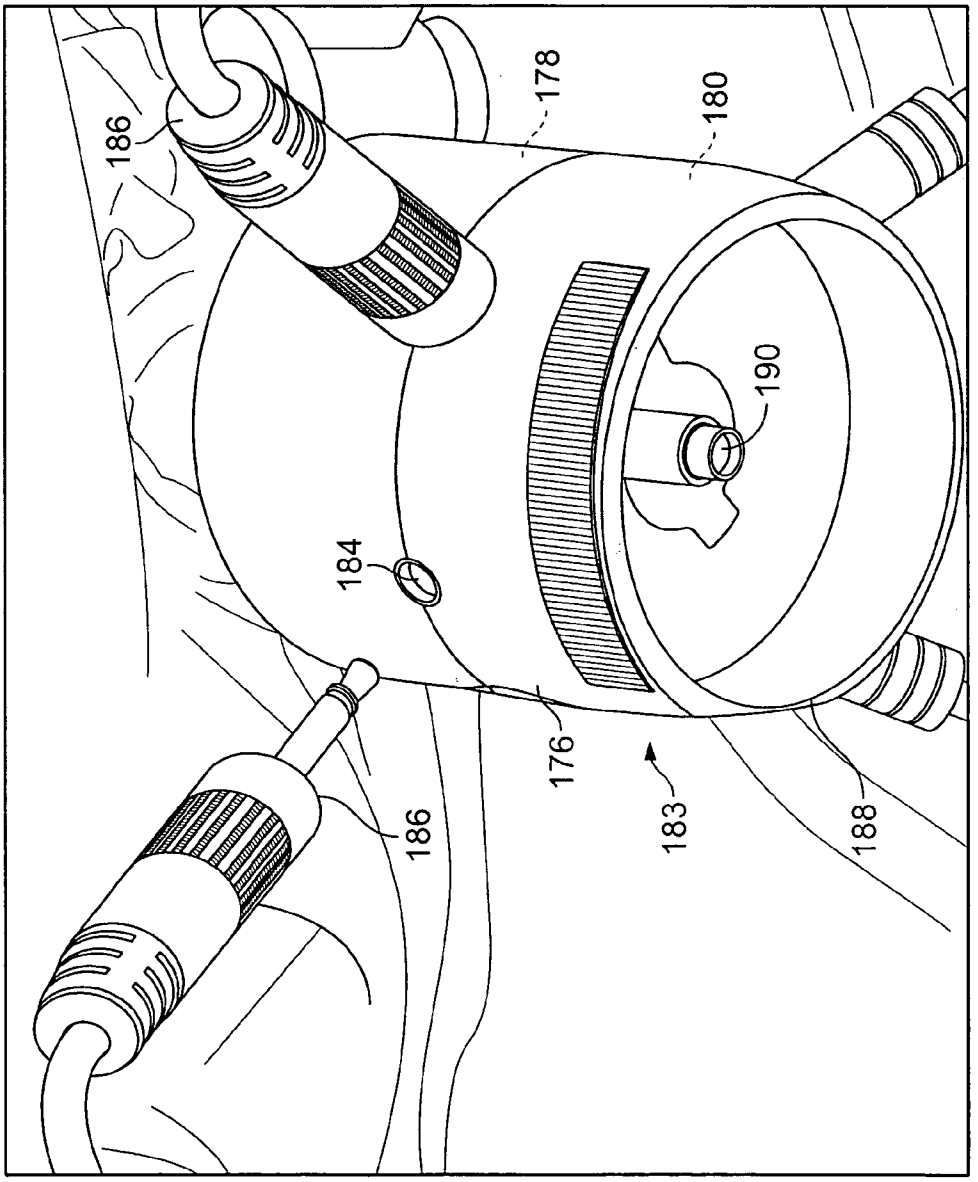

FIG. 13A

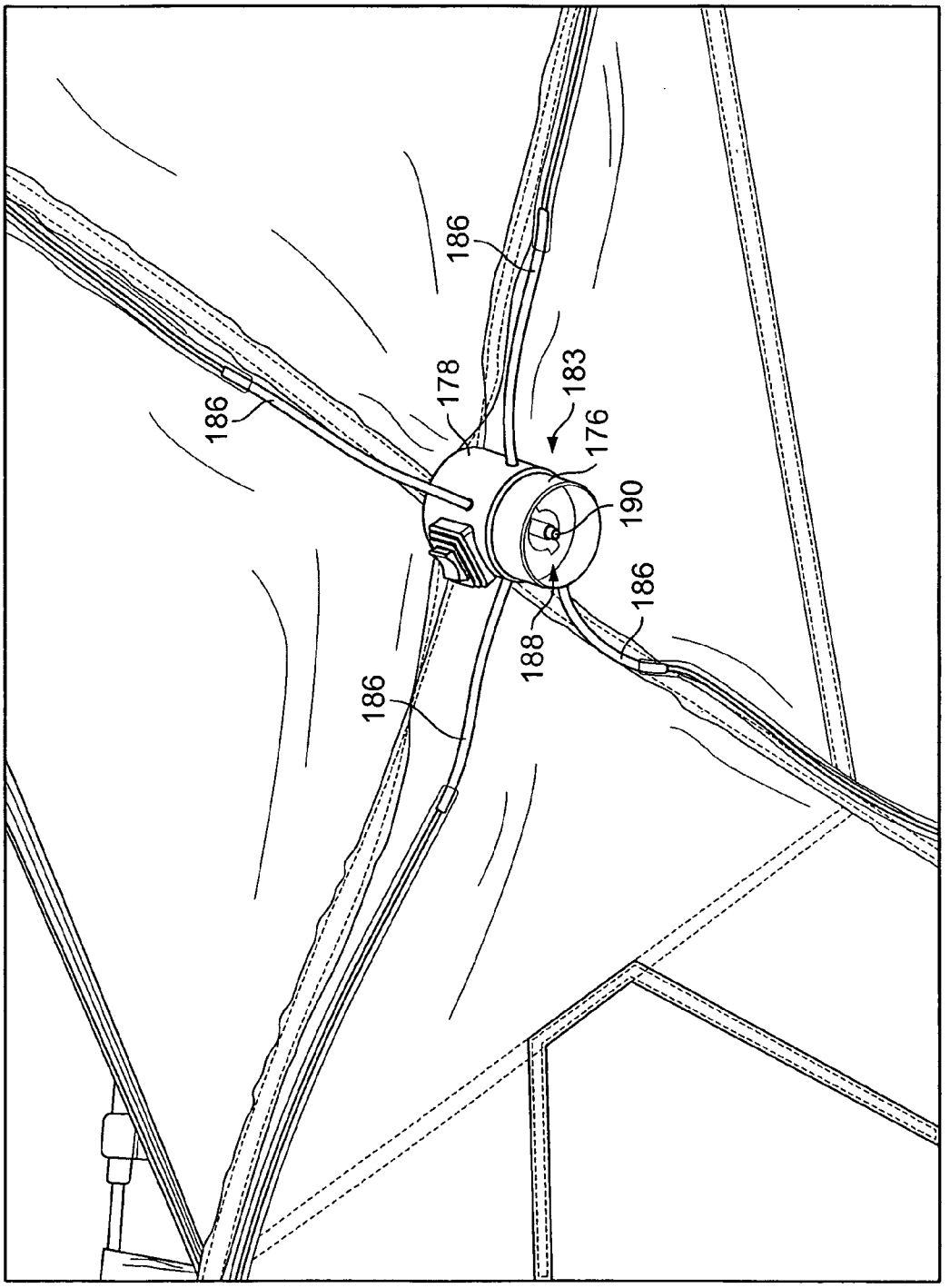

FIG. 13B

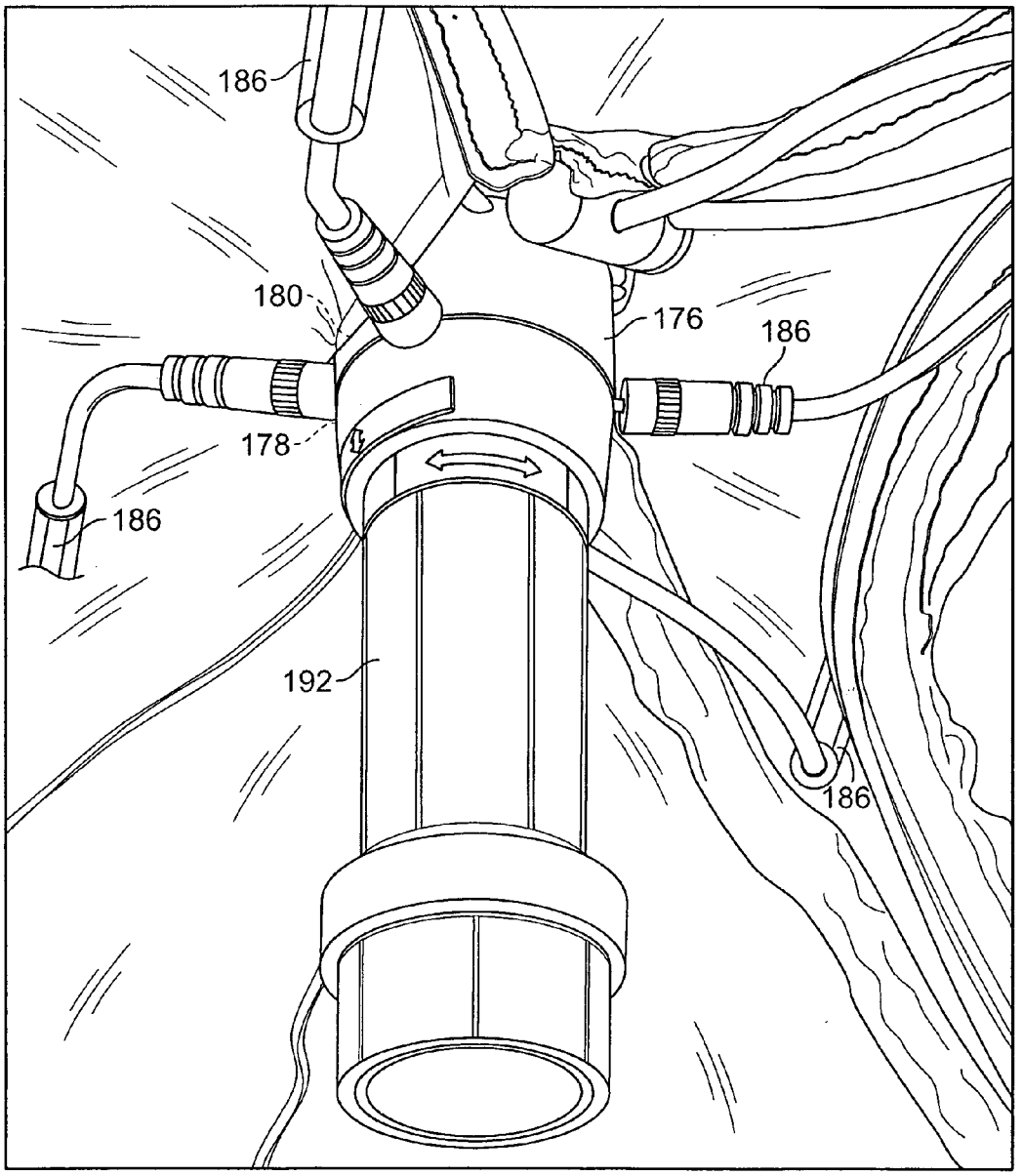

FIG. 14

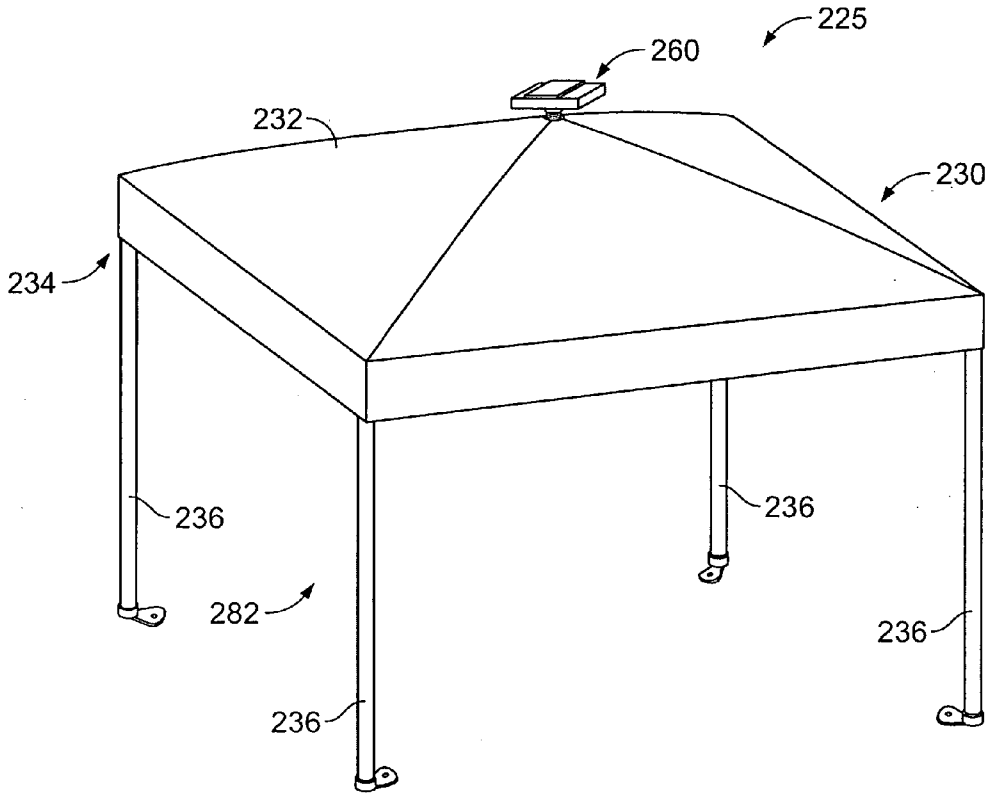

FIG. 15

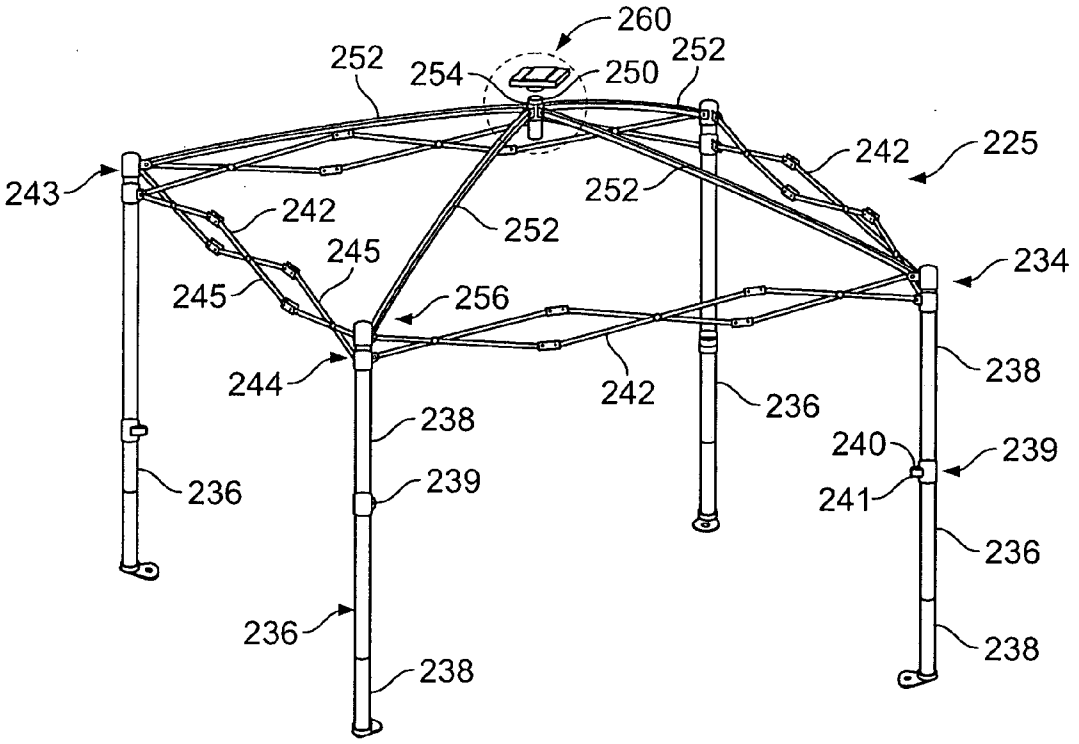
