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(54) **SHADING SYSTEM**

(57) The present invention relates to shading systems that are comprised of multiple individual and independent shading units mounted over at least one wire.

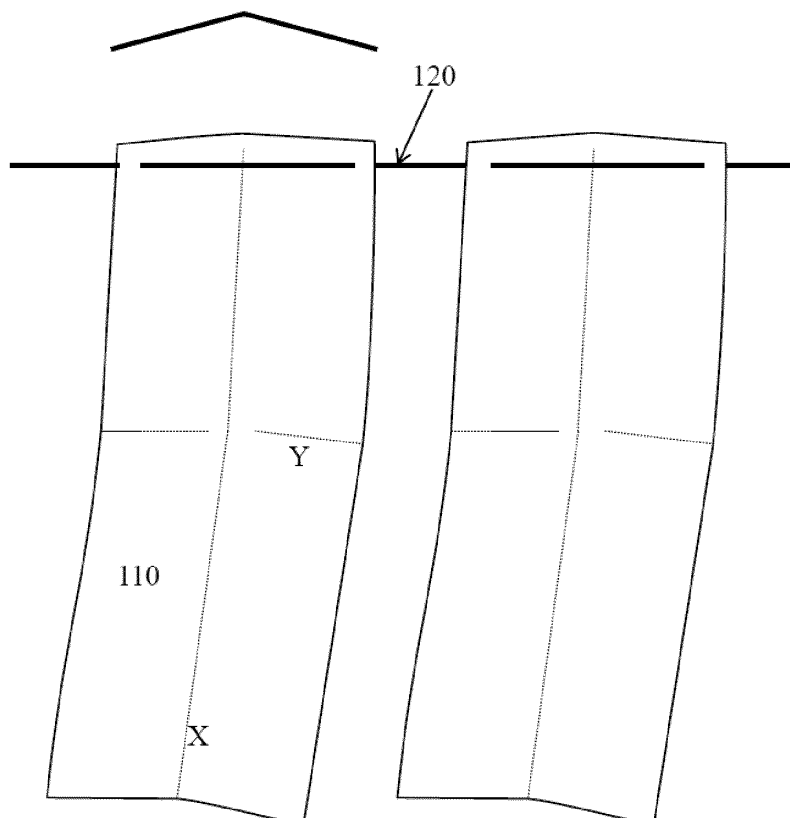


Fig. 2A

Description

FIELD OF THE INVENTION

[0001] The present invention relates in general to shading systems, more particularly, to shading systems that comprise multiple individual and independent shading units.

BACKGROUND

[0002] The invention relates to a shading system, comprising a hanging frame/net with one or multiple hanging wires, on which plurality of independent shading units are mounted, wherein each independent shading unit is mounted on a single hanging wire. Such shading systems can be used for shading areas, e.g. building's terraces and stadium tiers, open areas like gardens, open spaces and even streets, parks etc.

[0003] Various shading systems and sunshades have been developed during the years but they suffer from various drawbacks and disadvantages. For instance, the most common systems involve a shading sheet spread over the desired area to be shaded. However, such sheets tend to keep warm / moist air beneath them, such that the more shade they make the more warm/moist air is locked beneath. In addition, a shading sheet is susceptible to forces applied by wind and might tear when strong wind blows-as such, the larger the sheet is the more forces are applied thereon, which makes it more susceptible to tearing. Moreover, some of these shading sheets need to be installed in an angle to enable rainwater to flow off and prevent formation of water-pockets, which add additional pressure thereon. Other system use folding blinds to control the amount of shade according to need and sun angle, but they require sophisticated and expensive preparation and framing, a mechanical technology, and often also a power source. In addition, most sunshades used today irradiate heat towards the shaded area due to direct sunlight heating the sunshade.

[0004] Alternative approaches for shading involve the use of multiple shading units mounted on parallel strings, such as described in CN 203761903 and WO 2011/055476. However, these systems use straight shading units that do not provide constant shade during movement of the sun and/or when wind moves the units.

