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(72) Inventor; and

(71) Applicant : NAIR, Mark [US/US]; 2301 Harmony,
Amarillo, TX 79106 (US).

(74) Agent: VAN DYKE, Raymond; Washington Square,
P.O. Box 65302, Washington, DC 20035 (US).

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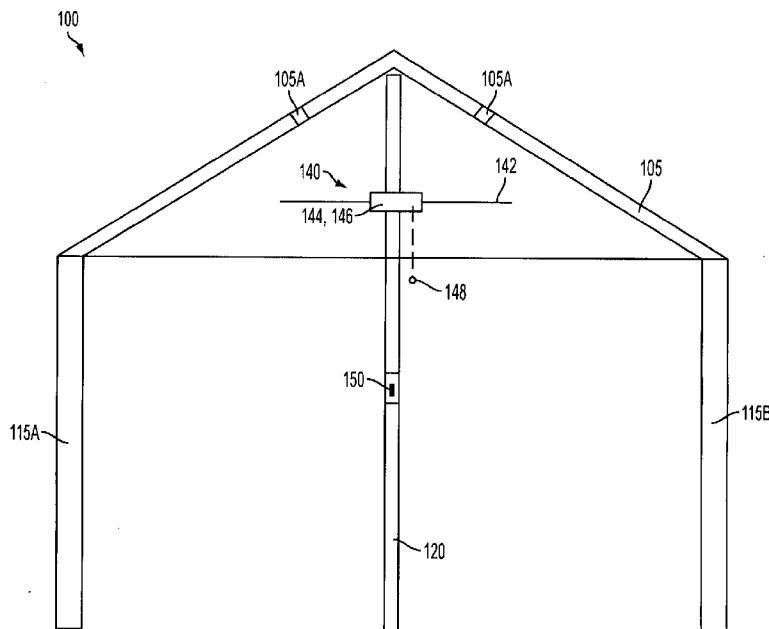


FIG. 2A

(57) Abstract: A portable solar cell canopy or tent with supports to elevate the canopy or tent and expose solar cells affixed thereon to the sun to collect energy for use within the tent. Flexible components, including spray-on solar cells, permit dismantling and reassembly of the entire apparatus into a portable kit for remote usages. The present invention provides energy in remote areas, such as drawing water from a deep well and providing emergency phone service, as well as providing energy in urban or other areas.

PORTABLE SOLAR CANOPY WITH MODULAR CONNECTIONS**CROSS REFERENCE TO RELATED APPLICATIONS**

[0001] The present invention claims priority from U.S. Provisional Patent Application Serial No. 61/223,531, entitled "Portable Solar Canopy with Modular Connections," filed July 7, 2009, the subject matter of which is incorporated by reference herein.

BACKGROUND OF THE INVENTION**Field of Invention**

[0002] The present invention relates to the field of solar power energy usage, for example, as it relates to the use of newly-developed spray-on solar cells on a portable canopy, and is also in line with the U.S. Department of Energy's Solar America Initiative (SAI) to contain the growing threat of global warming.

Description of the Related Art

[0003] In addition to providing protection from inclement weather (hail, rain, and wind), a key function of a shade canopy or tent is to protect people or locations from dangerous or intense sun rays or light that would harm someone or destroy property. Instead of inertly absorbing or perhaps reflecting these rays, a shade canopy can actively absorb them and produce power from those rays, which in turn can operate a variety of modular devices, including fans, inside the canopy area or nearby.

[0004] People currently carry and set up portable shade canopies at all sorts of events and locations. For example, it is common to see families huddled under shade canopies at soccer games and picnics, but the kinds of canopies envisioned by the teachings of the present invention can serve purposes far beyond mere weekend entertainment. For example, in parts of the world without substantial shelter and energy, the canopies of the present invention can provide both life-saving shade from the harsh sun and a cool breeze (that blows away insects), e.g., using an attached fan or water misting apparatus. Since an electrical power source can be rare at these and most remote locations, PhotoVoltaic (PV) devices applied on the canopy surfaces provide power to operate these attachments. Previous efforts

to collect solar energy in this fashion have primarily explored the relationship between fans and shade, particularly fans within umbrellas that are attached to patios.

[0005] Applicant has found that, as far back as 1909, inventors have tried to solve the desire to enhance a sunshade with a fan device, e.g., U.S. Patent No. 956,959. More recently, although U.S. Patent No. 5,007,811 sets forth a procedure for mounting an electric fan on a patio umbrella shaft, the reference utterly fails to describe or suggest powering the fan with a solar power source. U.S. Patent No. 6,017,188 generally describes a procedure for mounting a fan with lights on a pole through the center of a patio table, and although providing solar power, the installation is both permanent and non-modular, meaning the fan cannot be substituted for another device using the same power source. U.S. Patent No. 7,000,624 describes a solar powered lit patio umbrella, but neither provides a cooling fan, nor electricity for any modular units according to the present invention. Further, U.S. Patent No. 5,462,412 describes a traditional ceiling fan with a permanent installation and fixed blades.

[0006] Although U.S. Patent No. 5,180,284 uses separate mounting brackets and a lock ring to allow for easily detachable fan blades, the system therein is quite complex and does not treat the fan itself as a modular and removable piece, as in the instant invention. U.S. Patent No. 5,172,711 describes a personal umbrella comprising a solar powered fan, wherein the solar panels are attached to the material of the umbrella between the stays, however does not contemplate a modular system according to the present invention capable of providing electricity for other components. More recently, U.S. Patent No. 7,013,903 generally describes the installation and use of solar energy to provide an outdoor umbrella with a lighting system, and U.S. Patent No. 5,349,975 describes a hand carry personal umbrella with a fan powered by solar energy. Published U.S. Patent Application No. US2004/0228118 describes a self-contained rechargeable lighting system for use with a canopy to provide illumination in the absence of sunlight, but not for cooling purposes.

[0007] U.S. Patent No. 6,338,422 describes an air-cooled umbrella powered by a rechargeable battery or a solar cell panel. The fan is built directly under the canopy, which is a fixed design and not portable. U.S. Patent No. 4,481,774 similarly converts solar power to wind inside a non-modular canopy. For more personal cooling, U.S. Patent Nos. 6,024,264, 4,680,815 and 6,032,291 generally describe a collapsible hood or canopy which attaches to the top portion of a backpack frame for cooling while hiking. U.S. Patent No. 6,760,925

generally describes the implementation of electrically-powered personal fans mounted in hats to keep a person cool. U.S. Patent No. 5,782,993 describes a flexible solar panel capable of being adhered to a building or structure in order to provide shelter and electricity. However, the reference does not contemplate a modular, portable canopy system as contemplated herein. U.S. Patent No. 5,478,407 describes a solar panel shade used to provide shade and electricity to areas capable of being negotiated on foot, using rigid solar panels suspended between cables. However, the reference does not contemplate a flexible modular system as contemplated herein.

[0008] U.S. Patent No. 6,397,869 describes a square domed personal tent with fan which can optionally be solar powered. However, the solar panels are not an integral part of the tent structure, but an added external accessory. U.S. Patent No. 7,285,719 describes a solar panel array that may be used to provide power as well as shelter. The reference further contemplates cooling, lighting, and security to the array. The array describes rigid solar panels suspended from cables that are not flexible. Thus, this reference, as with the others cited herein, does not contemplate a modular, portable canopy system as set forth and claimed in the present invention.

[0009] U.S. Patent No. 4,713,492 sets forth a flexible modular solar panel array that can be used to provide electricity to availability of electrical devices. However, the reference does not contemplate the use of the array as a personal shelter as is contemplated by the instant invention. U.S. Patent application US2005/0268962 discloses flexible solar cells capable of providing electricity to a variety of modular electrical devices. However, the reference does not disclose the use of the solar cells as a portable, flexible solar canopy capable of providing both shelter and electricity as contemplated herein. Furthermore, POWERFILMTM Inc. discloses a solar powered shelter for military use (see, powerfilmsolar.com/products/military/armytents). However, this approach does not contemplate a modular, portable canopy system, as contemplated herein.

[00010] After reviewing all of the above references, Applicant believes that none of the aforementioned references addresses the issue of a portable shade canopy or tent with solar cell capability and with modularized attachments.

[00011] In particular, Applicant has found that none of the above-described devices provide the needed degree of flexibility and modularity needed in best using canopies today, particularly in poor regions across the globe, in remote areas without direct access to electricity, or in disaster areas where the electrical infrastructure is damaged and no electricity is available. In addition to providing energy, the solar cells of the prior art devices are delicate, require special handling, and operate only in direct sunlight. Additionally, the canopies are neither lightweight nor portable, are not easy to breakdown, fold or transport, and are almost useless (except for general shelter) in cloudy weather. In addition, the aforescribed prior art devices fail to also provide the degree of modularity needed in canopy use, particularly in providing modularity in electrical connectivity in the Third World or other impoverished areas having a diversity of survival needs.

[00012] Advances in photovoltaics and nanotechnology, however, provide a new approach to solving the above problems by providing a lightweight portable shelter capable of producing electrical power in a variety of weather conditions. Applicant's invention of a portable shelter represents a synergistic improvement in the flexibility and modularity of solar canopies and tents far and above those of the above-referenced prior art devices. As nanotechnology and other technologies become more affordable, their use in these and other applications will increase, eventually making the structures proposed in the present invention within the financial reach of most people of the world, and opening the principles of the present invention to additional usages, as discussed in more detail hereinbelow.

[00013] Accordingly, there is a need for portable solar canopies, particularly with the use of modularized components for ease of assembly and disassembly in remote or other places. More specifically, there is a need for apparatuses and kits employing portable solar canopies for providing shelter and more importantly power to remote areas.

SUMMARY OF THE INVENTION

[00014] A portable solar canopy with detachable fan or other detachable devices has been designed to employ recent developments in photovoltaics and nanotechnology, such as thin film polymer photovoltaics or thin film nanocomposite 3D solar cells. Additional technologies, such as spray-on solar cells or cells woven into the fabric of the canopy itself,

provide further cost-effective sources of energy. Solar cells disposed on the canopy top power a fan or any modular electrical device attached to a canopy housing. The solar cells send electrical current down the center or other pole or conduit to an electrical connector, which can provide electricity to any modular device. In this fashion, the present invention provides a lightweight portable kit construction and a lifesaving setup for remote geographic areas where electrical energy is sparse or completely unavailable.

[00015] The aforementioned needs are satisfied by several aspects of the present invention, directed to apparatuses, kits and methodologies for facilitating delivery of power to remote or difficult terrain. It should be appreciated that the embodiments herein can be implemented in numerous ways, including as a system, kit, device and instructions for the use therefor. Several embodiments of the present invention are described below.

[00016] Other embodiments and advantages of the invention are apparent from the following Detailed Description, taken in conjunction with the accompanying Drawings, illustrating, by way of example, the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[00017] While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter that is regarded as forming the present invention, it is believed that the invention will be better understood from the following description taken in conjunction with the accompanying Drawings, where like reference numerals designate like structural and other elements, in which:

[00018] FIGURE 1A is an elevational top view of a first embodiment of a solar-powered canopy pursuant to the teachings of the present invention, having a rectangular configuration;

[00019] FIGURE 1B is an elevational top view of an alternate embodiment of the solar-powered canopy of the present invention, having a square configuration;

[00020] FIGURE 1C is an elevational top view of an alternate embodiment of the solar-powered canopy of the present invention, having a circular configuration;

[00021] FIGURE 1D is an elevational top view of another alternate embodiment of the solar-powered canopy of the present invention, also having a circular configuration;

[00022] FIGURE 1E is an elevational top view of another alternate embodiment of the solar-powered canopy of the present invention, having an extendable rectangular configuration;

[00023] FIGURE 1F is an elevational top view of another alternate embodiment of the solar-powered tent of the present invention, having a rectangular configuration;

[00024] FIGURE 2A is a cross-sectional side view of the solar-powered canopy of FIGURE 1A;

[00025] FIGURE 2B is a cross-sectional side view of the solar-powered canopy of FIGURE 1B;

[00026] FIGURE 2C is a cross-sectional view of the solar-powered canopy of FIGURE 1E, having multiple interior supports;

[00027] FIGURE 2D is a side view of the solar-powered tent of FIGURE 1F;

[00028] FIGURE 2E is a cross-sectional, side view of the solar-powered tent of FIGURE 1F;

[00029] FIGURE 3A is a cross-sectional, transverse side view of the solar-powered canopy of FIGURE 1A;

[00030] FIGURE 3B is a sectional view of a modular electrical connector in the solar-powered canopy of FIGURE 3A;

[00031] FIGURE 3C is a sectional view of a modular electrical connector utilizing electrical sockets in the solar-powered canopy of FIGURE 3A;

[00032] FIGURE 3D is a sectional view of a modular electrical connector in the solar-powered canopy of FIGURE 3A;

[00033] FIGURE 4 is a sectional view of an exemplary fan assembly and electrical housing employed by the apparatus of the present invention;

[00034] FIGURE 5A is a sectional view of an exemplary fan blade assembly employed by the apparatus of the present invention;

[00035] FIGURE 5B is an expanded view of a portion of the exemplary fan assembly shown in FIGURE 5A; and

[00036] FIGURE 6 is a cross-sectional, side view of the solar-powered canopy of FIGURE 1B providing electricity to a remote well pump.