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FIG. 16

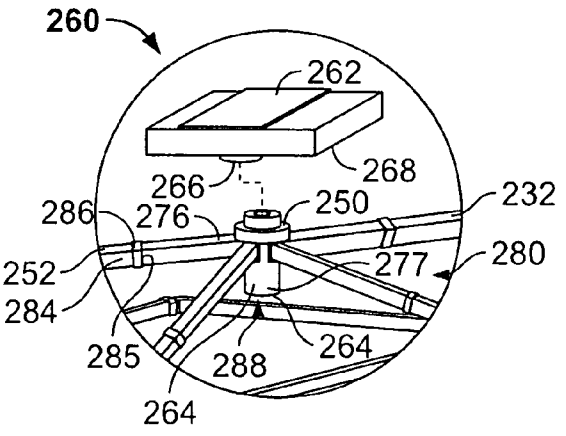
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FIG. 17

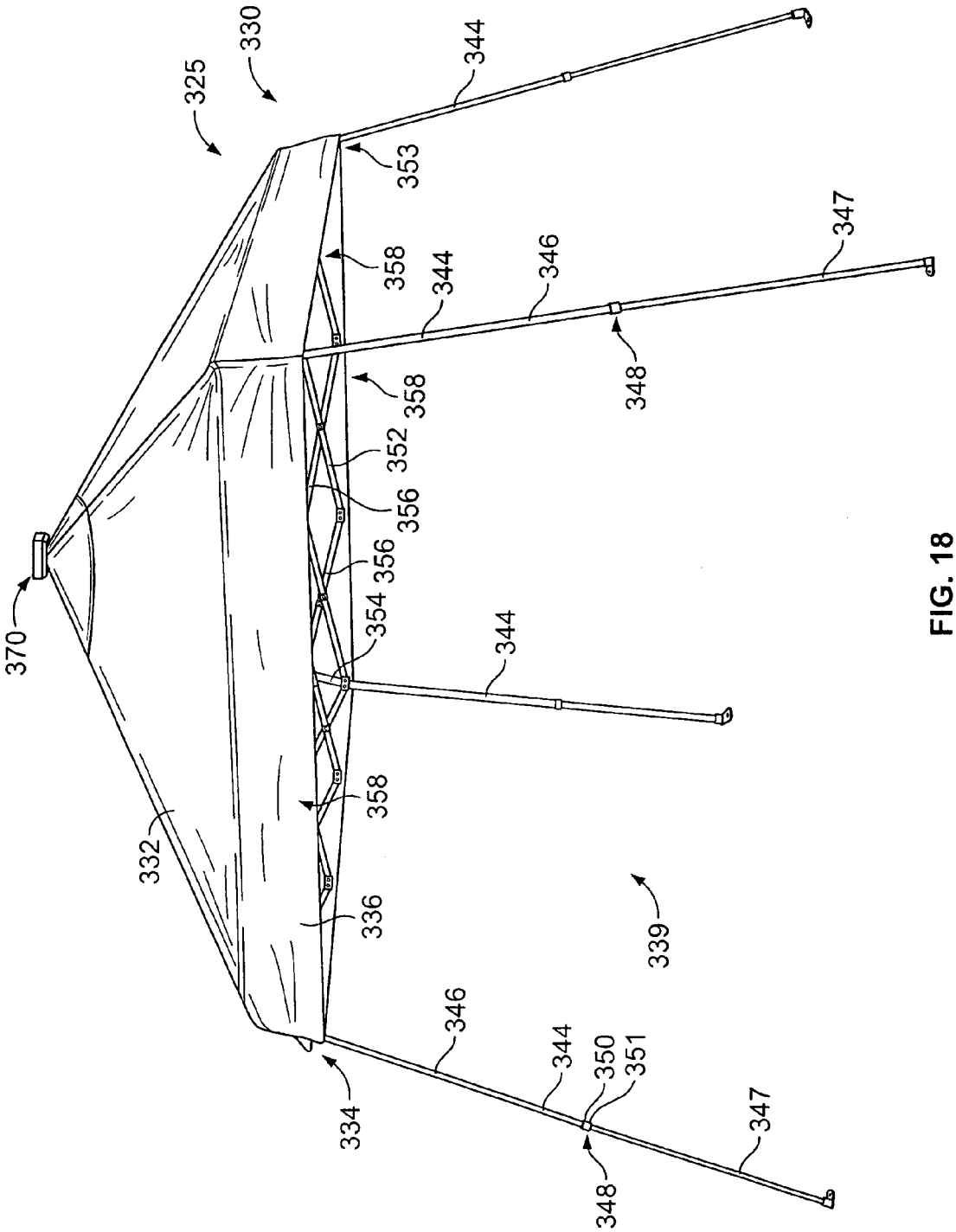
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FIG. 18