SUMMARY

[0005] The present invention provides a shading system **100** for shading a ground area below, the system **100** comprising: (a) at least one hanging wire **120**; (b) a plurality of shading units **110**, each one of said plurality of shading units **110** comprising an upper section and a lower section that are not on the same plane; and (c) a plurality of mounting connectors **121**, wherein said at least one hanging wire **120** is adapted to be hung above said ground area, and each one of said plurality of shading units **110** is adapted to be mounted onto a single hanging wire **120** of said at least one hanging wire **120** via one or more mounting connectors **121** connected to the upper section of each shading unit **110**, such that each shading unit **110** can tilt with air movement.

[0006] The present invention further provides a shading unit **110** for use with the shading system **100** of the invention for mounting onto a single hanging wire thereof, the shading unit **110** comprising an upper section and a lower section that are not on the same plane, and optionally, a right section and a left section that are not on the same plane.

[0007] The present invention further provides a method for shading an area, the method comprising the steps of: (a) hanging and stretching one or more hanging wires **120** in parallel to one another in accordance with the sun's movement direction; (b) mounting the shading units **110** of the invention onto the wires **120**; and c) optionally, affixing each one of the shading units **110** to the wire **120** using stoppers **114**.

[0008]

BRIEF DESCRIPTION OF DRAWINGS

Figs. 1A-1C show one specific embodiment of a shading unit of the invention: **Fig. 1A** is a front view; **Fig. 1B** is a side view; and **Fig. 1C** is a rear view.

Figs. 2A-2F illustrate some embodiments of a shading system according to the invention: **Fig. 2A** is a front view of illustrating two shading units mounted on a wire; **Fig. 2B** is a side view of a single shading unit of **Fig. 2A** mounted on a wire; **Figs. 2C-2F** are front views of different possible structure of shading units according to the invention; and **Fig. 2G** is a side view of a single shading unit of **Fig. 2F** mounted on a wire.

Figs. 3A-3C illustrate an embodiment of the shading system of the invention in which the shading units are mounted onto a main cable via a spring mechanism.

Figs. 4A-4B illustrate hot air flow (**4A**) and kinetics/movement (**4B**) of the shading units in the shading system of the invention.

Fig. 5 illustrates a shading profile created by the shading system of the invention.

Figs. 6A-6B illustrate the flexibility of the amount of shading created when using the shading system of the invention.

Figs. 7A-7C illustrate an embodiment of a shading system of the invention in which the shading units are assembled together without a main cable: **Fig. 7A** is a 3-D view; **Fig. 7B** is a side-view; and **Fig. 7C** is an upper view.

Fig. 8 illustrates another embodiment of a shading system of the invention in which the shading units are assembled together without a main cable.

Figs. 9A-9C illustrate an embodiment of a shading

system of the invention in which shading units are mounted onto a net of hanging wires via a single connection: **Fig. 9A** is a side-view; **Fig. 9B** is an upper-view; and **Fig. 9C** is a 3-D view of a shading system according to the invention with a plurality of cables and a plurality of shading units, each shading unit is mounted only on one of the plurality of cables.

Figs. 10A-10D illustrate one embodiment of a shading unit according to the invention: **Fig. 10A** is a 3-dimensional view; **Fig. 10B** is a side view; **Fig. 10C** is a front view; and **Fig. 10D** is a rear view.

Figs. 11A-11B illustrate one embodiment of a shading system according to the invention with the shading units of **Fig. 10** mounted on a net of hanging wires: **Fig. 11A** is a 3-dimensional view; and **Fig. 2B** is a side view.

Figs. 12A-12B illustrate a single shading unit mounted on a hanging wire net as illustrated in **Fig. 11**, illustrating the movement of the shading unit forward and backwards (**Fig. 12B**).