DETAILED DESCRIPTION

[00037] The present invention will now be described more fully hereinafter with reference to the accompanying Drawings, in which preferred embodiments of the invention are shown. It is, of course, understood that this invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that the disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. It is,

therefore, to be understood that other embodiments can be utilized and structural changes can be made without departing from the scope of the present invention.

[00038] As noted, humankind has long thought of adding a fan device to an umbrella or considered various ways to utilize personal fans. Up to now, however, these usages have not considered or suggested a portable solar canopy pursuant to the present invention, particularly in view of very recent technological advances which create new paradigms of operations capabilities.

[00039] With various new developments in the field of nanotechnology, the electricity generating power of the sun includes more than just the traditional visible spectrum. Advances include the ability to utilize visible, ultraviolet (UV) and infrared light in order to generate electricity via photovoltaic cells.

[00040] As solar panel technology matures, the cost of using photovoltaics for everyday use is becoming more and more realistic. Applicant has found that there have been some advances in incorporating photovoltaics in apparel, e.g., U.S. Patent No. 6,388,422, as well as technological improvements to increase efficiency and decrease the weight and cost of producing the photovoltaic cells. These and other developments, described herein, have provided, for the first time, the possibility of a portable solar-powered canopy or tent capable of generating sustainable power in a variety of weather conditions for a multitude of modular electrical devices.

[00041] Since the main purpose of a shade canopy is to block the sun's rays, the material used to provide the shade has, at least in part, direct exposure to the sun, making it amenable for solar panel placement. A portable and collapsible structure is described herein, so the photovoltaics are flexible enough to be folded or rolled with the material when the canopy structure is disassembled, as described further hereinbelow. Today, such materials could be thin film polymer photovoltaics or thin film nanocomposite 3D solar cells, but recent technologies, particularly new developments in spray-on solar cells or cells woven into the fabric of the canopy itself, provide additional interesting and cost-effective alternatives. Thus, the solar cells or panels of the present invention are an integral portion of the canopy or tent material, either as a constituent of the canopy fiber itself, or applied to the exterior of the canopy's material in such a manner that the solar cells or panels are permanently affixed or

adhered to the canopy or tent. The application of the solar cells or arrays to the canopy can be through any methodology known in the art, including, but not limited to the cells being sprayed on, painted on, affixed with glue or other adhesive, or laminated. The application of such solar panels or cells will be sufficient to generate enough electricity to the desired modular electrical devices, while maintaining a lightweight, portable, flexible canopy capable of providing shade to the user.

[00042] As used herein, the term "flexible" refers to any material of the canopy of the instant invention that is capable of flexing or bending or has a degree of elasticity without breaking, damaging, or reducing the function of the material, including the photovoltaic cells.

[00043] As used herein, the term "portable" refers to the ability of the canopy of the instant invention to easily or conveniently be movable from location to location, by as few as a single person.

[00044] As used herein, the term "lightweight" refers to the ability of the canopy of the instant invention to be able to be lifted and carried, by as few as a single person.

[00045] A variety of solar cells can be employed in the present invention. As noted, advances in thin film and nanotechnology-based solar films, which can be sprayed on, and film polymer photovoltaics can be employed. For instance, U.S. Patent No. 4,713,492 describes a flexible solar panel that may be used in accordance with the present invention. U.S. Patent No. 6,849,798 discloses the use of Cu_2O that can be used to harness the solar energy produced by the UV spectrum. The flexible solar panel or array used in the canopy or tent of the instant invention can comprise or consist of any flexible, thin film semiconduction material for producing solar cells according to the instant invention. By way of non-limiting examples, such materials can include silicon alloys, germanium alloys, silicon-germanium, cadmium telluride, cadmium selenide, cadmium sulphides, potassium niobate, gallium arsenide, copper indium diselenide, sodium titanate, and combinations thereof. The solar cells can further comprise or consist of fullerenes and single-wall nanotubes and well as other polymer compositions capable of generating and transmitting solar energy.

[00046] For example, a plastic solar cell has recently been invented (*Stefan Lovgren, National Geographic News, January 14, 2005*), and efficiencies of solar cells have increased

dramatically, particularly when they can more effectively turn the power of the sun into electrical energy, regardless of the weather. The plastic materials employed in these new solar cells use recent advances in nanotechnology, which incorporates the requisite solar cells that harness the sun's visible, as well as infrared light rays. More importantly, like paint, these composite nanotechnological materials can be sprayed or otherwise flexibly applied onto surfaces such as a canopy to provide electricity to portable devices in electrical communication therewith. In addition, newly-developed quantum dot technologies, described further hereinbelow, further make the solar cells portable and collect energy from the visible to infrared ranges. These and other developments in solar technology have, for the first time, made solar cells totally portable and usable in daily home and countless other applications.

[00047] As mentioned above, another breakthrough in solar cell technology comes from the recent research on quantum dot technologies, which is also developed from recent advances in polymer nanotechnology in the semiconductor industry. As is known to those skilled in the art, quantum dots confine the motion of conduction band electrons, valence band holes, or excitons (bound pairs of conduction band electrons and valence band holes) in all three spatial directions. This confinement is due to electrostatic potentials (generated by external electrodes, doping, stains and impurities), the presence of an interface between different semiconductor materials (e.g., in core-shell nanocrystal systems), the presence of the semiconductor surface (e.g., semiconductor nanocrystal), or a combination of these. A quantum dot has a discrete quantized energy spectrum. The corresponding wave functions are spatially localized within the quantum dot, but extend over many periods of the crystal lattice. A quantum dot contains a small finite number (of the order of 1-100) of conduction band electrons, valence band holes, or excitons, i.e., a finite number of elementary electric charges. The results are quantum dot solar cells or nanocrystal solar cells based on a silicon substrate with a coating of nanocrystals, which can be used to harness the full spectrum of solar energy. A great benefit of these cutting-edge solar cells is that these emerging technologies in nanotechnology and photovoltaics collect solar power on any day, regardless of the weather conditions.

[00048] Furthermore, these emerging technologies are reducing the cost of producing photovoltaic cells utilizing nanocrystals and nanotubes. Older production techniques, such as molecular beam epitaxy (MBE) processes, are time-consuming and expensive. However,

newer producing techniques, including a process known as “spin-coating,” as disclosed in U.S. Patent No. 7,375,369, is capable of significantly reducing the cost of producing quantum dot technologies. Additional advances in the purification of carbon nanotubes, capable of being used in photovoltaic cells, as disclosed in U.S. Patent Nos. 7,357,906, 7,357,907, and 7,375,366, and setting forth techniques to further reduce the time and cost of producing materials for photovoltaic cells.

[00049] Additionally, these technologies increase the flexibility of the solar cells produced, making the solar cells less fragile and more easily folded or rolled, allowing for the solar canopy or tent of the instant invention to be collapsed, stored, and transported. Also, quantum dot-based photovoltaics have mechanical flexibility, such as quantum dot-polymer composite photovoltaics, and can be used in the manner of spray-on paint (Gur, et al., "Air-Stable All-Inorganic Nanocrystal Solar Cells Processed from Solution," *Science* 2005, 310 (5745): 462-465), which can, thereby, be used to cover the canopy or other structures. Furthermore, U.S. Patent No. 7,354,877, generally describes the production of carbon nanotubes woven into fabrics, and U.S. Patent Application No. US2005/0268962, describes the production of flexible solar panel arrays, which are manufactured as photovoltaic fibers capable of generating and transmitting electricity.

[00050] With the increased flexibility of the solar cells and solar arrays of the instant invention, they may be employed on a range of materials, comprising or consisting of cloth, canvas, nylon and combinations thereof, as well as other such materials as may be used in manufacturing the canopy of the present invention. The material should be lightweight, durable, flexible, and water-resistant. In certain circumstances, it would be desirable to construct the canopy or tent using waterproof material, or insulated material in order to further protect the user and any equipment housed within the shelter from inclement weather, such as rain or snow.

[00051] Further embodiments include a canopy or tent with closable exterior walls in order to provide shelter from inclement weather for equipment and/or people, as well as sleeping quarters. Such exterior walls can be permanently attached to the roof of the canopy or tent with sheets of the same cloth material such as constituting the roof, and which can be rolled up and secured along the edges of the roof when not necessary. These individual walls can then be secured to each other via zipper, tie, rope, clamp, grommets, snaps, buttons,

VELCRO™ or other attachment mechanism known to those skilled in the art in order to provide an enclosed canopy or tent. In another embodiment, the walls are completely detachable, and can be added onto the roof via zipper, tie, clamp, etc. in order to provide an enclosed canopy or tent. The walls can be solid material walls, or can comprise openings for windows and doors for ventilation and natural light, or a mesh or netting in order to protect the user from insects, such as mosquitoes capable of transmitting diseases, such as Malaria, West Nile Virus and dengue fever.

[00052] The external and internal supports, as well as rib/stretchers capable of providing additional support to the canopy can comprise or consist of any lightweight, durable material, including, but not limited to, plastic, aluminum, steel, titanium, graphite, fiberglass, polymers or any combination thereof. The external and internal supports, as well as the rib/stretchers, can be either rigid or flexible supports, and can be solid material or hollow rods in structure. The external and internal supports, as well as the rib/stretchers can themselves be made of discrete individual segments, which can either be made to produce a specific canopy or tent or specific height or width proportions, or the supports and ribs can be produced in shorter interlocking segments (i.e., end-to-end) which the user can manipulate such that the canopy or tent has a specific height or width, depending on the number of interlocking segments placed together.

[00053] The solar cells and arrays of the instant invention can be interconnected in series, parallel, mixed series, or combinations thereof, as is well known to those skilled in the art. Also, it should be understood that by varying the amount of solar cells, and/or arrays on the canopy or tent, the maximum electrical output capacity of the canopy can be controlled (i.e., the greater the number of solar cells/arrays on the canopy results in a greater maximum electrical output). The canopy or tent further includes an electrical terminal capable of transferring the electrical energy produced by the solar cells to the electrical conduit that terminates in the electrical connections supplying electricity to the modular devices of the instant invention. The electrical terminal capable of transferring the electricity produced by the solar cells comprises or consists of any conducting material, including, but not limited to, copper, gold, silver, platinum, nickel, palladium, iron and alloys thereof, or combinations thereof.

[00054] The present invention includes the use of traditional electrical sockets, which can utilize any electronic device, and can be modified to provide the specific electrical sockets of a particular region, territory or country. Furthermore, the present invention contemplates proprietary electrical devices, such as the fan mentioned previously, which is manufactured for and can only be used with the present canopy or tent system.

[00055] As described hereinabove, and in more detail hereinbelow, FIGURES 1 through 6 illustrate various embodiments of an improved canopy combination pursuant to the teachings and principles of the present invention, which combine the various advances set forth herein into new configurations and uses. With reference now to FIGURE 1A of the Drawings, there is illustrated therein an elevational, top view of a solar-powered canopy pursuant to a first embodiment of the present invention. FIGURES 2A and 3A are cross-sectional, side views of a solar cell configuration of the canopy embodiment shown in FIGURE 1A, where the generally rectangular-shaped canopy is generally designated in the Drawings by reference numeral 100.