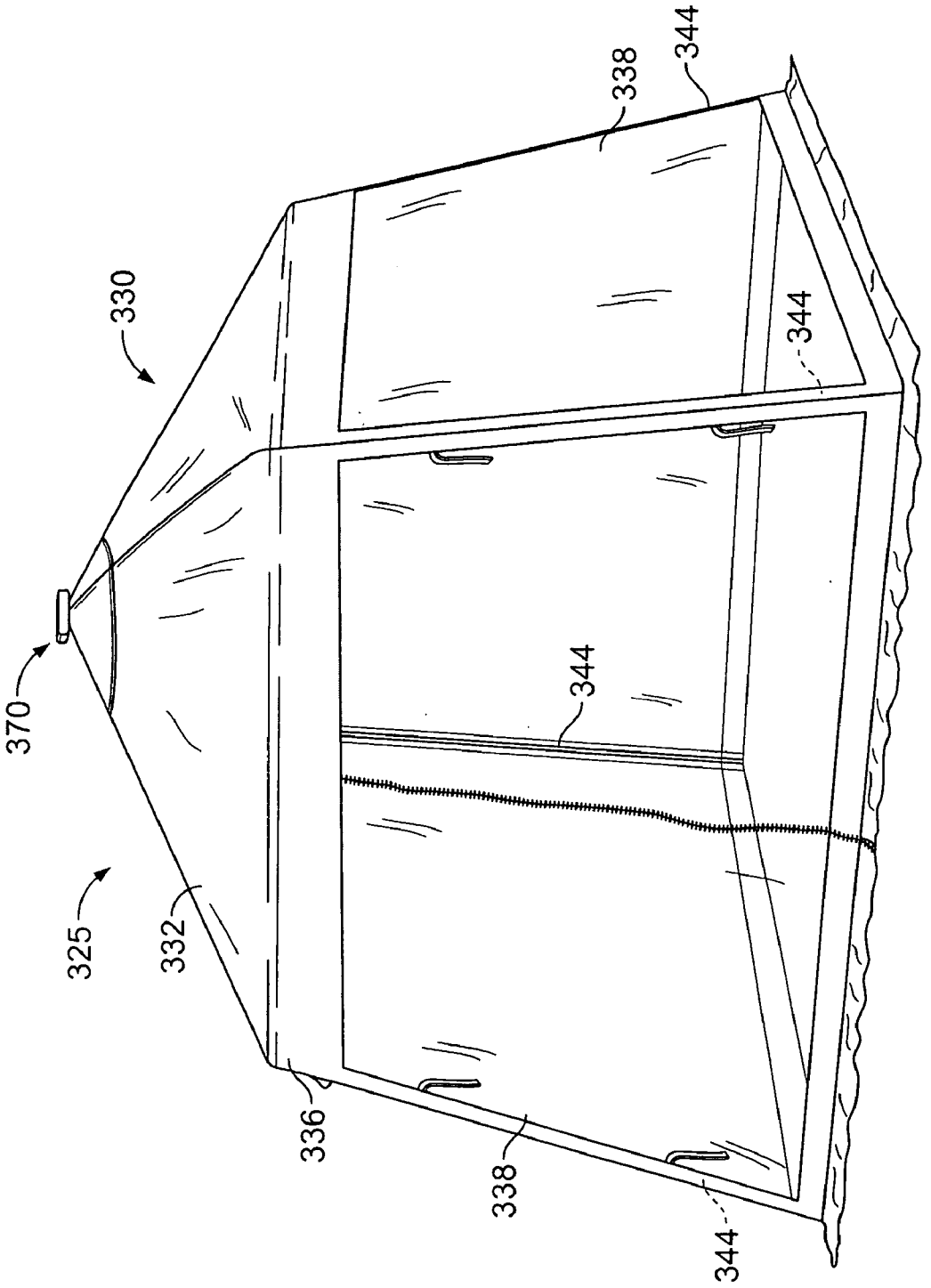

FIG. 19

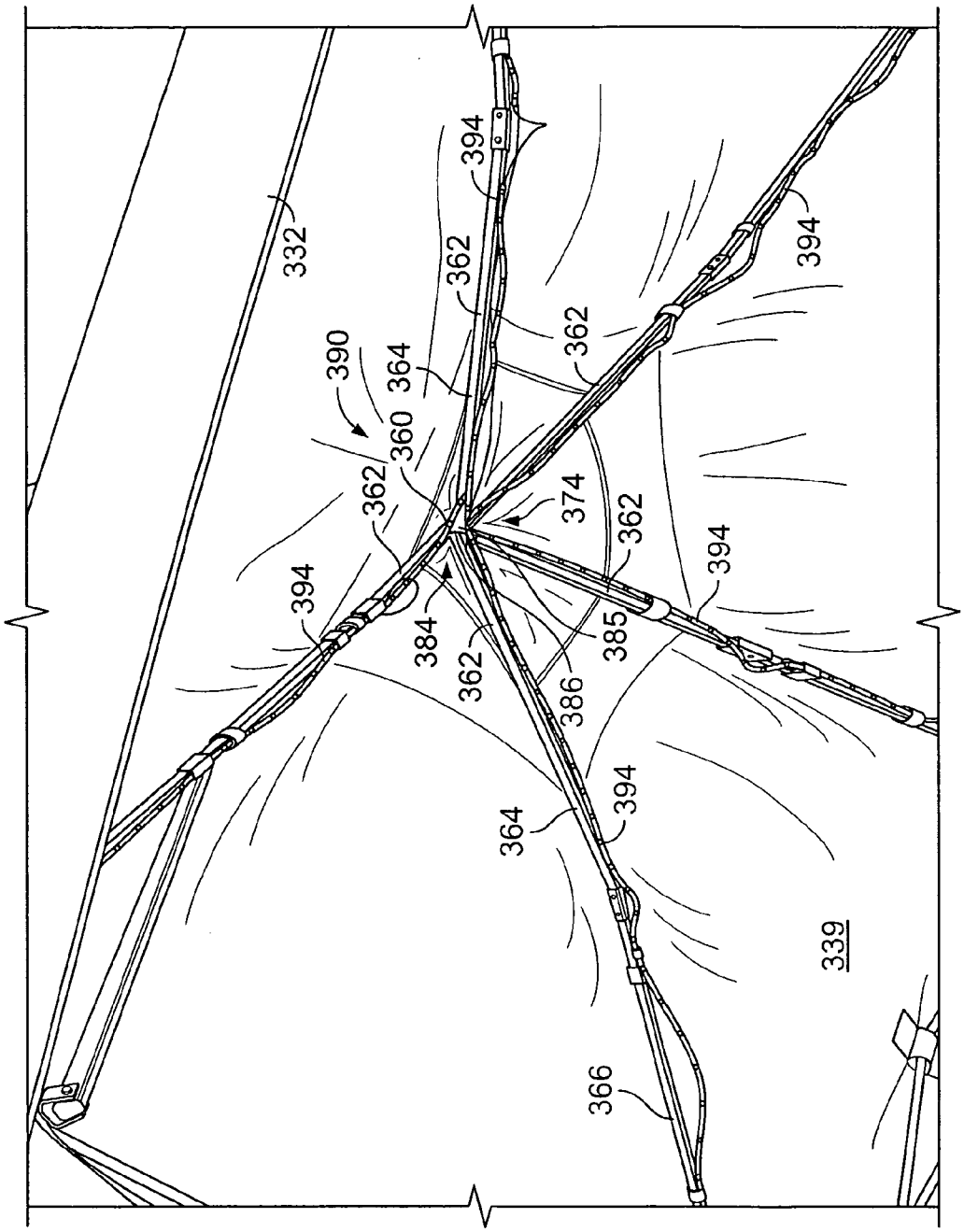
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FIG. 20