DETAILED DESCRIPTION

[0009] The present invention is aimed at providing efficient shading systems **100** that enables both dynamic shading and heat ventilation, while avoiding complicated constructions and gravity and wind-pulling effects.

[0010] When assembling sunshades, one should take into consideration the sun's movement angle, the area that needs to be shaded and wind velocity. In general, the larger the area that needs to be shaded, the greater effect wind and gravity have on standard sunshades due to moment powers applied on the sunshade that is stretched over the area. Gravity and moment powers cause sunshade sheets to sink in the middle, pull the surrounding edges, which loosens the shading sheet and applies pulling forces on the anchoring points of the shading sheet. As a result, when shading large areas, massive constructions and/or multiple supporting anchors or mounting beams are needed to both prevent sinking of the sunshade sheet(s) and distribute pulling forces between the anchoring points. Other alternatives are to add support pole(s) in the middle of the shading sheet or use solid construction frame to hold the shading sheet(s) or solid shading units.

[0011] The present invention eliminates the above effects and drawbacks by using separate independent lightweight shading units **110** that are mounted onto a single hanging wire **120** or onto a plurality of essentially parallel wires **120** or onto a net of such hanging wires **120** (see e.g. **Figs. 9C & 11**), wherein each shading unit **110** is mounted/attached onto a single wire. Accordingly, the present invention provides a shading system **100** that comprises two or more shading units **110** mounted onto a hanging wire or a net **120** thereof.

[0012] Accordingly, the present invention first provides a shading system **100** comprising: (a) at least one hanging wire **120**; and (b) a plurality of shading units **110** de-

signed to be mounted onto the at least one hanging wire **120**, each shading unit **110** comprises: (i) upper **111**- and lower **112**- sections, wherein the arch/angle between the two sections is between 91° and 179° (see "Y" in **Figs. 1 & 2**); and (ii) optionally, a right- and a left- sections, wherein the arch/angle between the two sections is between 91° and 179° (see "X" in **Figs. 1 & 2**).

[0013] The present invention further provides a shading system **100** for shading an essentially horizontal area, the system **100** comprising: (a) at least one hanging wire **120**; and (b) a plurality of shading units **110**, each one of the plurality of shading units **110** is designed to be mounted onto a single hanging wire **120** of the at least one hanging wire **120**, each shading unit **110** comprises: (i) upper- and lower- sections, wherein the arch/angle between the two sections is between 91° and 179°; and (ii) optionally, a right- and a left- sections, wherein the arch/angle between the two sections is between 91° and 179°, wherein each one of the plurality of shading units **110** is mounted onto a single hanging wire **120** of the at least one hanging wire **120** via a designated mounting connector(s) **121** such that the connector **121** enables the shading unit **110** to tilt on the hanging wire **120**.

[0014] The term "essentially horizontal area" as used herein refers to areas at any angle and size, such as mountain/hill slope, backyards, streets, balconies, etc. It should be noted that the area to be shaded does not need to be fully horizontal but can have any angle according to the surface orientation.

[0015] The present invention further provides a shading system **100** for shading a ground area below, the system **100** comprising: (a) at least one hanging wire **120**; (b) a plurality of shading units **110**, each one of said plurality of shading units **110** comprising an upper section and a lower section that are not on the same plane; and (c) a plurality of mounting connectors **121**, wherein said at least one hanging wire **120** is adapted to be hung above said ground area, and each one of said plurality of shading units **110** is adapted to be mounted onto a single hanging wire **120** of said at least one hanging wire **120** via one or more mounting connectors **121** connected to the upper section of each shading unit **110**, such that each shading unit **110** can tilt with air movement.

[0016] The term "ground area" as used herein to describe the area to be shaded refers to any area that can be walked on, including, but not limited to, actual ground, road, sidewalk, garden, field, balcony, terrace, rooftop, playing ground, etc.