[00056] As shown in FIGURE 1A, the solar cells are arrayed or situated on the roof of a canopy portion or side 105. More particularly, the solar cells, generally designated by the reference number 110, are on the upper portion or topside of the canopy or side 105 for exposure to the sun, and, may be arrayed in segments thereon, e.g., solar cell panels or segments 110A, 110B, 110C and 110D, as shown in more detail in FIGURE 1A.

[00057] It should, of course, be understood that alternative array structures for situating the solar cells 110 on the canopy side 105 are possible and contemplated by the teachings of the present invention. For example, the solar cell panels 110 can be configured to better conform to folds when the canopy portion 105 is collapsed or disassembled when in storage or not in use, e.g., in transport. For example, with a circular canopy 100 configuration, shown in FIGURES 1C and 1D, the canopy portions or the entire canopy portion 105 may be rolled instead of folded, thereby helping to make the component more portable. Solar cells 110 may be arranged in segments, as shown in FIGURES 1A and 1B, or arranged in one or more ring portions, as shown in FIGURE 1C. Advances in solar cell technology and composites will lead to more resilient and durable material characteristics and durable configurations, permitting more folding and handling options, such that the solar cell

portions are better capable of easily being folded for transport or storage when not being used.

[00058] With further reference to the embodiments shown in FIGURES 1 and 2, particularly FIGURES 1A and 2A, canopy structure 100 has four supports 115 along the four corners of the rectangular-shaped structure. For larger structures or for additional support, e.g., in windy areas, an additional central support 120 may be added. Since the central or interior support 120 can also be useful for interior control, further details on this are discussed hereinbelow. It should be understood, however, that the controls can instead be placed on any of the supports 115. It should, of course, also be understood that each of supports 115 and 120 may include additional means to anchor the canopy structure 100 to the substrate in question, comprising or consisting of stakes, weights or other means to secure the respective support and hence the canopy structure 100 to the ground or other substrate.

[00059] Inside the canopy, further support may be provided by rib and stretcher structures, such as those employed within an umbrella. For example, a plurality of flat ribs, designated generally in the Drawings by the reference numeral 125, may be incorporated in the canopy 100, e.g., along and within the topside portion 105, and extend along the surfaces thereof to provide structure and support, e.g., in windy environments, as illustrated in the elevational, top view of FIGURE 1B, i.e., from above the configuration looking down on the canopy design. Similarly, a rib 125 can be employed for further interior support, as indicated by reference numeral 125A, which extends transversely within, as illustrated in more detail in FIGURE 3A, forming a structural support lattice. As with umbrella configurations, the ribs 125 may contain extendable members therein, also called stretchers, to expand the length of the respective rib/stretcher 125, from a short version, with the stretchers retracted, to a long version, with the stretchers extended. In this fashion the ribs and stretchers 125, although rigid in construction, can be shortened to make the entire canopy 100 portable. It should, of course, be understood that the rib/stretchers 125 can be removable and inserted into pockets or slots within the canopy portion 105 material to provide support when the canopy 100 is in use.

[00060] A possible internal configuration of the canopy structure 100 is shown in FIGURE 2A, which is a cross-sectional, side view of the elevational, top view of FIGURE 1A. As shown in FIGURE 2A, supports 115A and 115B, along two of the corners of the

canopy 100, provide support for the canopy 100, and the central support 120 may provide additional support where necessary. It should, of course, be understood that additional interior supports 120 and additional exterior supports 115 may be needed for larger configurations or for more robust support, as is understood to those skilled in the art. Also, rib/stretcher 125 constructions may be employed for additional support in these alternate configurations.

[00061] One potential such larger configuration is illustrated in FIGURES 1E and 1F, and FIGURE 2C, which may comprise or consist of as many as two, three or more interior supports 120, and as many as eight or more exterior supports 115, as needed in the overall structure. Further, the arrangement of solar cells 110 in such larger arrays may be open to a variety of configurational and operational constraints, and offer multiple energy sources and controls, as discussed in more detail hereinbelow.

[00062] The energy converted by the solar cells 110 may be sent down the center pole 120 or conduit to electrically connect to a variety of devices via connectors. In the embodiments shown in FIGURES 1-3, for example, the various solar cells 110 feed the converted energy, e.g., in the form of direct current from the various solar cells disposed on the various panels or segments 110 to a central point, e.g., the apex of the central support 120, designated in the FIGURES by the reference numeral 120A, particularly within FIGURE 3A, from which the power is centralized and directed downwards for ease of use to canopy users.

[00063] With reference now to FIGURES 3A-D of the Drawings, there are illustrated therein electrical connectivity embodiments of the present invention. The cross-sectional, side view of the embodiment of FIGURE 1A, shows a canopy portion 105 with solar panels or segments 110, particularly solar panel 110D in FIGURE 1A, arranged thereon. As discussed, the energy converted by the solar panels 110 is collected and passed to an electrical connector or conduit, designated generally by the reference numeral 130, which may run down any of the supports 115 and 120 for ease of access by the user. In this embodiment, conduit 130 runs along internal support 120. It should be understood that multiple conduits 130 may be employed, e.g., in the larger configuration shown in FIGURES 1E and 1F, where current feeds from multiple apex points 120 down respective supports 115 and 120 to devices thereinbelow, e.g., the various supports 115 and 120 shown in FIGURE 2C.

[00064] FIGURES 3B and 3C represent a cross-sectional view of various and generalized electrical connections of the instant invention. It should be understood that the electrical housing 160 can be the terminal point for electrical connectivity and various devices, with devices 170 receiving power directly from the housing 160. It should also be understood that the electrical connectivity can extend through the device 170 to connect to further devices 170, e.g., a first device 170A comprises or consists of an adapter, an electrical socket, an extension cord, or a multi-plug device, providing another connection post 170B for receiving another device, thereby expanding the number of connections. As illustrated in FIGURE 3C, a standard electrical socket 170 is envisioned. In any event, the components 160 and 170 should be designed to securely fasten to each other, as described in more detail hereinbelow.

[00065] By way of example, an interior fan assembly can be operated and controlled by a user standing underneath the canopy structure 100 and in proximity to the interior support 120. It should, of course, be understood that with additional connectivity, described further herein, other electrical devices can be powered by the solar panels 110 and operated by the user, the load limited only by the power generated. With reference again to FIGURE 2A, there is shown such an interior fan assembly, designated generally by the reference numeral 140. As is understood in the art, fan assembly 140 includes a number of blades 142, a motor 144 and a transmission 146, receiving power through the conduit 130 and enabling power transference to rotate the fan assembly 140 in a concentric way around the interior support 120, thereby cooling the area underneath. To facilitate cooling, the canopy may comprise or consist of vents or apertures above the fan assembly 140 to permit the warmer air to escape more readily. Vents or apertures in the canopy portion 105 are illustrated in FIGURE 2A of the drawings and are generally designated by the reference numeral 105A. The fan assembly in this embodiment can be controlled by a switch, e.g., a drawstring 148 or a toggle (or other) switch 150, as also illustrated in FIGURE 2A.

[00066] In the alternate embodiment of the present invention, shown in FIGURE 3A, however, various devices are modularized for ease of interconnectivity to receive power from the source, and support 120 may not actually provide physical support to the canopy structure 100, as do the supports 115, but may instead extend only partway down from the apex 120A, e.g., to a point accessible by a standing person. In this alternate configuration, interior

support 120 provides access to the control of the fan assembly 140 or other devices disposed nearby, and frees up the central space therebelow for the user.

[00067] With reference now to FIGURE 4 of the Drawings, the end of interior support 120 opposite apex 120A has a detachable connection apparatus or housing attached thereto, designated generally by the reference numeral 160, from which the electricity can be transferred from a device or connector 170A on the housing to a connector 170B on the particular device, such as the fan 140, thereby powering the fan. It should be understood that the type of power derived from the solar cells is generally direct current in nature, and devices can be made to run off of this direct current. Alternatively, the electrical housing 160 can convert the direct current to a particular voltage or a different mode of use for most electrical devices, i.e., an alternating current. For example, a Switched Mode Power Supply (SMPS), converts the DC voltage from the solar cells 110 to any voltage that is required, such as 12 VDC, to drive a notebook computer or 110 VAC for an electrical fan or fluorescent lamps, or other mode depending on the desired attachable devices. It should also be noted that recent improvements in this industry have made DC/DC converters and DC/DC regulators capable of running at very high efficiencies and with very little energy loss due to the requisite transformers.

[00068] As securing the devices to the canopy 100 structure is critical, various locking mechanisms are envisioned. Since the improved canopy 100 of the present invention is envisioned for usage in a variety of climates and for a variety of users, including uneducated people, the securing mechanism must be reliable, simple to use and durable. A simple turn-and-twist locking mechanism should suffice for the variety of usages and personages envisioned. In any event, the power from conduit 130 is transformed within the housing 160 (or perhaps via another attachment for further conversion) and accessible at a connector 170A. As shown in FIGURE 4, connector 170, upon physical securement to the housing 160, connects via a connection port 170A to the power in the appropriate voltage or format, completing the circuit and availing the user of power.

[00069] With reference now to FIGURES 5A and 5B, there is illustrated a presently-preferred configuration of the aforementioned fan assembly 140 of the present invention. In this embodiment, four blades 180, such as the aforementioned blades 142 of fan assembly 140, are shown attached to the connector 170, which in this instance is a fan

connector. As with the secure connectivity between the housing 160 and connector 170 described hereinabove, the respective blades 180 must be securely affixed to the connector 170, e.g., through various slots 185 therethrough, perhaps using conventional push down notches 190 on the blade shank, which engage respective holes 195 in the connector 170 designated to receive the notches 190. Preferably, there are four such holes 195 with corresponding notches 190 for each blade 180, thereby firmly securing the blades 180 to the connector 170. In a preferred configuration, two blades are at +14° pitch and two are at -14°pitch, as is understood in the art.

[00070] It should be understood that the blades 180 in the above embodiment are interchangeable, being push-button operated. Thus, in environments requiring a lighter or longer blade, they can be easily substituted. It should also be understood that twisting the blade 180 in the slots 185 in one direction, e.g., the right, will lock the blade into the +14° pitch position, which is appropriate for warm or hot weather operation since the fan would circulate air downwards. Conversely, locking the blade into the -14° pitch position would be better for cool weather operation since the fan would lift cool air and move the heated, stratified air at the top of the canopy 100 (with the vents 105A preferably closed) downward. It should further be understood that the four blades comprise or consist of any lightweight durable material, including but not limited to plastic, metals such as aluminum, tin, steel, etc., resins and polymers, or any combination thereof. Furthermore, the length of the blade can vary from as little as one to several inches in length, to as long as several feet in length.

[00071] FIGURE 6 represents a cross-sectional, side view of one embodiment of the invention wherein the solar powered canopy 100 is capable of providing electrical power to an electrical device in a remote location, for example, providing electricity to a water pump within an isolated well. In this embodiment, the solar powered canopy need not be tall enough to provide shelter, other than for the well, although it need not necessarily be placed over the well at all to provide the requisite power to run the pump therein. In this embodiment, the solar panels 110 provide electricity through electrical conduit 130 to the well pump 200 submerged within the well. The well pump is then able to supply water up to a spigot or faucet 210 nearby the well location. However, the solar powered canopy should only be high enough and large in enough in area to provide adequate electricity to enable to pump to function. In embodiments wherein the solar powered canopy is to be left

unattended, the canopy's exterior supports 115 may be permanently secured to the ground or surrounding terrain via proper fastenings, such as through bolts or poured concrete footings.

[00072] As indicated above, advances in photovoltaics and nanotechnology will allow people to harness light energy, not only from the visible spectrum but also the infrared, perhaps increasing the efficiency of solar cell technology fivefold. Previous solar cells absorbed some of the light energy, causing electrons to become loose and flow in certain directions, creating electrical current. In operation, these cells required high power intake, such as found in direct visible light, to knock the electrons loose. Due to the aforementioned recent advances employing quantum dot technology, infrared energy is captured and used to excite the electrons. Even though these quantum dots are made from semiconductor crystals only a few nanometers thick, their power output is much greater due to their ability to absorb more ranges of light, particularly infrared light, e.g., wavelengths between 1,000 and 2,000 nm, which constitute roughly half of the sun's energy reaching the earth's surface. Furthermore, ultraviolet and infrared energy can also be used to further increase the electrical generating capacity of the solar canopy or tent of the instant invention.