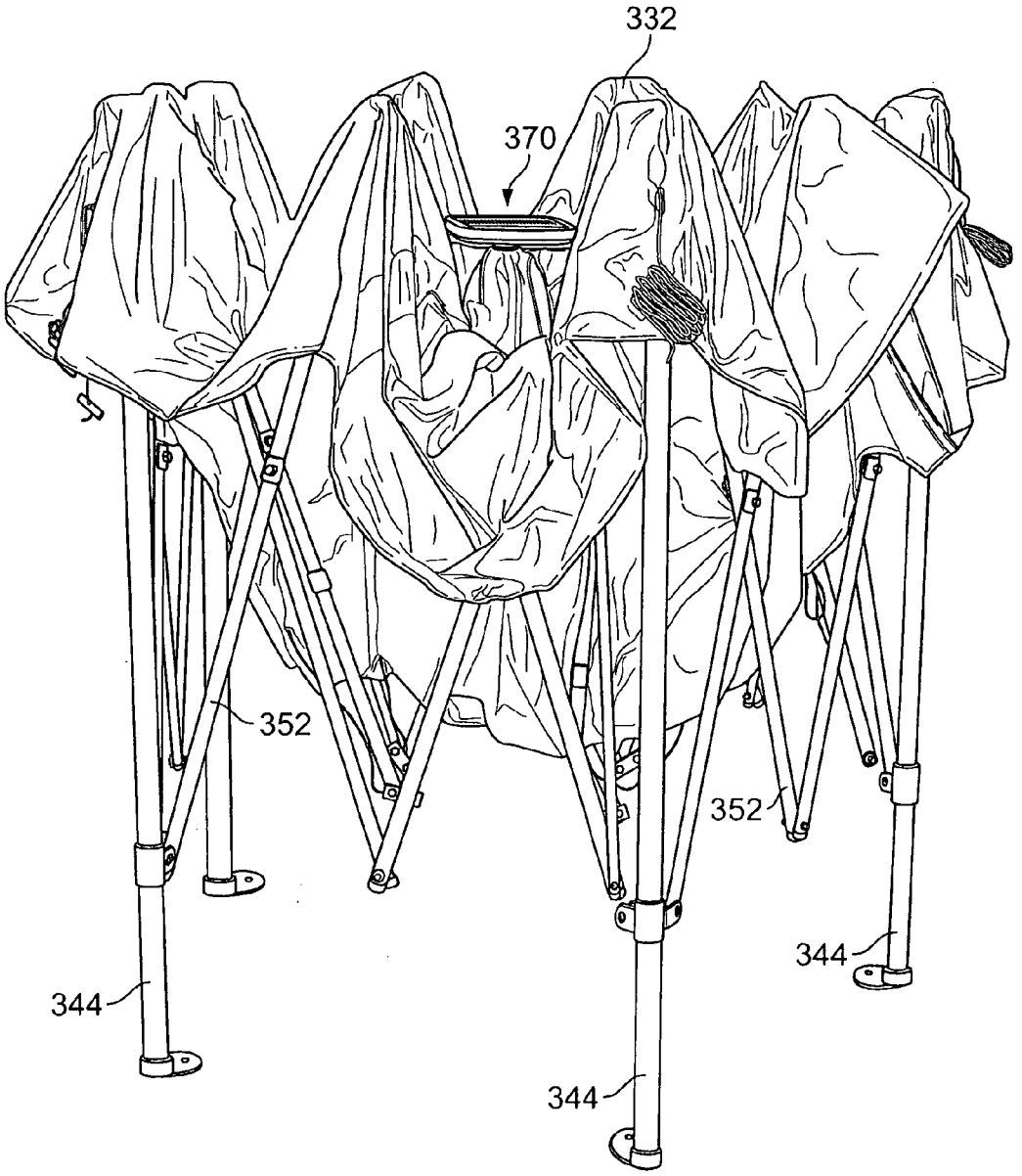

FIG. 21

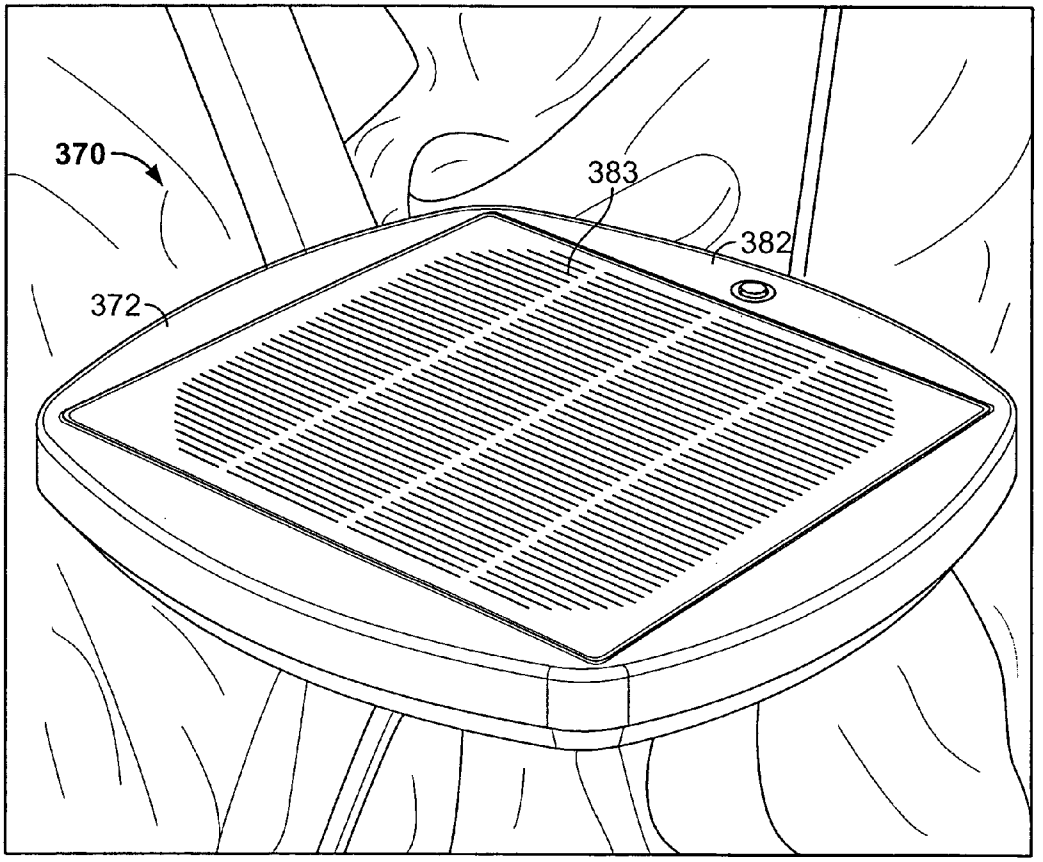

FIG. 22

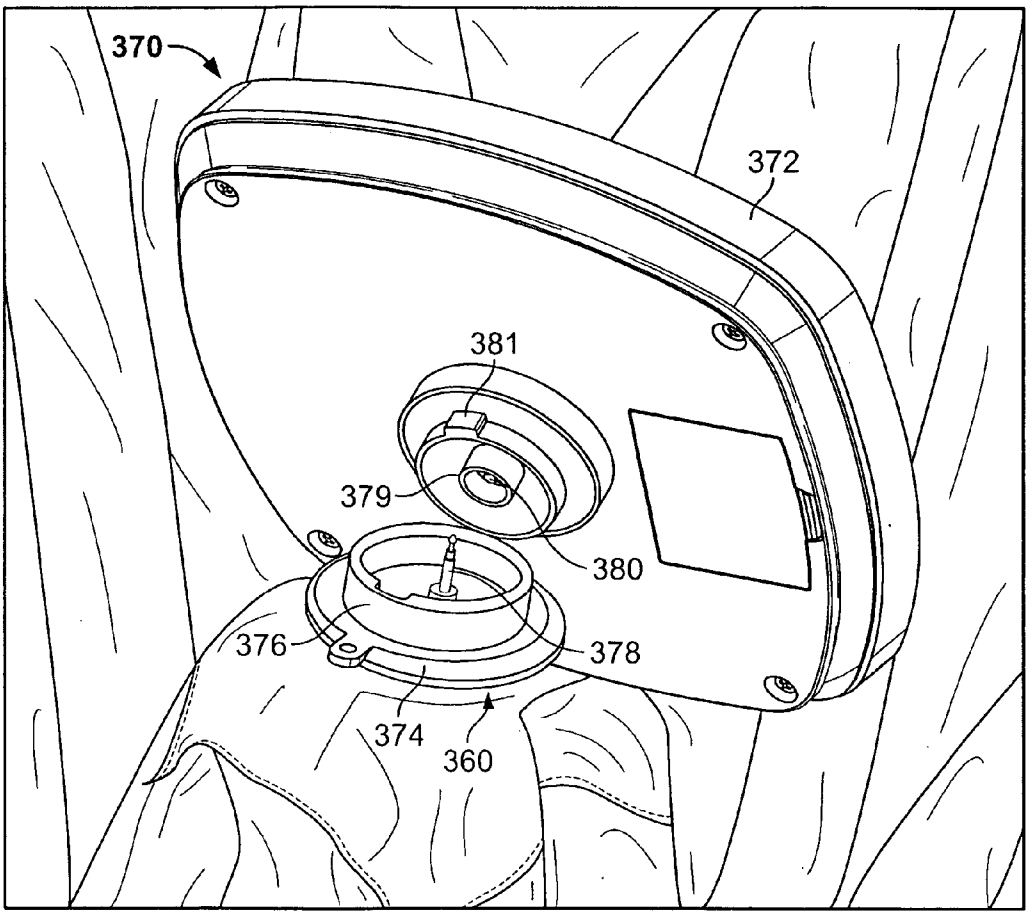

FIG. 23

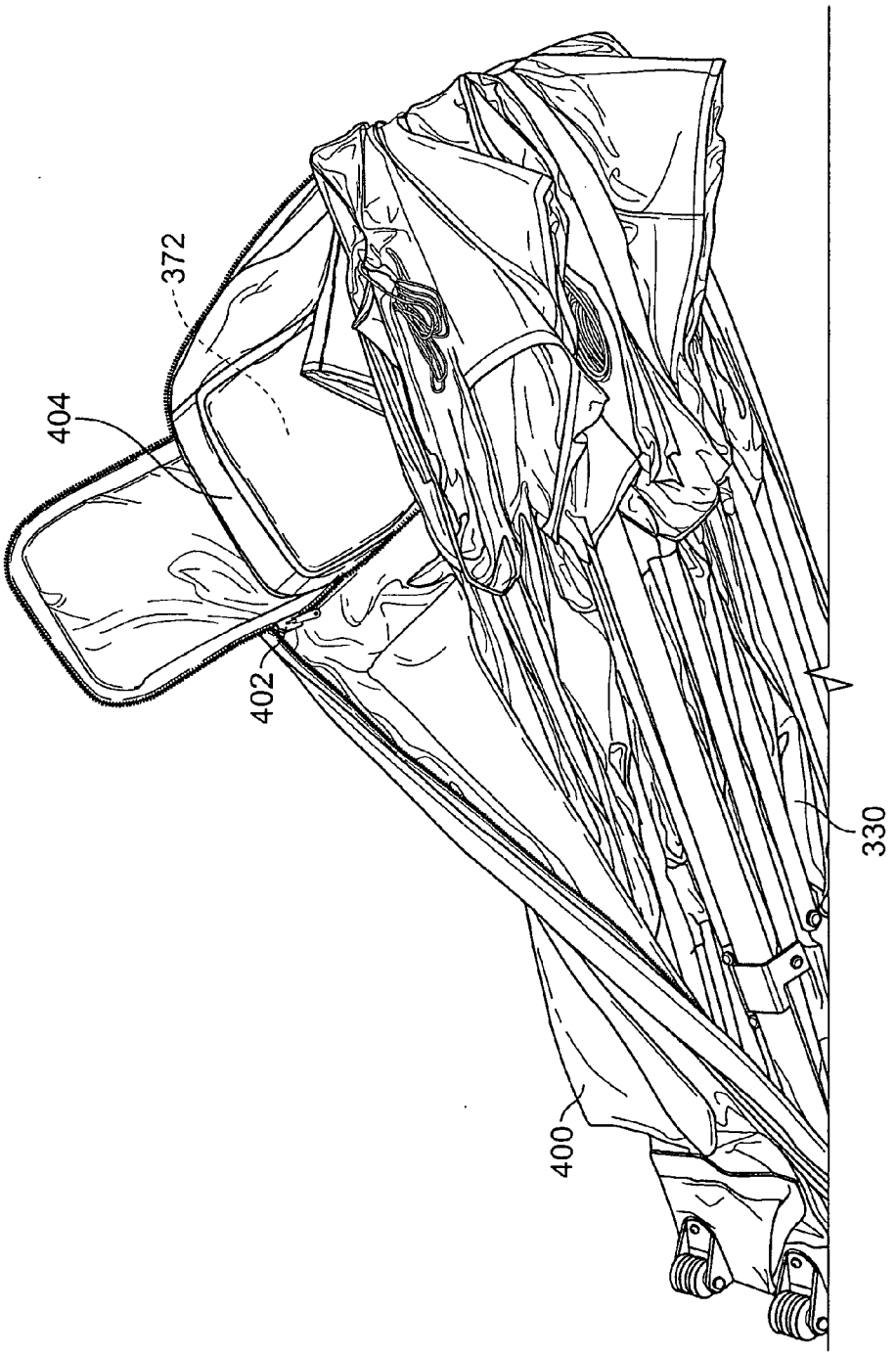

FIG. 24

APPARATUS AND METHOD FOR LIGHTING A COLLAPSIBLE STRUCTURE

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of Chinese Patent Application 200520126787.2 entitled "Solar Tent" filed on Dec. 29, 2005, which is hereby incorporated by reference in its entirety.

BACKGROUND OF THE INVENTION

[0002] This invention relates generally to collapsible structures, such as tents and gazebos, and, more particularly, to collapsible structures having an apparatus for converting solar energy to electrical energy and providing that energy to an interior space defined by the collapsible structure.

[0003] Camping and social activities are becoming increasingly popular. With people's current living, standards improving, so are the demands for simplified and user-friendly camping and/or social activity structures. For example, tents are becoming a favored necessity for camping activities. To provide more enjoyment for the camper, electric home appliances and/or lighting devices provide the modem conveniences that the camper is accustom to in his or her lifestyle. In many camping situations, batteries are the only available power source for these conveniences. However, many conventional batteries supply only a limited amount of electric power.

BRIEF DESCRIPTION OF THE INVENTION

[0004] In one aspect, a solar power generator for a structure including a collapsible frame assembly is provided. The solar power generator includes a solar panel removably coupled to the collapsible frame assembly. The solar panel is configured to absorb solar energy from the sun. A power module is electrically coupled to the solar panel. The power module includes a power source configured to convert the solar energy absorbed by the solar panel to electrical energy. At least one power output is electrically coupled to the power source and configured to supply electrical energy to a coupled load device.

[0005] In another aspect, a collapsible structure is provided. The collapsible structure includes a hub. A solar panel is removably coupled to the hub. The solar panel is configured to absorb solar energy from the sun. A power module is electrically coupled to the solar panel. The power module includes a power source configured to convert the solar energy absorbed by the solar panel to electrical energy. The power module defines a plurality of first power ports positioned about an outer housing of the power module and electrically coupled to the power source. A first light source is removably electrically coupled to a corresponding power port. Each first light source is configured to receive electrical energy from the power source.

[0006] In another aspect, a method for lighting an interior space defined by a collapsible structure is provided. The method includes providing a collapsible structure including a hub and a plurality of frame members each pivotally coupled to the hub. The frame members at least partially form a collapsible frame assembly of the collapsible structure. A solar power generator is removably coupled to the collapsible structure. The solar power generator includes a solar panel that is removably coupled to the hub and configured to absorb solar energy from the sun. A power module is electrically coupled to the solar panel. The power module includes a power source that is configured to convert the solar energy absorbed by the solar panel to electrical energy. At least a portion of the electrical energy is supplied to at least one lighting source electrically coupled to the power source. The at least one lighting source is configured to receive the electrical energy and emit light.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIG. **1** is a schematic sectional view of an exemplary collapsible structure;

[0008] FIG. **2** is a schematic sectional view of the collapsible structure shown in FIG. **1** with a portion of the tent structure removed to show an interior space defined by the collapsible structure;

[0009] FIG. **3** is a schematic view of the collapsible structure shown in FIG. **1** in a collapsed configuration;