[0017] In specific embodiments of the shading system **100** of the invention, a shading unit **110** further comprises a right section and a left section that are not on the same plane.

[0018] The term "same plane" as used herein means a straight, i.e. 180°, plane, that is not arched, bent or folded in an angle. The shading units **110** according to the invention are thus designed to have: a curved shape (without clear angles); an angular shaped, i.e. with a clear angle between their upper- and lower- sections and op-

tionally between their left- and right- sections; or both curved and angular shaped. In specific embodiments-when creating an imaginary line between the tips of the upper section and the lower section (and between the left and right sections) an imaginary rectangular shape is formed, either with a curved point or an angled one at the connection point between the two sections- and said curved or angled point is between 91° and 179°.

[0019] The present invention further provides individual shading units **110** that are to be used for shading an area using a shading system, each shading unit **110** comprises: (a) upper- and lower- sections, wherein the arch/angle between the two sections is between 91° and 179° (see "Y" in Figs. 1 & 2); and (b) optionally, a right- and a left-sections, wherein the arch/angle between the two sections is between 91° and 179° (see "X" in Figs. 1 & 2).

[0020] In specific embodiments of the system **100** of the invention, at least part, or all, of the of shading units **110** are permanently mounted on the at least one hanging wire **120**. It should be noted that in such a configuration, additional shading units **110** may be mounted on the hanging wire **120** if need arises, e.g. to increase the shading effect at a certain region. In further specific embodiment, the shading units **110** may be moved along the wire **120** or removed entirely according to need, e.g. to remove units **110** above a region that does not need shade.

[0021] The term "arch/angle" as used herein is aimed at describing the relationship between the different parts/sections of the shading unit **110** of the invention at their attachment/border line. Accordingly, two sections may be connected to one another in either an angle (see e.g. Figs. 2A-2C and 2E) or in a curved manner (see e.g. Figs. 2G, 2F, 3 and 9-12) which creates an arch rather than an angle.

[0022] In certain embodiments, each shading unit **110** within the system **100** is composed of two sections: a first section perpendicular to the ground and a second section connected to the first part with an angle (typically more than 90 degrees but less than 179 degrees). In specific embodiments, each shading unit **110** is made of a single sheet of material. In alternative embodiments, each shading unit **110** is made of two, three, four or more separate units attached together to obtain the final 3-dimensional form thereof.

[0023] In certain embodiments, and as illustrated in Figs. 2A-2F and 8-10, the shape of the shading units **110** of the invention can vary according to need and desire (e.g. for aesthetics purposes), e.g. like a leaf without clear separation of sections (upper/lower & right/left) (see e.g. Fig. 2D).

[0024] In certain embodiments, the arch/angle between the upper and lower sections is between 95° and 175°; between 110° and 165°; between 110° and 155°; between 110° and 145°; between 110° and 135°; between 110° and 125°. In a specific embodiment, the angle is 111°.

[0025] In certain embodiments, the arch/angle between the right and left sections is 180°, i.e. straight or no angle. In alternative embodiments, the angle is between 95° and 175°; between 110° and 165°; between 110° and 155°; between 110° and 145°; between 110° and 135°; between 110° and 125°. The purpose of such an angle is to provide structural strength the unit **110**. However, such structural strength can also be obtained by other means, such as supporting rods and/or embedded strengthening materials/wires within the material of the shading unit **110** (see e.g. **118** in Fig. 2E. Another alternative or additional way to provide structural strength to the unit **110** is to fabricate same in a unique 3-dimensional structure that provides such mechanical and structural strength, e.g. a leaf (Fig. 2D). Another alternative or additional way to provide structural strength to the unit **110** is to fabricate same from a rigid material that provides both mechanical and structural strength. It should be noted that the above examples for strengthening the shading unit **110** of the invention are for exemplary purposes only, and any other suitable technique that can strengthen the units **110** can be used as well by a skilled artisan, e.g. strengthening stitches, rigid or semi-rigid material reinforced with bar(s), etc.