[00073] With spray-on solar cells 110, such as used in the present invention, folding the canopy 100 and all of its parts becomes very easy and convenient. Furthermore, all of the parts are attachable and detachable, e.g., the connector 170, blades 180, etc. The present invention has the tremendous advantage of rapid assembly and disassembly of the whole canopy system 100 and can be truly lightweight, portable and attachable, e.g., as a kit strapped to a backpack, or placed in the back or on top of a car or truck.

[00074] Additionally, the present invention is ideally suitable for deployment to disaster relief areas which are remote from any electrical supply or in more developed areas where the electrical infrastructure is damaged and not functioning. In such situations, the solar canopy of the instant invention is capable of providing lifesaving support to emergency crews and people displaced by said disaster. The canopy of the instant invention is capable of providing shelter and electricity to emergency medical equipment, such as portable echocardiograms, portable x-ray machines, portable sterilizers, etc.

[00075] Research has shown that power density of solar radiation is around 1.4kW/m^2 . With improved energy efficiency spray-on solar cells 110, as in the present invention, the

efficiency can reach 41%. Even at a conservative estimation of 20%, for an average-sized canopy 100, the energy absorption area is around 10 m² (roughly 10 feet x 10 feet), then the present invention can easily deliver over 2 kW, a measure exceeding the power consumption of most popular home appliances, but a power source that can also be portable.

[00076] As discussed, the canopy or tent of the instant invention comprises or consists of modular devices that can be connected to receive the power generated by the solar cells 110. With the aforementioned advances in power output and realization by recent solar cell 110 technology, the potentials for apparatus connection increase from that of a simple fan (65-175 watts) to a great variety of discretionary devices, including without limitation a clock radio (10 watts), an electric blanket (100 watts), a television (133 watts), Video Cassette Recorder (17-21 watts), Digital Video Device (20-25 watts), water misting humidifier (ultrasonic, 300 watts), stereo radio (400 watts), refrigerator (frost-free, 16 cubic feet, 725 watts), furnace (750 watts), microwave oven (750-1100 watts), toaster (800-1400 watts), coffee maker (900-1200 watts), toaster oven (1225 watts), and countless other devices, e.g., cell phones, global positioning devices, weather radios, walkie-talkies and other communications equipment, which can be operated or charged.

[00077] Water pump (deep well) constructions to provide potable water for consumption usually require around 250-1100 W and can also be powered by the present invention. In remote areas without any other source of water, a detachable water pump and a satellite phone provide critical, and perhaps life-saving, functions. The systems, apparatuses and kits of the present invention are particularly useful in these challenging environments, but may also be employed in urban settings, e.g., on a picnic.

[00078] The modular attachment method set forth in the present invention is ideal for portable structures, particularly in climates and countries without electricity. The fan module helps cool the underlying environment and move the air. Other modules can provide various other functionalities that are necessary in various environments, and the full range of usage is limited only by the imagination of humans.

[00079] It should be understood that, although a preferred embodiment of the present invention is directed toward providing a secure shelter for humans or animals, i.e., an elevated canopy to protect from the harmful rays of the sun, the canopy 100 of the present

invention can be engineered for other usages, which are also within the scope of the invention.

[00080] For example, a small canopy, configured to have a size requisite to a particular need, can be positioned atop or near a device requiring the electricity, such as the aforementioned well pump and like equipment, which may be quite remote and unattended. The canopy in this instance need not be elevated much, e.g., it should be positioned above the ground level to avoid damage by animals and the terrain; however human height elevation is not necessary. Thus, the remote device requiring power can be operated by a portable kit that assembles on-site. The solar cell 110 area needed can be predetermined and the configuration deployed for maximum solar exposure, which could be far from horizontal. For example, with the improved power generation capabilities of the solar panels 110, a canopy or sheet can be deployed with anchoring pegs on the side of a mountain to power a light, a transmitter or other device, perhaps at great angles, so long as direct exposure to the sun's energy is provided, e.g., along a Southern face of a mountain.

[00081] It should also be understood that such remote usages may require a battery to best service the attached devices on a continual basis. Thus, housing 160 or connector 170 can comprise or consist of a battery therein to store the electrical energy generated by the panels 110 for later use. It should, of course, also be understood that the power generated from the panels 110 keep the battery recharged.

[00082] It should also be understood that the aforementioned improvements in solar panels 110 or solar cell technologies may allow deployment of solar cells both on the roof portion, the preferred embodiment described hereinabove, and the side walls as well, e.g., material with solar panels 110 thereon hanging from the roof portion between the supports or poles, e.g., between supports 115A and 115B and between supports 115B and 115C, as shown in FIGURE 2B. So long as there is adequate exposure to the sun, the entire canopy structure, i.e., the top and side walls, can include solar cell technology with solar cells embedded, affixed, attached or otherwise connected to the outside layer of the covering material. The covering material, therefore, provides both protection from the elements inside the canopy, and power through the solar cells on the outside.

[00083] It should also be understood that the tent configuration employed in the present invention need not be rectangular but could be triangular (3 supports), a pentagon shape or other shape. The particular shape may be dependent on the terrain, the usage and/or the constraints of the technology. For example, high winds may entail a short triangular-shaped construction with the faces or panels oriented to best capture the sunlight and avoid the ravages of the wind.

[00084] Although the above description focuses on land-based configurations, the principles of the present invention are also applicable in snowy or icy terrain, desert and also in water (with appropriate flotation apparatus). The improvements in flexibility and capability of the new solar cells enable a host of potential usages in a variety of environments, only a few of which are illustrated herein

[00085] The previous descriptions are of preferred embodiments for implementing the invention, and the scope of the invention should not necessarily be limited by these descriptions. It should be understood that all articles, references and citations recited herein are expressly incorporated by reference in their entirety. The scope of the current invention is defined by the following claims.

THE CLAIMS

What is claimed is:

1. A solar canopy comprising:
at least one solar panel;
a canopy, said canopy disposed above a substrate, said at least one solar panel disposed on an exterior surface of said canopy with exposure to the sun;
a support, said support holding said canopy with said at least one solar panel thereon off the substrate; and
a power outlet, said power outlet being disposed within said canopy and providing power to a user therein, said power outlet receiving power from said at least one solar panel,
whereby said canopy and said at least one solar panel thereon are flexible, collapsible and portable.
2. The solar canopy according to claim 1, wherein said at least one solar panel collects light energy, said light energy being selected from the group consisting of visible light, infrared light, ultraviolet light and combinations thereof.
3. The solar canopy according to claim 1, wherein said at least one solar panel is composed of a material being selected from the group consisting of plastic, composite, thin film semiconductor material, thin film photovoltaics, nanotechnology materials, thin film nanocomposites, quantum dot materials, spray-on composites, and combinations thereof.
4. The solar canopy according to claim 1, wherein said at least one solar panel comprises a plurality of solar panels arrayed on said canopy.
5. The solar canopy according to claim 1, wherein said canopy forms a shape when configured, said shape having a footprint selected from the group consisting of rectangular square, triangular and circular.

6. The solar canopy according to claim 1, further comprising:
at least one electrical device connected to said power outlet, said at least one electrical device secured to said power outlet via a locking means.
7. The solar canopy according to claim 6, wherein said at least one electrical device is selected from the group consisting of a fan, a water pump, adaptor, electrical socket, extension cord, multi-plug device, converter, regulator, cell or portable phone, computer, PDA devices, GPS device and combinations thereof.
8. The solar canopy according to claim 1, wherein said support comprises at least three poles, said poles holding said canopy above the substrate.
9. The solar canopy according to claim 8, wherein said power outlet is affixed to at least one of said poles of said support.
10. The solar canopy according to claim 8, wherein said poles include at least one center pole, said power outlet affixed to said at least one center pole.
11. The solar canopy according to claim 10, wherein said at least one center pole does not extend to the substrate.
12. The solar canopy according to claim 1, wherein said solar canopy components are detachable, said canopy and at least one solar panel flexible for folding, and said support detachable from said canopy, said canopy components capable of rapid assembly and disassembly.
13. The solar canopy according to claim 1, wherein said canopy further includes a plurality of walls, forming an enclosure, said walls being detachable.

14. The solar canopy according to claim 13, wherein said canopy and walls are secured together by attachment means, said attachment means being selected from the group consisting of zippers, ties, ropes, clamps, grommets, snaps, buttons, Velcro and combinations thereof.

15. The solar canopy according to claim 13, wherein said walls are perpendicular to the substrate or at an angle thereto.

16. The solar canopy according to claim 13, wherein said walls have at least one solar panel affixed thereto.

17. The solar canopy according to claim 1, wherein said canopy has at least one aperture therethrough, said aperture being selected from the group consisting of vents, windows, doors and combinations thereof.

18. The solar canopy according to claim 1, wherein said support for said canopy is deployable over a plurality of substrates, said substrates selected from the group consisting of ground, rock, sand, ice and water.

19. A solar canopy comprising:
solar panel means for gathering solar energy;
canopy means, said canopy means disposed above a substrate, said solar panel means disposed on an exterior surface of said canopy means with exposure to the sun;
support means supporting said canopy means above said substrate;
power means disposed within said canopy means and providing power to a user therein, said power means receiving power from said solar panel means,
whereby said canopy means and said solar panel means thereon are flexible, collapsible and portable.

20. A solar canopy kit comprising:

a plurality of solar panels for gathering solar energy;

a canopy portion, said canopy portion made of a flexible material, said plurality of solar panels being affixed to an exterior surface of said canopy portion with exposure to the sun, said canopy with said plurality of solar panels thereon capable of being folded for transport;

a plurality of supports to elevate said canopy portion above a substrate;

an electrical conduit, said electrical conduit receiving power from said plurality of solar panels and disposed within said canopy portion, said electrical conduit providing power to a user therein, at least a portion of said electrical conduit being flexible,

whereby said canopy portion with said plurality of solar panels thereon and said electrical conduit are flexible, collapsible and portable, said plurality of supports detachable, and the entire solar canopy capable of being assembled and disassembled.