[0010] FIG. **4** is a schematic view of a portion of the collapsible structure shown in FIG. **1**;

[0011] FIG. **5** is a perspective view of an exemplary collapsible structure;

[0012] FIG. **6** is a perspective view of a portion of the collapsible structure shown in FIG. **5**;

[0013] FIG. **7** is a perspective view of the collapsible structure shown in FIG. **5** with a rain fly;

[0014] FIG. **8** is a perspective view of an interior space defined by the collapsible structure shown in FIG. **7**;

[0015] FIG. **9** is a perspective view of a portion of the collapsible structure shown in FIG. **7**;

[0016] FIG. **10** is a perspective view of a portion of the collapsible structure shown in FIG. **5** in a collapsed configuration;

[0017] FIG. **11** is a perspective view of an exemplary solar panel coupled to a ridge hub;

[0018] FIG. **12** is a perspective view of an exemplary ridge hub and an exemplary solar panel removably attachable to the ridge hub;

[0019] FIG. **13**A is a perspective view of an exemplary power module;

[0020] FIG. **13**B is a perspective view of an alternative exemplary power module;

[0021] FIG. **14** is a perspective view of an exemplary lighting device removably coupled to the power module shown in FIG. **13**A;

[0022] FIG. **15** is a perspective view of an exemplary collapsible structure;

[0023] FIG. **16** is an exploded view of the collapsible structure shown in FIG. **15** with the roof structure removed;

[0024] FIG. **17** is a perspective view of a portion of the collapsible structure shown in FIG. **16**;

[0025] FIG. **18** is a perspective view of an exemplary collapsible structure;

[0026] FIG. **19** is a perspective view of an exemplary collapsible structure;

[0027] FIG. **20** is a perspective view of an interior space defined at least partially by roof surface of the collapsible structure shown in FIG. **18**;

[0028] FIG. **21** is a perspective view of the collapsible structure shown in FIG. **18** in a collapsed configuration;

[0029] FIG. **22** is a perspective view of an exemplary solar panel coupled to the collapsible structure shown in FIG. **21**;

[0030] FIG. **23** is a perspective view of the solar panel shown in FIG. **22** decoupled from the collapsible structure; and

[0031] FIG. **24** is a front view of a collapsible structure in a collapsed configuration for storage within a storage bag.

DETAILED DESCRIPTION OF THE INVENTION

[0032] The present invention provides a collapsible structure, such as a tent, a canopy or a gazebo, including an apparatus for facilitating converting solar energy to electrical energy for supplying electric power to a load device, such as an appliance and/or a lighting device for lighting an interior space defined by the collapsible structure and/or an exterior area about the collapsible structure. In one embodiment, the apparatus utilizes photovoltaic principles to generate electrical energy from solar power obtained from the sun.

[0033] The present invention is described below in reference to its application in connection with and operation of an apparatus and method for facilitating lighting an interior space defined by a collapsible structure, such as a tent, a canopy or a gazebo. However, it will be apparent to those skilled in the art and guided by the teachings herein provided that the invention is likewise applicable to any suitable collapsible and/or permanent structure for facilitating providing electric power to any suitable load device including, without limitation, a household appliance and/or a lighting device.

[0034] FIGS. **1-4** show an exemplary collapsible structure **25**. In this embodiment, collapsible structure **25** is a tent **30** that includes a main tent structure **32** formed of a suitable fabric material. Tent structure **32** is coupled to a collapsible frame assembly **34** to form a plurality of walls **36**. A floor **38** is coupled to each wall **36** to form the collapsible structure and define an interior space **39** therein. Interior space **39** is large enough to comfortably accommodate one or more people. It is apparent to those skilled in the art and guided by the teachings herein provided that tent **30** may include any suitable number of walls having any suitable size and/or shape.