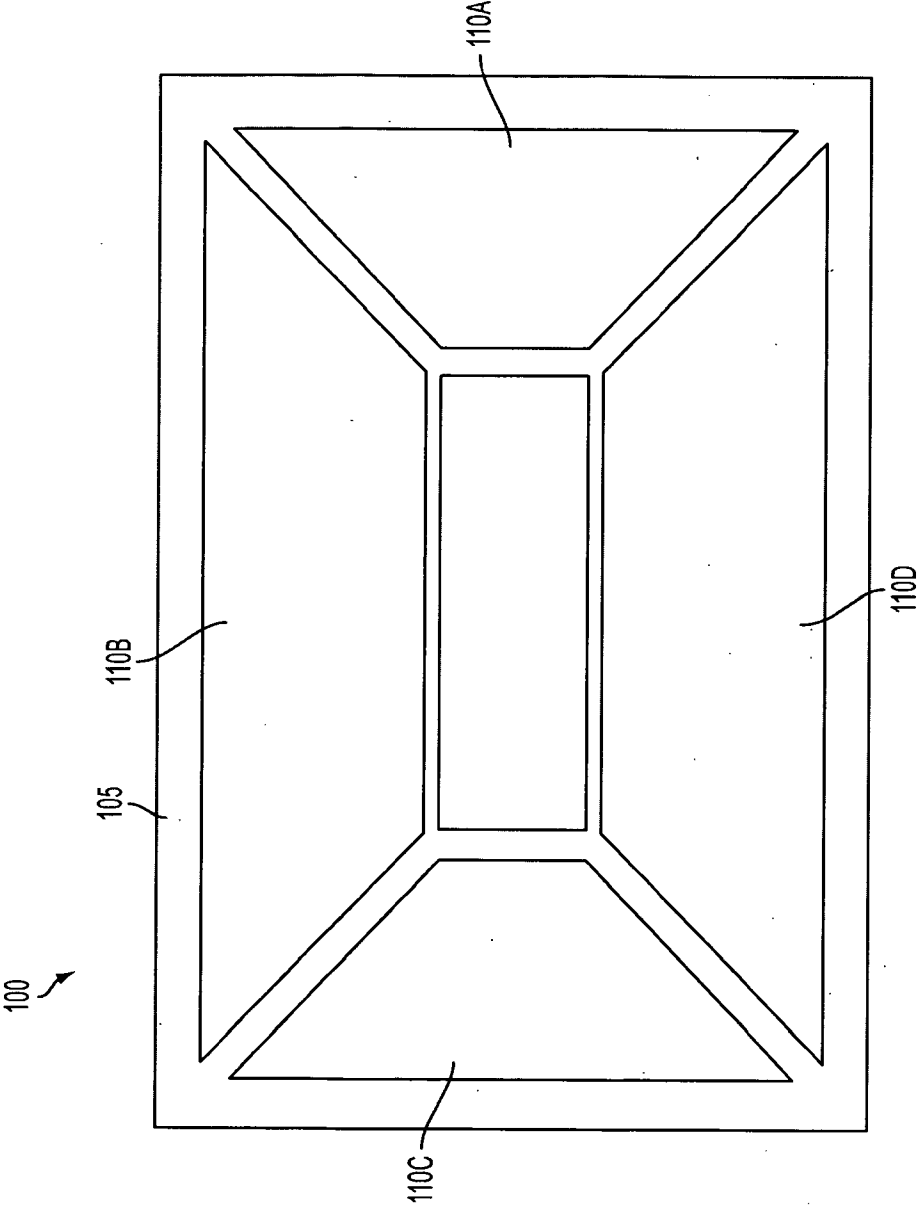


FIG. 1A

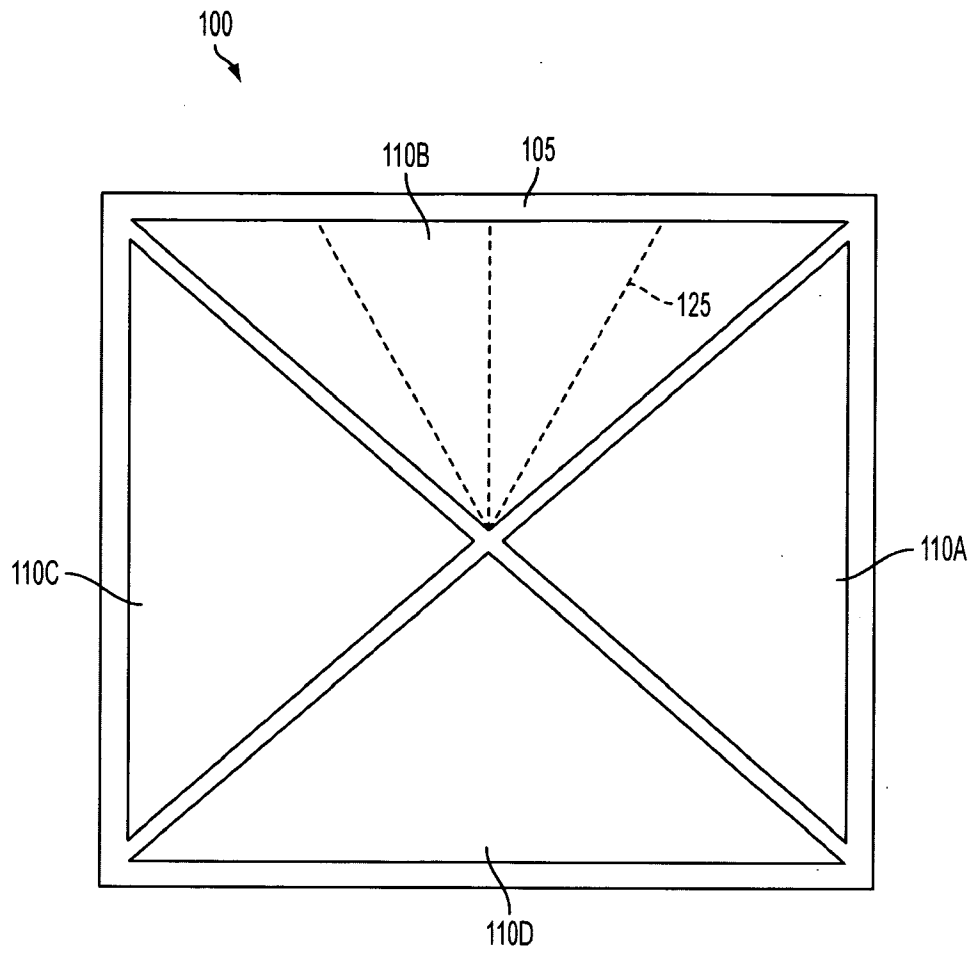


FIG. 1B

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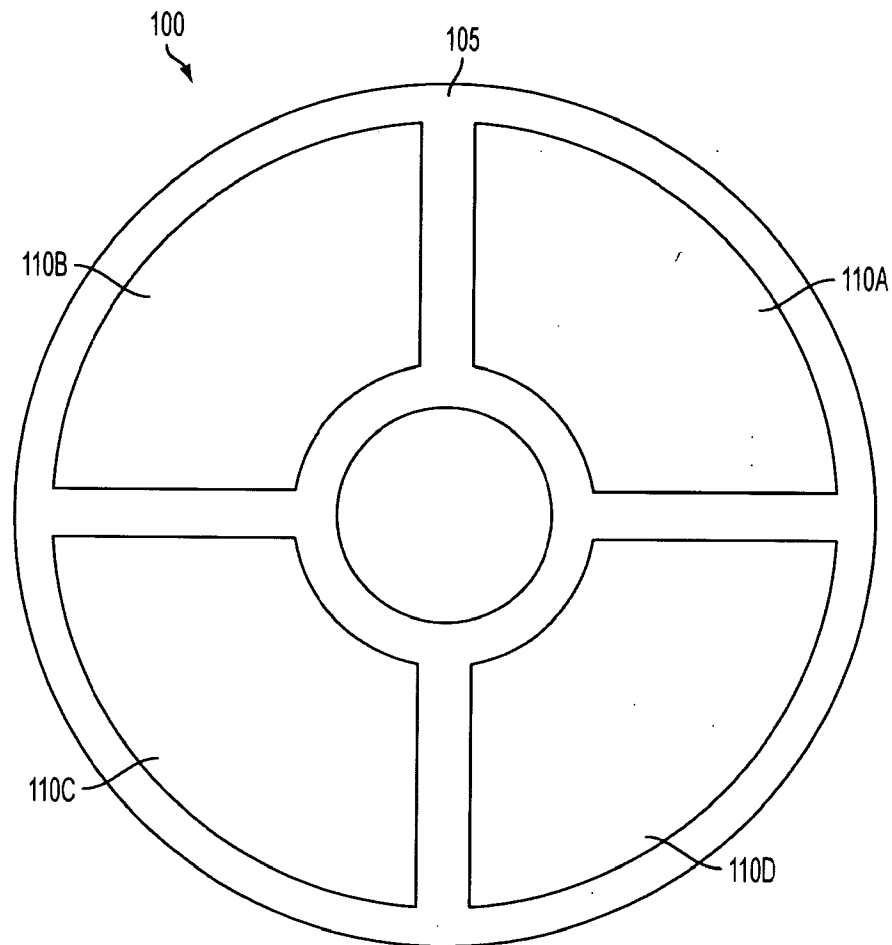


FIG. 1C

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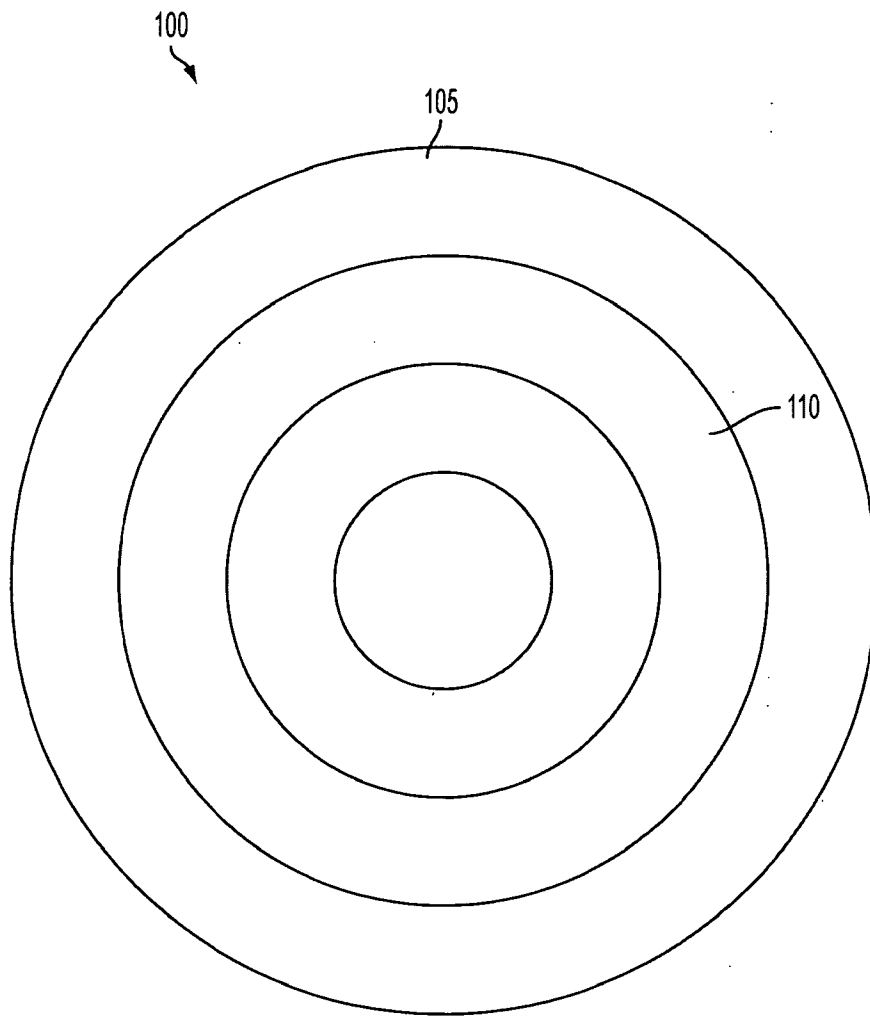


FIG. 1D

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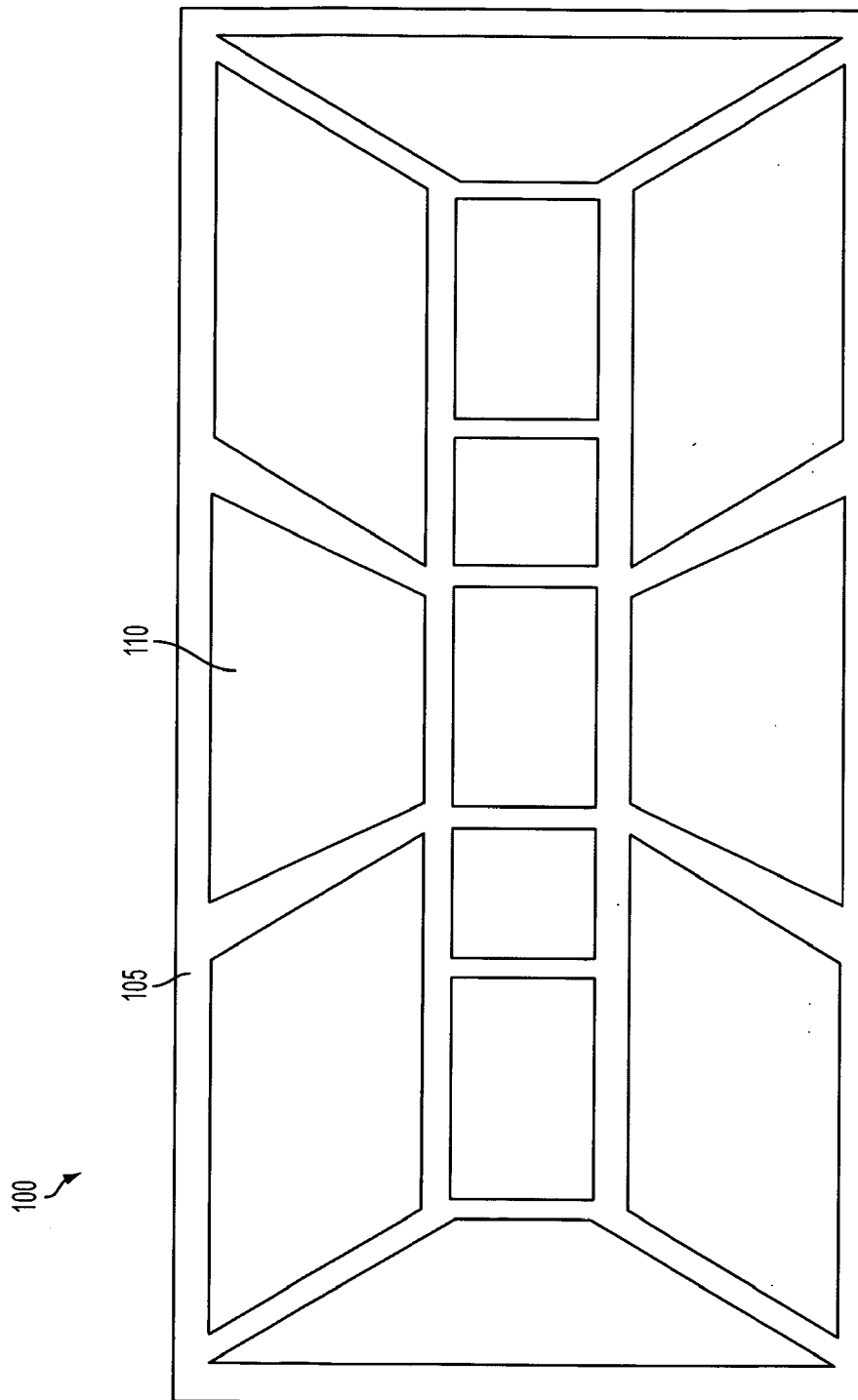


FIG. 1E

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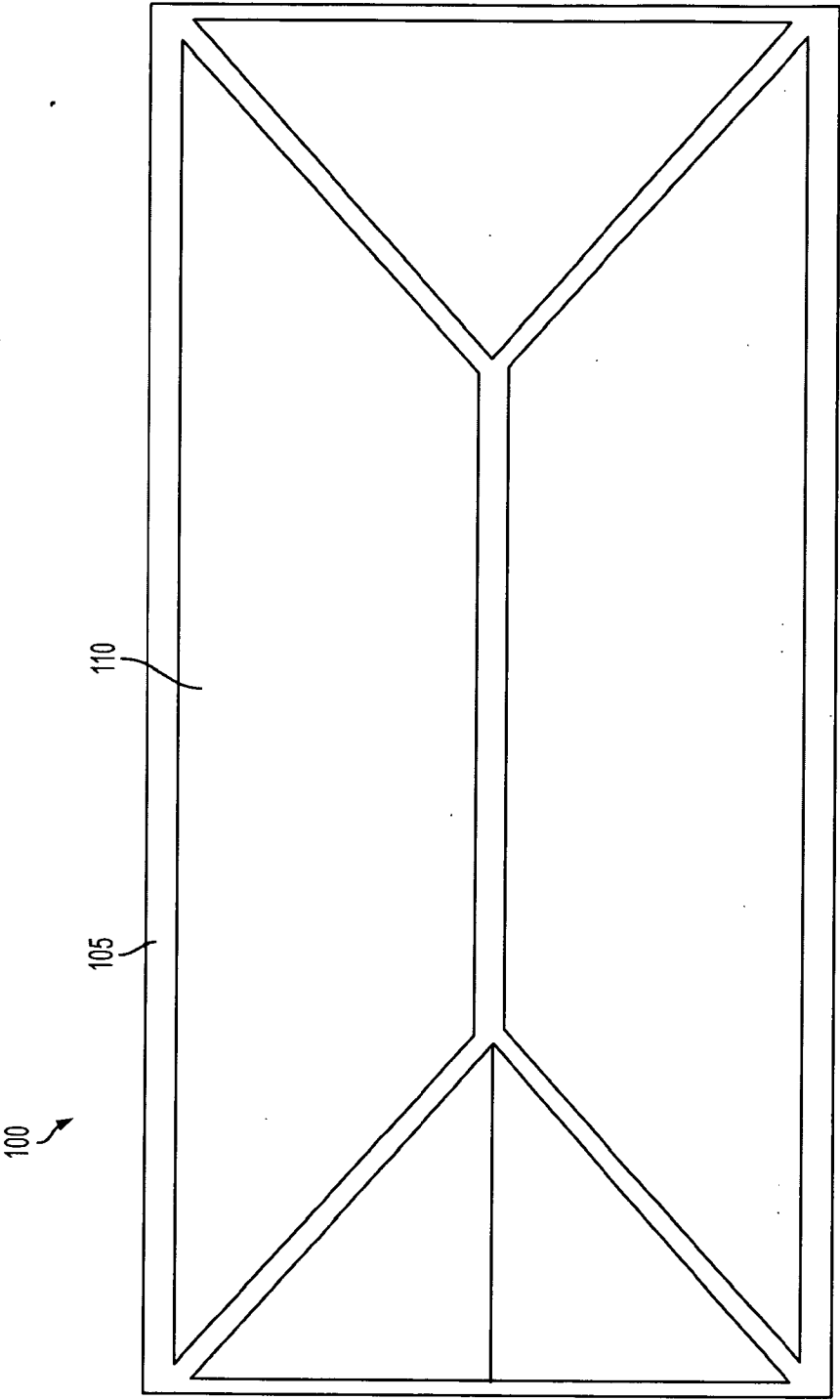


FIG. 1F

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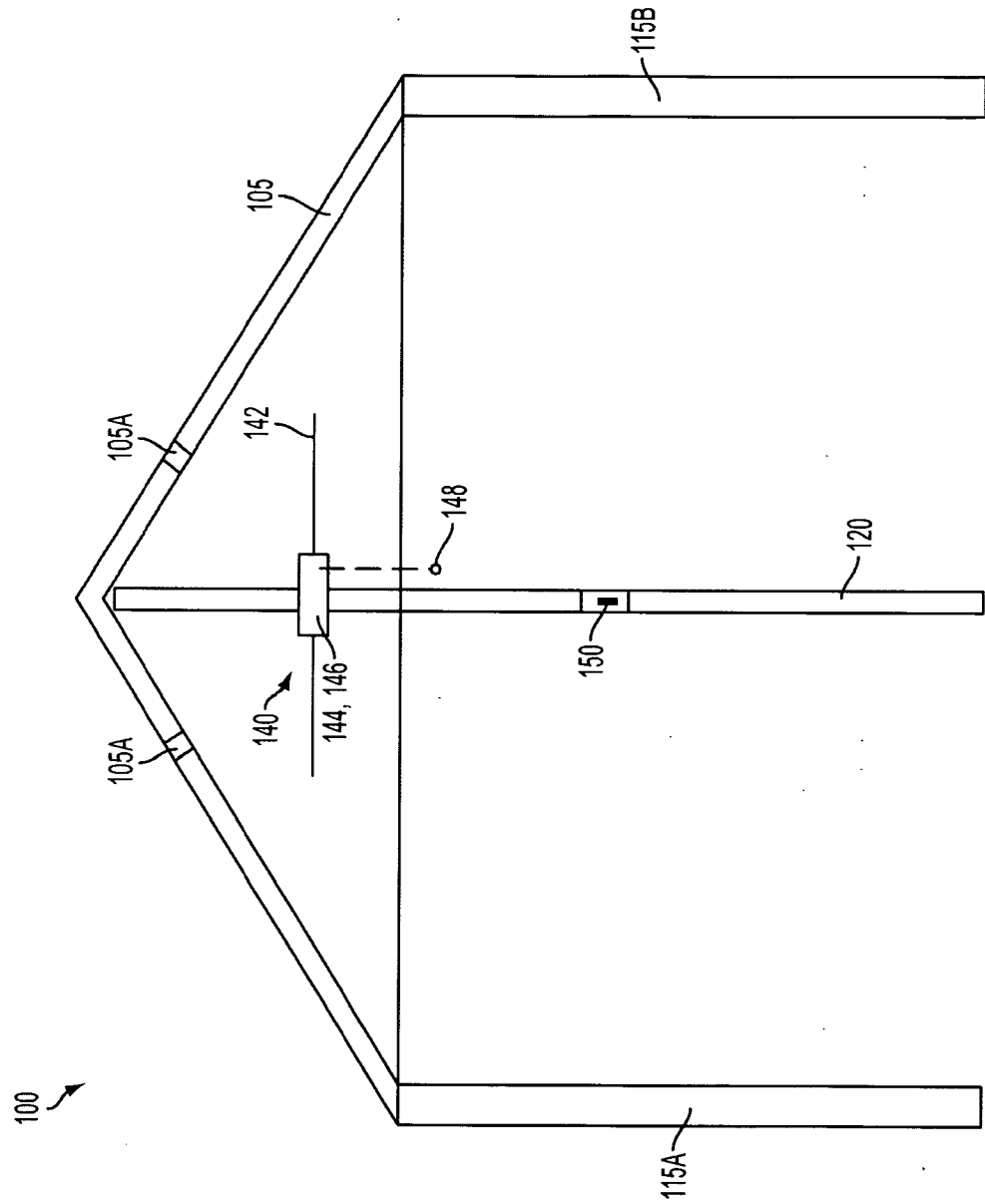


FIG. 2A

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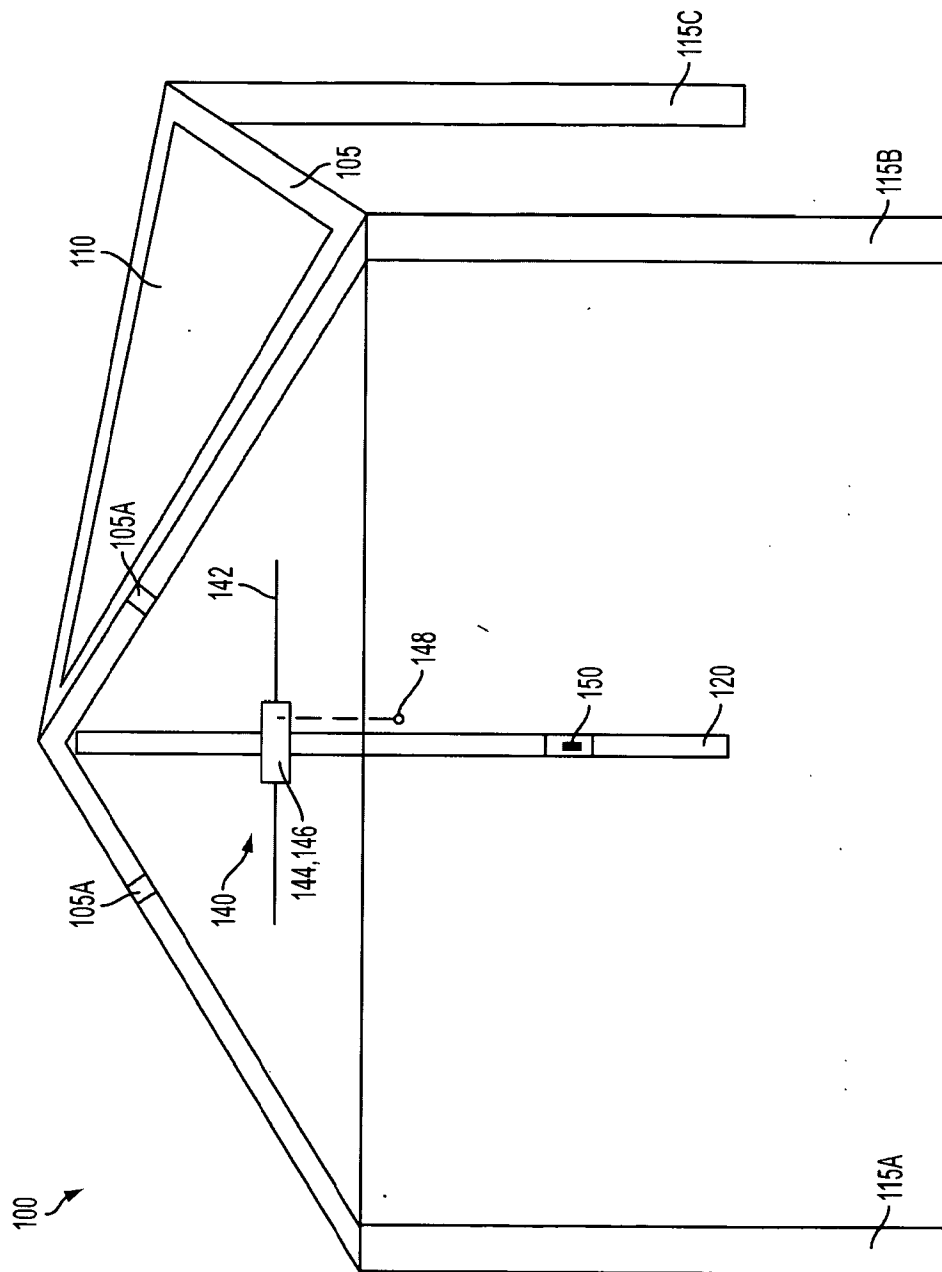