[0035] Collapsible frame assembly **34** includes a roof assembly **40** that includes a plurality of collapsible ribs or frame members **42** pivotally coupled to a rib holder or ridge hub **44**. In one embodiment, collapsible frame assembly **34** includes four groups of collapsible frame members **42** pivotally coupled to ridge hub **44** to form roof assembly **40**. Roof assembly **40** also includes a plurality of spreaders **45** coupled to a second hub **46**. As shown in FIG. **4**, second hub **46** is generally aligned coaxially with ridge hub **44**. In one embodiment, roof assembly **40** includes four groups of spreaders **45** coupled to second hub **46**. In a particular embodiment, each spreader **45** is slidably coupled about a corresponding frame member **42**. In this embodiment, spreader **45** slides along a length of collapsible frame member **42** for facilitating moving collapsible frame assembly **34** between an erected configuration and a collapsed configuration, as shown in FIG. **3**.

[0036] Referring further to FIG. **3**, an elastic spring **47** is in a state of energy storage with tent **30** in the collapsed configuration such that collapsible frame assembly **34** is extended through an outer force applied from second hub **46** to spreaders **45** under a restoring force of spring **47** for facilitating collapsing tent **30**. In this embodiment, the user applies a sufficient force to second hub **46** to move second hub **46** in an upward direction, along with ridge hub **44**, and at the same time an extension force of collapsible frame assembly **34** will lapse to allow tent **30** to collapse.

[0037] As shown in the FIG. **4**, tent **30** includes a solar apparatus **50** that is removably coupled to ridge hub **44**. In one embodiment, solar apparatus **50** includes a solar panel **52**, a storage battery (not shown), a circuit board (not shown) and a power output end **54**. Further, solar apparatus **50** includes an electric power source including a storage device for facilitating providing electric power to a coupled load device. In one embodiment, a plug is electrically coupled to the power source to removably couple the load device to the power source. In a particular embodiment, a photoconductor device is coupled to the circuit board.

[0038] In one embodiment, solar apparatus **50** forms an arcuate or circular ring protrusion **56** on a bottom surface **58** of solar apparatus **50**. In this embodiment, protrusion **56** is configured to be threadedly coupled to ridge hub **44**. It is apparent to those skilled in the art and guided by the teachings herein provided that protrusion **56** and/or ridge hub **44** may form or define any suitable mechanism for removably coupling solar apparatus **50** to ridge hub **44**. Solar apparatus **50** includes a conductive wire **60** extending from bottom surface **58** and within arcuate ring protrusion **56** to electrically couple the storage battery of solar apparatus **50** to a socket **62**. In a particular embodiment, conductive wire **60** extends through tent structure **32** and/or ridge hub **44**. Socket **62** includes a plurality of power ports (not shown) that are electrically coupled to conductive wire **60** and extend radially about an outer surface of socket **62**. Additionally or alternatively, socket **62** includes a power port (not shown) that is electrically coupled to conductive wire **60** and extends generally coaxially with ridge hub **44** and second hub **46** from a bottom surface of socket **62**. In one embodiment, a cap (not shown) is threadedly coupled to ridge hub **44** to prevent damage to an interior region of ridge hub **44** with solar apparatus **50** removed from ridge hub **44**.

[0039] Referring further to FIGS. **2** and **4**, a lighting device **70** is electrically coupled to solar apparatus **50** and configured to receive electrical energy produced by solar apparatus **50** for facilitating providing light to interior space **39** defined within tent **30**. In one embodiment, lighting device **70** includes a plurality of pipe lights **72** having a LED indicator that is positioned within a corresponding transparent tube or pipe **74**. In this embodiment, each transparent tube **74** is coupled to main tent structure **32** and/or a corresponding frame member **42**. Each pipe light **72** includes a power output end that is electrically coupled to a

corresponding power port formed within socket **62**. In an alternative embodiment, a fluorescent light **76** is electrically coupled within the power port formed in the bottom surface of socket **62**. It is apparent to those skilled in the art and guided by the teachings herein provided that any suitable number of lights and/or type of electrical lighting devices can be used with solar apparatus **50** of the present invention for facilitating illuminating interior space **39** defined by tent **30**.

[**0040**] FIGS. **5-14** show an exemplary collapsible structure **125**. As shown in FIGS. **5-7**, collapsible structure **125** is a tent **130** that includes a main tent structure **132** formed of a suitable fabric material. Tent structure **132** is coupled to a collapsible frame assembly **134** to form a plurality of walls **136**. A floor **138** is coupled to each wall **136** to form the collapsible structure and define an interior space **139** therein. Interior space **139** is large enough to comfortably accommodate one or more people. It is apparent to those skilled in the art and guided by the teachings herein provided that tent **130** may include any suitable number of walls **136** having any suitable size and/or shape. As shown in FIG. **5**, a first wall **136** forms a door **140** that is configured to provide access to interior space **139** through an opening **141** defined within wall **136**. In one embodiment, at least one window **142** is formed in at least one wall **136**. In a particular embodiment, tent **130** includes a ceiling panel **143**, as shown in FIG. **6**, coupled to each wall **136** to define a ceiling of tent **130**.

[**0041**] Referring further to FIG. **5**, collapsible frame assembly **134** includes a plurality of frame members **144** pivotally coupled to a ridge hub **146**. In one embodiment, frame members **144** are fabricated of a flexible material, such as a metal, alloy, composite and/or fiberglass material, sufficiently strong to provide adequate support to tent **130**. Each frame member **144** extends from ridge hub **146** downwardly to couple with a retaining pin **148** or other suitable coupling member positioned at a corresponding corner area of floor **138**. In one embodiment, frame member **144** is slidably positioned within a pocket **150** formed at a transition line or area defined between adjoining walls **136**. In a particular embodiment, as shown in FIG. **1**, pocket **150** is segmented and formed of a plurality of pocket segments **152**. In an alternative embodiment, pocket **150** is continuous.

[**0042**] As shown in FIG. **7**, in one embodiment tent **130** includes a rain fly **154** that is coupled with respect to main tent structure **132** to provide further protection from harsh environmental elements, including rain and/or snow for example. In one embodiment, rain fly **154** is coupled to collapsible frame assembly **134** using a suitable coupler, such as a guywire, a strap and/or a clip.

[**0043**] In one embodiment, collapsible frame assembly **134** includes spreaders **156** that interconnect frame members **144**. In this embodiment, each spreader **156** is slidably coupled at a first end about a corresponding frame member **144**. Spreader **156** is coupled to corresponding frame member **144** with a suitable collar **157** such that spreader **156** is slidably movable along a length of frame member **144**. As shown in FIG. **7**, spreader **156** is coupled at an opposing second end to a central second hub **158**. In one embodiment, a spring **159** is positioned between ridge hub **146** and second hub **158** for facilitating moving tent **130** between an erected configuration and a collapsed configuration.

[**0044**] Referring further to FIGS. **7-14**, tent **130** includes a solar power generator **160**. Solar power generator **160** includes a solar panel **162** that is removably coupled to ridge hub **146**. In one embodiment, solar panel **162** is sealingly coupled to rain fly **154**, as shown in FIGS. **8** and **9**. Referring to FIGS. **10-12**, in one embodiment ridge hub **146** forms a socket **164** including a conducting pin **166**. In alternative embodiments, ridge hub **146** includes any suitable electrically conducting member, such as a plug, known to those skilled in the art and guided by the teachings herein provided. Solar panel **162** forms a protrusion **168** defining a port **170** that is mateable with conducting pin **166** with solar panel **162** coupled to ridge hub **146**. In a particular embodiment, protrusion **168** forms a ring or arcuate wall **171** about port **170** that cooperates with an outer surface of ridge hub **146** for facilitating coupling solar panel **162** to ridge hub **146**. In this embodiment, solar panel **162** is rotatable with respect to ridge hub **146** with protrusion **168** cooperating with socket **164** to move solar panel **162** between a locked position and an unlocked position with respect to ridge hub **146**. In one embodiment, a cap **172** is threadedly coupled to ridge hub **146** to prevent damage to an interior region of ridge hub **146** with solar panel **162** removed from ridge hub **146**.

[**0045**] Solar panel **162** is configured to receive solar energy from the sun. In one embodiment, as shown in FIG. **11**, solar panel **162** includes a frame **173** within which a plurality of photovoltaic cells or modules **174** are mounted and electrically coupled. Each module **174** includes a suitable semiconductor, such as silicon, to convert sunlight into electricity using a suitable process know to those skilled in the art and guided by the teachings herein provided. Referring to FIGS. **13A-14**, a power module **176** is in electrical communication with solar panel **162**. Power module **176** is configured to convert the solar energy absorbed by solar panel **162** to electrical energy for supplying the electrical energy to a load device, such as a lighting device and/or a small appliance.

[**0046**] In one embodiment, power module **176** includes a power source **178** configured for facilitating converting the solar energy absorbed by solar panel **162** to electrical energy. Power source **178** is electrically coupled to solar panel **162** using a suitable conductive wire **179** (as shown in FIG. **6**). In one embodiment, power source **178** includes a battery **180**, such as a deep-cycle battery or other suitable battery known to those skilled in the art and guided by the teachings herein provided. Battery **180** is configured to store at least a portion of the generated electrical energy. In one embodiment, battery **180** is electrically coupled through conductive wire **179** to conducting pin **166**, which is mateable with a solar power output, such as port **170** defined by solar panel **162**.

[**0047**] In one embodiment, at least one power output **183** is configured to supply electrical energy to a coupled load device. In a particular embodiment, as shown in FIG. **13A**, power output **183** includes at least one power port **184** defined by power module **176**. Each power port **184** is positioned on an outer surface of the housing for power module **176** such that a corresponding lighting device **186** is electrically coupled to power port **184**. Each power port **184** is electrically coupled to power source **178**. In one embodiment, lighting device **186** includes at least one pipe light having a LED indicator that is positioned within a corre-

sponding transparent tube or pipe. In this embodiment, each transparent tube is coupled to main tent structure **132** using at least one clamp and/or stitching. Each pipe light includes a power output end that is electrically coupled to a corresponding power port **184** formed within power output **183**. In an alternative embodiment, as shown in FIG. **13**B, each lighting device **186** is electrically coupled directly or permanently to power source **178**.