FIG. 2B

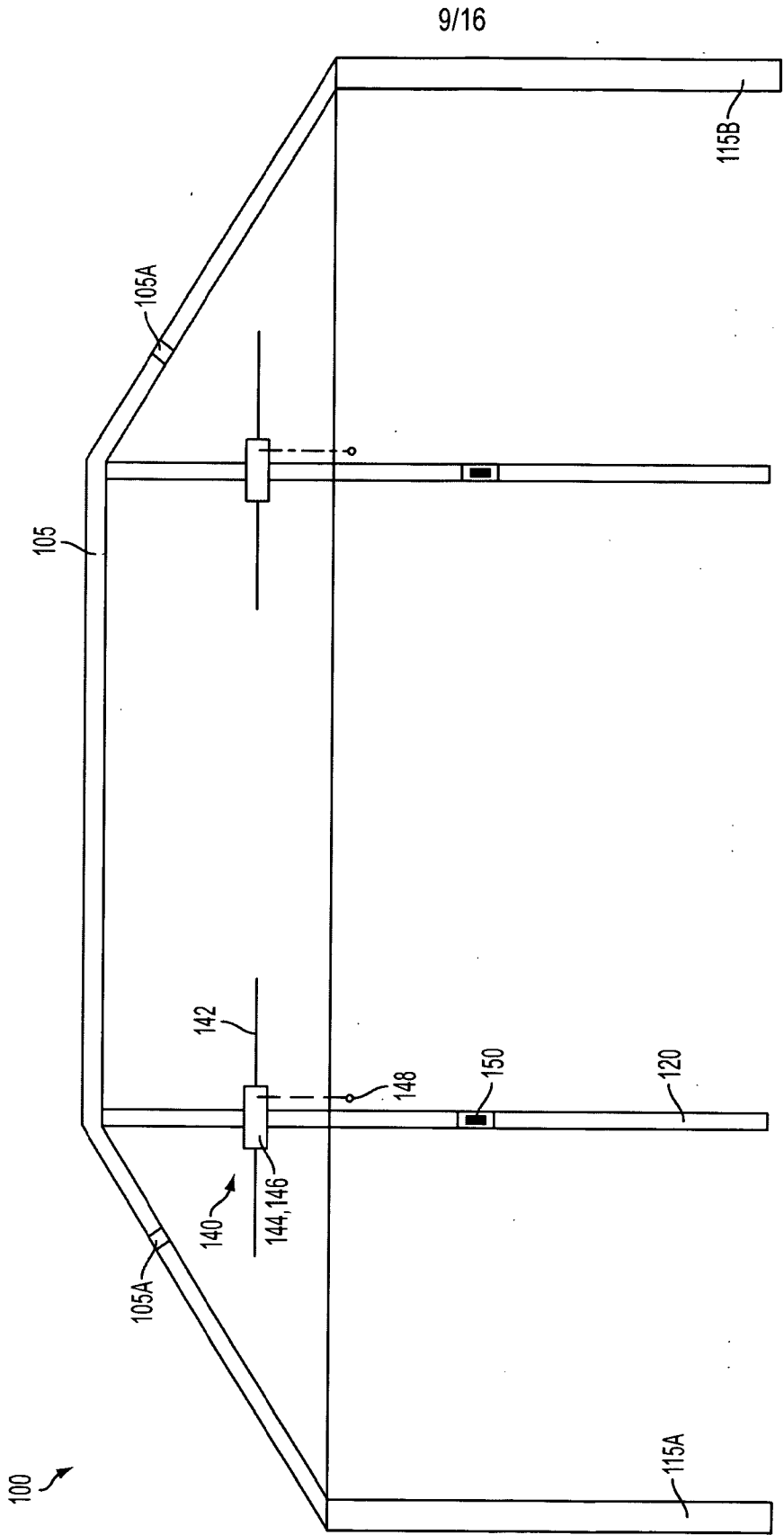


FIG. 2C

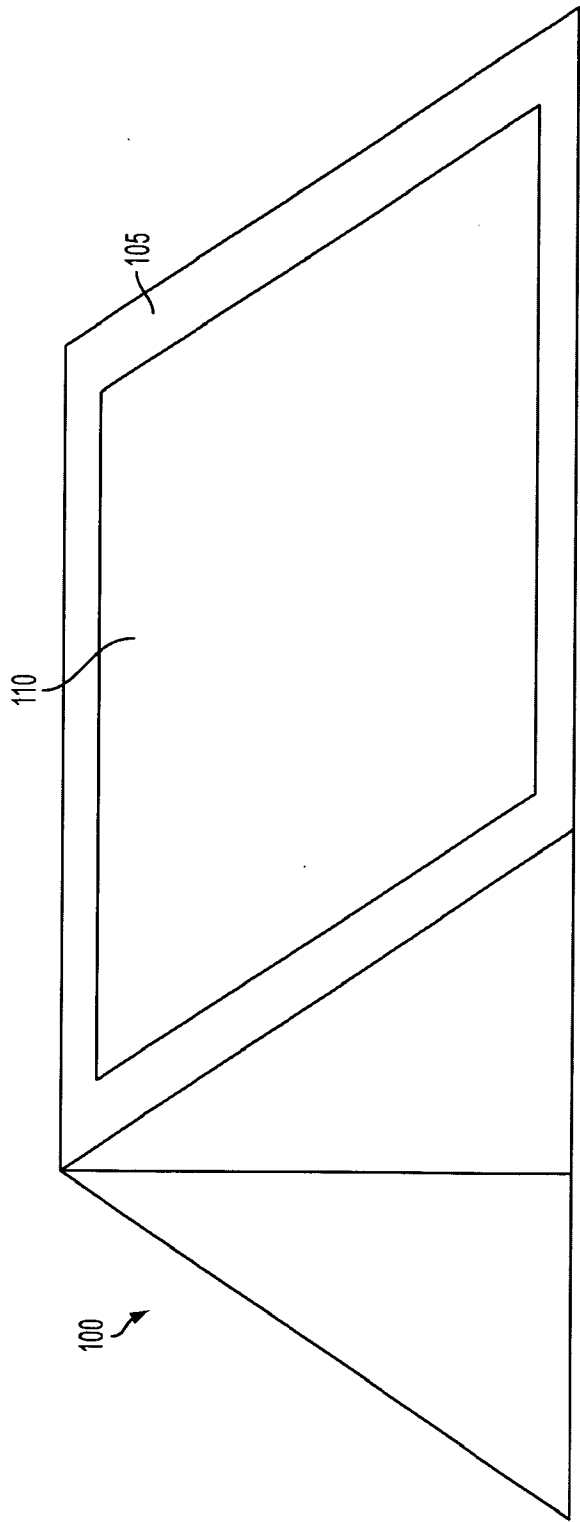


FIG. 2D

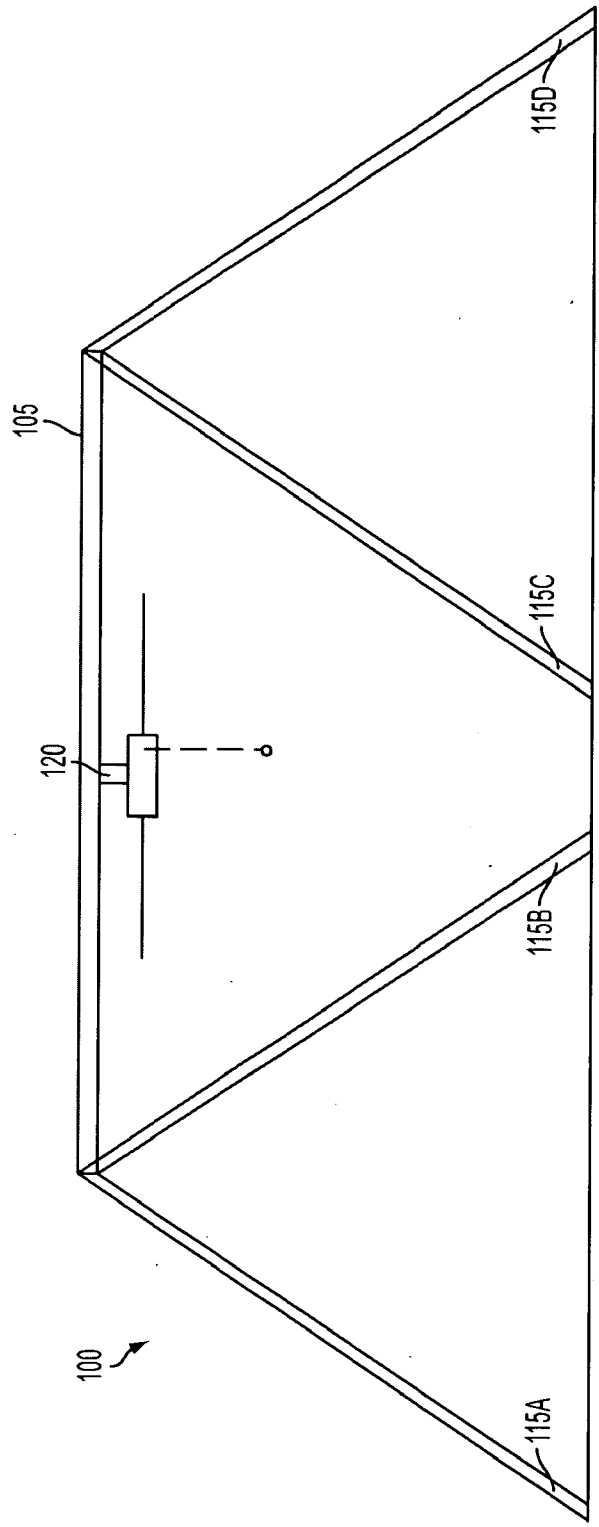


FIG. 2E

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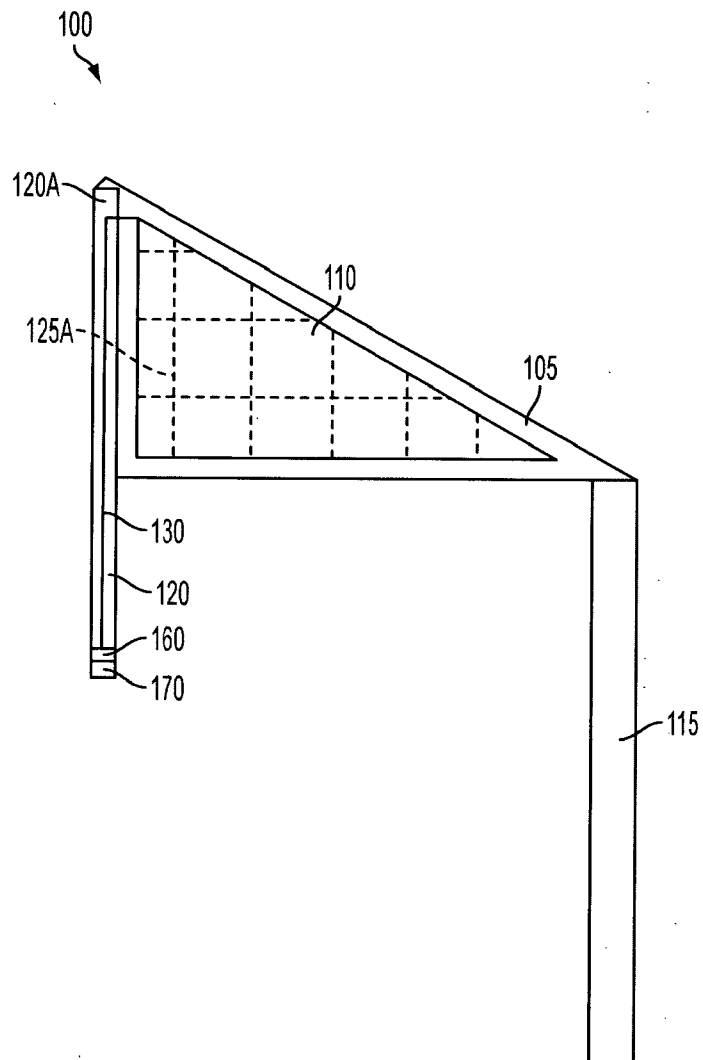


FIG. 3A

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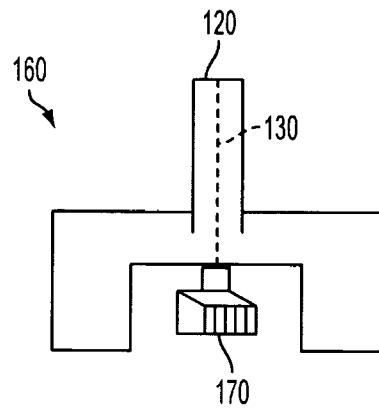


FIG. 3B

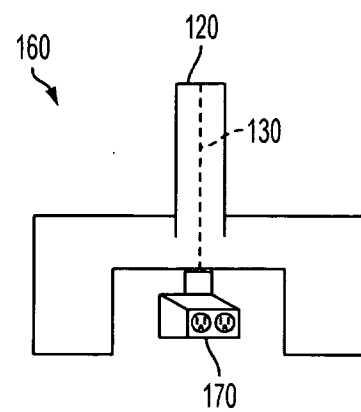


FIG. 3C

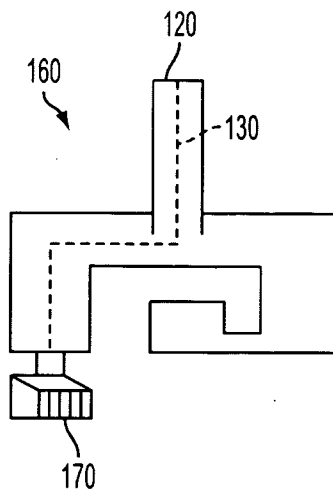


FIG. 3D

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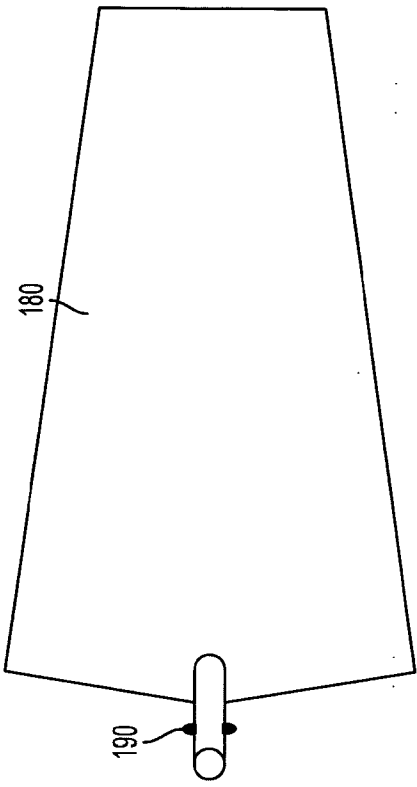
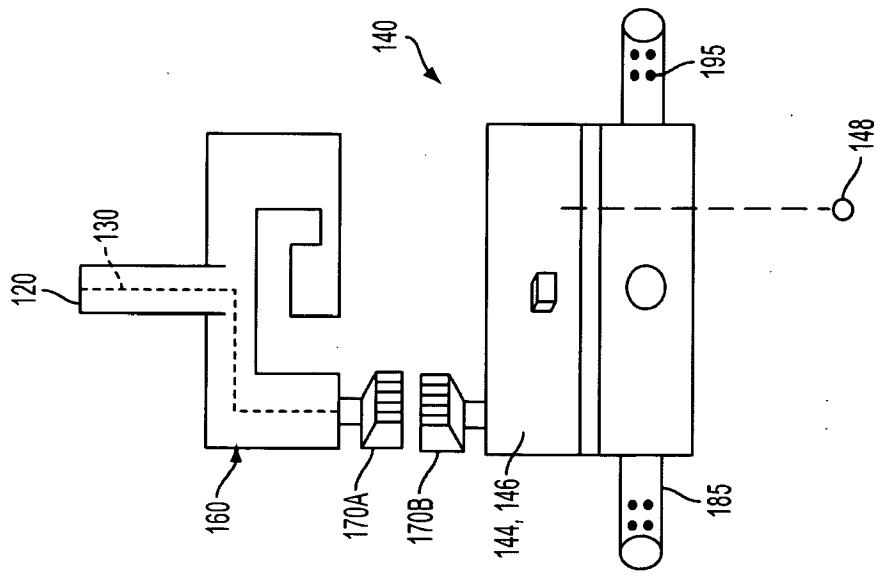


FIG. 4

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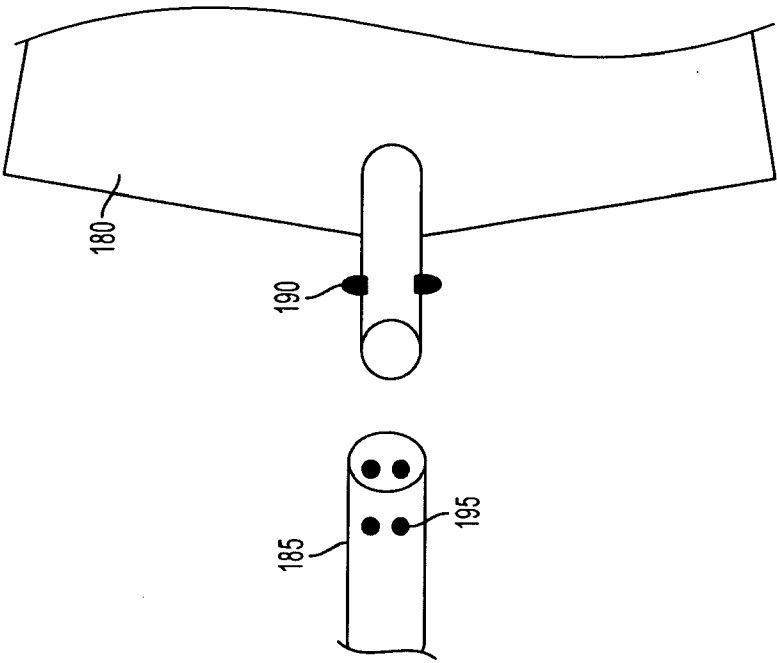


FIG. 5B

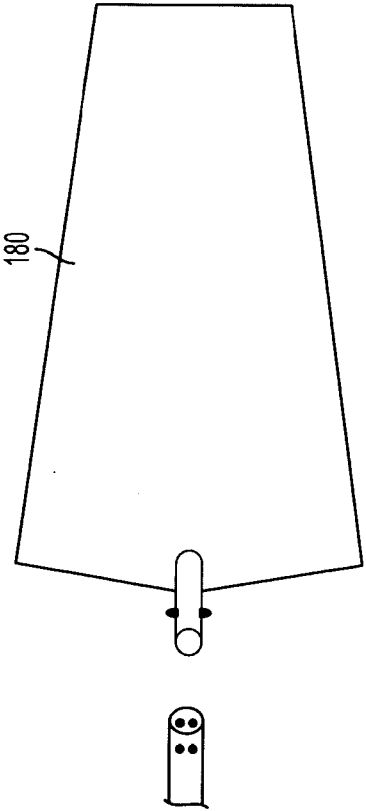


FIG. 5A

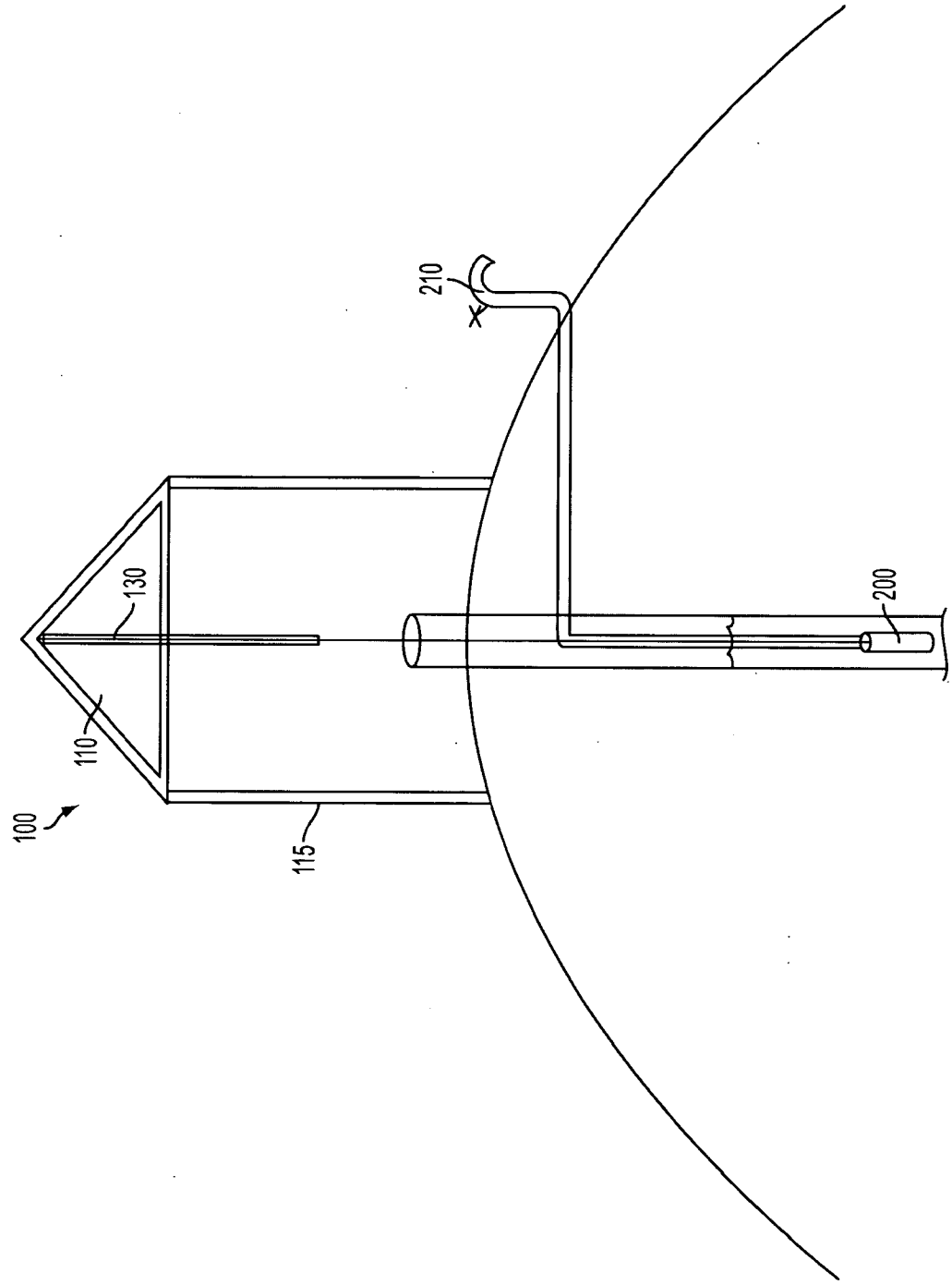


FIG. 6