[**0048**] Further, as shown in FIGS. **13**A and **13**B, power module **176** forms a socket **188** that defines a power port **190** electrically coupled to power source **178**. A lighting device **192**, as shown in FIG. **14**, is removably positioned within socket **188**. Lighting device **192** includes a suitable conducting pin (not shown) positionable within power port **190** to electrically couple lighting device **192** to power source **178**. In one embodiment, lighting device **192** includes a rechargeable power source, such as one or more rechargeable batteries, configured. to store electrical energy supplied by power source **178**. With lighting device **192** positioned within power port **190**, lighting device **192** is electrically chargeable to store electrical energy for supplying electrical power to lighting device **192** with lighting device **192** decoupled from power source **178**. With lighting device **192** decoupled from power source **178**, lighting device **192** is portable for facilitating providing light in areas, as desired.

[**0049**] In one embodiment, power module **176** includes a switch (not shown) that is movable between an "on" position configured to supply electrical energy to at least one power port **184**, **190** and an "off" position configured to prevent energy from being supplied to at least one power port **184**, **190**. In a particular embodiment, lighting device **192** includes a switch (not shown) that is movable between an "on" position, configured to supply energy from the rechargeable batteries contained within lighting device **192** with lighting device **192** decoupled from power module **176**, and an "off" position, configured to prevent energy from being supplied to lighting device **192**. With lighting device **192** decoupled from power module **176**, lighting device **192** can be used as a portable light source.

[**0050**] FIGS. **15-17** show an exemplary collapsible structure **225**. In this embodiment, collapsible structure **225** is a gazebo **230** that includes a roof structure **232** formed of a suitable fabric material. Referring to FIGS. **15** and **16**, roof structure **232** is coupled to a collapsible frame assembly **234** that includes a plurality of posts **236**. In one embodiment, each post **236** includes two cooperating support members **238** slidably coupled together. In this embodiment, a locking device **239** includes a connector **240** that cooperates with a slider **241** to couple cooperating support members **238** together. Connector **240** is coupled to a lower end of a first or upper support member **238** and slider **241** is coupled to an upper end of a cooperating second or lower support member **238**. With locking device **239** in a locked position, slider **241** is prevented or limited from sliding with respect to connector **240**, and with locking device **239** in an unlocked position, slider **241** moves with respect to connector **240** such that the lower support member moves with respect to the upper support member in a telescoping manner to retract within the upper support member **238**.

[**0051**] As shown in FIG. **16**, collapsible frame assembly **234** includes a plurality of link member assemblies **242** configured to couple adjacent posts **236**. In one embodiment, each post **236** is coupled to an adjacent post **236** with a corresponding link member assembly **242**. Link member assembly **242** includes a first end **243** coupled to a first post **236** and a second end **244** coupled to an adjacent second post **236**. Each link member assembly **242** includes a pair of scissor-like links **245** that are pivotally movable with respect to each other to extend or retract each side of roof structure **232**.

[**0052**] Roof structure **232** includes a roof support member **250**, as shown in FIGS. **16** and **17**. A plurality of support links **252** are each pivotally coupled between a corresponding post **236** and roof support member **250**. In one embodiment, support link **252** includes an upper link member **254** pivotally coupled to roof support member **250** and a lower link member **256** pivotally coupled to post **236**.

[**0053**] Referring further to FIGS. **16** and **17**, gazebo **230** includes a solar apparatus **260** that is removably coupled to roof support member **250**. In one embodiment, solar apparatus **260** includes a solar panel **262**, a storage battery (not shown), a circuit board (not shown) and a power output end **264**. Further, solar apparatus **260** includes an electric power storage device for facilitating providing power for the storage battery and a plug coupled to the storage device. In this embodiment, an external power and/or a photoconductor device is coupled to the circuit board.

[**0054**] In one embodiment, solar apparatus **260** forms an arcuate or circular ring protrusion **266** on a bottom surface **268** of solar apparatus **260**. In this embodiment, protrusion **266** is configured to be threadedly coupled to roof support member **250**. It is apparent to those skilled in the art and guided by the teachings herein provided that protrusion **266** and/or roof support member **250** may form or define any suitable mechanism for removably coupling solar apparatus **260** to roof support member **250**. Solar apparatus **260** includes a conductive wire electrically coupling solar panel **262** to a power module **275** of solar apparatus **260**. In a particular embodiment, the conductive wire electrically couples solar panel **262** to a power source **276** including a storage battery housed within power module **275**. The storage battery of solar apparatus **260** is also electrically coupled to a socket **277**. In a particular embodiment, conductive wire **272** extends through roof structure **232** and/or roof support member **250**. Socket **277** includes a plurality of power ports (not shown) that are electrically coupled to the conductive wire and extend radially about an outer surface of socket **277**. Additionally or alternatively, socket **277** includes a power port (not shown) that is electrically coupled to the conductive wire and extends generally coaxially with roof support member **250** from a bottom surface of socket **277**. In one embodiment, a cap (not shown) is threadedly coupled to roof support member **250** to prevent damage to an interior region of roof support member **250** with solar apparatus **260** removed from roof support member **250**.

[**0055**] Referring further to FIG. **17**, a lighting device **280** is electrically coupled to solar apparatus **260** and configured to receive electrical energy produced by solar apparatus **260** for facilitating providing light to an interior space **282** defined within gazebo **230** (as shown in FIG. **15**). In one embodiment, lighting device **280** includes a plurality of pipe lights **284** having a LED indicator that is positioned within a corresponding transparent tube or pipe **285**. In this

embodiment, each transparent tube **285** is coupled to roof structure **232** using at least one clamp **286** and/or stitching. Each pipe light **284** includes a power output end that is electrically coupled to a corresponding power port formed within socket **277**. In an alternative embodiment, a fluorescent light **288** is electrically coupled within the power port formed in the bottom surface of socket **277**. It is apparent to those skilled in the art and guided by the teachings herein provided that any suitable number of lights and/or type of electrical lighting devices can be used with solar apparatus **260** of the present invention for facilitating lighting interior space **282** defined by gazebo **230**.

[**0056**] FIGS. **18-24** show an exemplary collapsible structure **325**. As shown in FIGS. **18-20**, collapsible structure **325** is a gazebo **330** that includes a roof structure **332** formed of a suitable fabric material. Roof structure **332** is coupled to a collapsible frame assembly **334** to form a plurality of side edges **336**, as shown in FIG. **18**. In one embodiment, gazebo **330** includes a plurality of walls **338** coupled to corresponding side edges **336** and/or collapsible frame assembly **334**, as shown in FIG. **19**. In a particular embodiment, walls **338** are removable, if desired. In an erected configuration as shown in FIGS. **18-20**, gazebo **330** defines an interior space **339** therein. Interior space **339** is large enough to comfortably accommodate one or more people. It is apparent to those skilled in the art and guided by the teachings herein provided that gazebo **330** may include any suitable number of side edges **336** and/or walls **338** having any suitable size and/or shape. Gazebo **330** is movable from the erected configuration, as shown in FIGS. **18-20**, to a collapsed configuration, as shown in FIG. **21**, for facilitating transporting and/or storing gazebo **330**.

[**0057**] Referring further to FIGS. **18-21**, collapsible frame assembly **334** includes a plurality of posts **344** fabricated of a suitable material, such as a metal, alloy, composite and/or fiberglass material, sufficiently strong to provide adequate support to gazebo **330**. In one embodiment, each post **344** includes two cooperating support members slidably coupled together. In this embodiment, a locking device **348** includes a connector **350** that cooperates with a slider **351** to couple cooperating support members together. Connector **350** is coupled to a lower end of a first or upper support member **346** and slider **351** is coupled to an upper end of a cooperating second or lower support member **347**. With locking device **348** in a locked position, slider **351** is prevented or limited from sliding with respect to connector **350**. With locking device **348** in an unlocked position, slider **351** moves with respect to connector **350** such that second support member **347** moves with respect to first support member **346** in a telescoping manner to retract within first support member **346**.

[**0058**] Referring to FIG. **18**, collapsible frame assembly **334** includes four posts **344** each coupled to adjacent posts **344**. In one embodiment, each post **344** is coupled to an adjacent post **344** with a corresponding link member assembly **352**. Link member assembly **352** includes a first end **353** coupled to a first post **344** and an opposing second end **354** coupled an adjacent second post **344**. Each link member assembly **352** includes a pair of scissor-like links **356** that are pivotally movable with respect to each other to extend or retract each side **358** of roof structure **332**.

[**0059**] Roof structure **332** includes a roof support member **360**. A plurality of support links **362** are each pivotally coupled between a corresponding post **344** and roof support member **360**. In one embodiment, support link **362** includes an upper link member **364** pivotally coupled to roof support member **360** and a lower link member **366** pivotally coupled to post **344**.

[**0060**] In one embodiment, gazebo **330** includes a solar power generator that is removably coupled to roof support member **360**. In one embodiment, the solar apparatus includes a solar panel, a storage battery, a circuit board and a power output end. Further, the solar apparatus includes an electric power storage device, such as a suitable storage battery, and a plug coupled to the electric power storage device. In this embodiment, an external power and/or a photoconductor device is coupled to the circuit board.

[**0061**] Referring further to FIGS. **20-23**, in one embodiment gazebo **330** includes a solar power generator **370**. Solar power generator **370** includes a solar panel **372** that is removably coupled to a hub **374**, which is coupled to or integrated with roof support member **360**. As shown in FIG. **23**, in one embodiment hub **374** forms a socket **376** that includes a conducting pin **378**. In alternative embodiments, hub **374** includes any suitable electrically conducting member, such as a plug, known to those skilled in the art and guided by the teachings herein provided. Solar panel **372** forms a protrusion **379** defining a port **380** that is mateable with conducting pin **378** with solar panel **372** coupled to hub **374**. In a particular embodiment, protrusion **379** forms a ring or arcuate wall **381** about port **380** that cooperates with an inner surface of hub **374** for facilitating coupling solar panel **372** to hub **374**. In this embodiment, solar panel **372** is rotatable with respect to hub **374** with protrusion **379** cooperating with socket **376** to move solar panel **372** between a locked position and an unlocked position with respect to hub **374**. In one embodiment, a cap (not shown) is coupled to hub **374** to prevent or limit damage to an interior region of hub **374** with solar panel **372** removed from hub **374**.

[**0062**] Solar panel **372** is configured to receive solar energy from the sun. In one embodiment, as shown in FIG. **22**, solar panel **372** includes a frame **382** within which a plurality of photovoltaic cells or modules **383** are mounted and electrically coupled. Each module **383** includes a suitable semiconductor, such as silicon, to convert sunlight into electricity using a suitable process know to those. skilled in the art and guided by the teachings herein provided. Referring to FIG. **20**, a power module **384** is electrically coupled with solar panel **372**. Power module **384** is configured to convert the solar energy absorbed by solar panel **372** to electrical energy for supplying the electrical energy to a load device, such as a lighting device and/or a small appliance.

[**0063**] In one embodiment, power module **384** includes a power source **385** configured for facilitating converting the solar energy absorbed by solar panel **372** to electrical energy. Power source **385** is electrically coupled to solar panel **372** using a suitable conductive wire (not shown). In one embodiment, power source **385** includes a battery, such as a deep-cycle battery or other suitable battery known to those skilled in the art and guided by the teachings herein provided. The battery is configured to store at least a portion of the generated electrical energy. In one embodiment, the battery is electrically coupled through the conductive wire to conducting pin **378**, which is mateable with a solar power output, such as port **380** defined by solar panel **372**.

[0064] In one embodiment, solar panel **372** is rotatably coupled to roof support member **360**. Solar panel **372** is electrically coupled to power module **384** of solar power generator **370**. In a particular embodiment, solar panel **372** is electrically coupled to power source **385** including a storage battery housed within power module **384**. The storage battery of solar power generator **370** is also electrically coupled to a socket **386**. In a particular embodiment, a conductive wire extends through roof structure **332** and/or roof support member **360** to couple solar panel **372** to power source **385**. Socket **386** includes a plurality of power ports (not shown) that are electrically coupled to the conductive wire and extend radially about an outer surface of socket **386**. Additionally or alternatively, socket **386** includes a power port (not shown) that is electrically coupled to the conductive wire and extends generally coaxially with roof support member **360** from a bottom surface of socket **386**.

[0065] Referring further to FIG. **20**, a lighting device **390** is electrically coupled to solar power generator **370** and configured to receive electrical energy produced by solar power generator **370** for facilitating providing light to interior space **339** defined within gazebo **330**. In one embodiment, lighting device **390** includes a plurality of pipe lights **394** having a LED indicator that is positioned within a corresponding transparent tube or pipe. In this embodiment, each transparent tube is coupled to roof structure **332** using a suitable coupling member, such as a clamp and/or a strap. Each pipe light **394** includes a power output end that is electrically coupled to a corresponding power port formed within socket **386**. In an alternative embodiment, a light, such as a fluorescent light (not shown), is electrically coupled within the power port formed in the bottom surface of socket **386**. It is apparent to those skilled in the art and guided by the teachings herein provided that any suitable number of lights and/or type of electrical lighting devices can be used with solar power generator **370** of the present invention for facilitating illuminating interior space **339** defined by gazebo **330**.

[0066] In one embodiment, gazebo **330** is stored within a storage bag **400** in the collapsed configuration, as shown in FIG. **24**. Storage bag **400** is made of any suitably durable material, such as a fabric material, and has any suitable size and/or configuration for facilitating storing gazebo **330** to prevent or limit undesirable exposure to environmental conditions when gazebo **330** is not being used. As shown in FIG. **24**, storage bag **400** forms a pocket **402** within which solar power generator **370** is stored. In a particular embodiment, solar power generator **370** is stored within a case **404** that is positionable within pocket **402** to further protect solar power generator **370** from undesirable exposure to environmental conditions and/or contact with items that may damage the components of solar power generator **370**.

[0067] The above-described apparatus and method facilitate illuminating an interior space defined by a collapsible structure, such as a tent or a gazebo. More specifically, the apparatus and method utilize photovoltaic principles to generate electrical energy from solar power obtained from the sun. As a result, in one embodiment electrical energy in the form of light is provided in an efficient, environmentally conscience and cost-effective manner.

[0068] Exemplary embodiments of an apparatus and method for providing a light source for facilitating lighting an interior space defined by a collapsible structure are described above in detail. The apparatus and method are not limited to the specific embodiments described herein, but rather, components of the apparatus and/or steps of the method may be utilized independently and separately from other components and/or steps described herein. Further, the described apparatus components and/or method steps can also be defined in, or used in combination with, other apparatus and/or methods, and are not limited to practice with only the apparatus and method as described herein.

[0069] While the invention has been described in terms of various specific embodiments, those skilled in the art will recognize that the invention can be practiced with modification within the spirit and scope of the claims.

What is claimed is:

1. A solar power generator for a structure having a collapsible frame assembly, said solar power generator comprising:

a solar panel removably coupled to the collapsible frame assembly, said solar panel configured to absorb solar energy from the sun;

a power module electrically coupled to said solar panel, said power module including a power source configured to convert the solar energy absorbed by said solar panel to electrical energy; and

at least one power output electrically coupled to said power source and configured to supply electrical energy to a coupled load device.

2. A solar power generator in accordance with claim 1 wherein the coupled load device comprises at least one lighting device removably coupled to said power source.

3. A solar power generator in accordance with claim 1 wherein said at least one power output comprises a plurality of power ports defined by said power module, each said power port electrically coupled to said power source.

4. A solar power generator in accordance with claim 3 further comprising a plurality of lighting devices, each said lighting device electrically coupled to a corresponding power port.

5. A solar power generator in accordance with claim 1 wherein said collapsible frame assembly further comprises:

a hub configured to removably couple said solar panel thereto; and

a plurality of frame members pivotally coupled to said hub, said plurality of frame members at least partially forming said collapsible frame assembly.

6. A solar power generator in accordance with claim 1 further comprising a conductive wire electrically coupling said solar panel to said power source.

7. A solar power generator in accordance with claim 1 wherein said power source further comprises a battery configured to store at least a portion of the converted electrical energy.

8. A solar power generator in accordance with claim 1 wherein said power module further comprises a socket defining one power port of said plurality of power ports, and a lighting device removably positioned within said socket, said lighting device including a conducting pin electrically coupled to said power outlet with the lighting device positioned within said socket.

9. A solar power generator in accordance with claim 8 wherein, with said lighting device positioned within said socket, said lighting device electrically chargeable to store a quantity of electrical energy.

10. A solar power generator in accordance with claim 1 wherein said lighting device further comprises a rechargeable battery configured to store electrical energy supplied by said power source.

11. A solar power generator in accordance with claim 1 wherein said power module further comprising a switch movable between an on position configured to supply energy to said plurality of power ports and an off position configured to prevent energy from being supplied to said plurality of power ports.

12. A solar power generator in accordance with claim 1 wherein said power module further comprises a conducting pin electrically coupled to a battery, said conducting pin mateable with a solar power output defined by said solar panel.

13. A solar power generator in accordance with claim 1 wherein said power module forms a socket and said solar panel forms a plug removably electrically coupled to said socket.

14. A solar power generator in accordance with claim 1 wherein said solar panel is rotatable with respect to said hub between a locked position and an unlocked position.

15. A solar power generator in accordance with claim 1 wherein the coupled load device comprises at least one lighting device directly coupled to said power source.

16. A solar tent comprising:

a hub;

a solar panel removably coupled to said hub, said solar panel configured to absorb solar energy from the sun;

a power module electrically coupled to said solar panel, said power module configured to convert the solar energy absorbed by said solar panel to electrical energy, said power module defining at least one first power port positioned about an outer housing of said power module and electrically coupled to said power source.

17. A solar tent in accordance with claim 16 further comprising at least one first light source, said at least one first light source removably electrically coupled to a corresponding power port of said at least one first power port, each said first light source configured to receive electrical energy from said power module.

18. A solar tent in accordance with claim 16 further comprising:

a socket defining a second power port electrically coupled to said power module; and

a second light source removably positioned within said socket, said second light source including a conducting pin positioned within said power port for electrically coupling said second light source to said power module.

19. A solar tent in accordance with claim 18 wherein said second light source further comprises a rechargeable battery configured to store electrical energy supplied by said power module.

20. A solar tent in accordance with claim 16 wherein said power module further comprises a power source having a battery configured to store at least a portion of the converted electrical energy.

21. A solar tent in accordance with claim 16 wherein said at least one first light source further comprises one of a LED indicator, a rainbow decoration light, a fluorescent light and a lamp.

22. A solar gazebo comprising:

a hub;

a solar panel removably coupled to said hub, said solar panel configured to absorb solar energy from the sun;

a power module electrically coupled to said solar panel, said power module configured to convert the solar energy absorbed by said solar panel to electrical energy, said power module defining at least one first power port positioned about an outer housing of said power module and electrically coupled to said power source.

23. A solar gazebo in accordance with claim 22 further comprising at least one first light source, said at least one first light source removably electrically coupled to a corresponding power port of said at least one first power port, each said first light source configured to receive electrical energy from said power module.

24. A method for providing energy to an interior space defined by a collapsible structure, said method comprising:

providing a collapsible structure including a hub and a plurality of frame members each pivotally coupled to the hub, the plurality of frame members at least partially forming a collapsible frame assembly of the collapsible structure;

removably coupling a solar power generator to the collapsible structure, the solar power generator including a solar panel removably coupled to the hub and configured to absorb solar energy from the sun;

electrically coupling a power module to the solar panel, the power module configured to convert the solar energy absorbed by the solar panel to electrical energy.

25. A method in accordance with claim 24 further comprising supplying at least a portion of the electrical energy to at least one lighting source electrically coupled to the power module, the at least one lighting source configured to receive the electrical energy and emit light.

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