[0026] It should be noted that the shading units **110** are made of a rigid material that enable the fabrication of the final shape thereof. Accordingly, the shading units **110** of the invention can be made from any rigid or semi-rigid material, such as plastic, polycarbonate, metal, wood, rubber, etc., and which is preferably light-weighted such as aluminum, plastic or some polymer such as polycarbonate.

[0027] In certain embodiments, the shading units **110** of the invention are fabricated from a flat sheet of material that is designed to be cut and fold into the final 3-dimensional shape of the unit before use. This enables saving storage space and assists in transportation of the system. In another or alternative embodiments, the shading units **110** are designed such that they can be loaded one onto/into the other in a compact manner to save space.

[0028] In certain embodiments of the shading system **100** according to any of the embodiments above, each shading unit **110** is mounted/hung/attached onto a single hanging wire **120**. In certain embodiments, each hanging wire **120** is comprised of a single wire. In specific alternative embodiments, each hanging wire **120** is comprised of a pair of parallel wires, such that each shading unit **110** is mounted thereon (see e.g. Fig. 3A), optionally using one or more dedicated connectors **121**. In specific embodiments, the connectors comprise or consist of a spring or a spring-like mechanism that enables movement (i.e. tilting forward & backward and optionally sideways) of each shading unit **110** independently from the other shading units. Such connectors **121** may be attached to each shading unit, or may be an integral part thereof. Alternatively, they may be an integral part of the wire **120**. Such connectors **121** may be mounted onto the wire **120** using any suitable attachment means such

as a clip, or may be string onto the wire prior to assembly.

[0029] In certain embodiments of the shading system **100** of any of the above embodiments, each shading unit **110** is mounted on a single wire **120** and can tilt forward & backward, and optionally sideways, independently from other shading units **110**. The tilting of each shading unit **110** is independent from that of the rest of the shading units **110**.

[0030] In certain embodiments, the shading unit **110** of the invention according to any of the embodiments above further comprises a bird repelling construct **113** at the upper surface of the upper section. Such bird repelling construct **113** may be an add-on attached to the upper surface of the unit **110** or may be formed by cutting the upper surface of the unit into spike-like elements (see Figs. 1-2).

[0031] In certain embodiments, the shading unit **110** of the invention according to any of the embodiments above is perforated (see e.g. Figs. 10-12). Such perforation of the unit **110** enables wind to pass therethrough thereby eliminating/reducing wind effect to thereby reduce moment and pulling forces applied on the entire shading system **100** and wires **120**. It should be noted that the perforation of the shading unit **110** can be in any configuration according to user's desire and may be affected by, e.g., wind velocity at different locations within the area to be shaded and decorative / ornamental desires of the user. For instance, there can be 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 or more holes in a single shading unit **110**. It should be noted that the number of holes may vary between different shading unit **110** within a single shading system **100**.

[0032] In certain embodiments, the shading unit **110** of the invention, when ready for use, exhibits a rectangle shape when viewed from the front or back, and a parallelogram shape when viewed from the side. Figs. 1A-1C illustrate how one embodiment of a shading unit **110** according to the invention looks like in a folded-ready-to-use state. It should be noted that the shading unit **110** of the invention may be fabricated as a plane sheet of material in order to reduce storage space and shipping costs, wherein the sheet of material has cut- and folding-lines for cutting and folding the sheet of material into the final 3-dimensional form of the shading unit **110** prior to use, i.e. hanging on a wire **120**.

[0033] In certain embodiments, the size, in length from top to bottom in folded-ready-to-use form, of a shading unit **110** according to the invention is from 1 to 120 cm. The size of the units **110** effects the distance between two adjacent units **110** so that the ratio between the units **110** is kept in accordance with the angle of the sun at the location's latitude and units' **110** length. The ratio between size of the units **110** and distance between two adjacent units **110** is such that optimum and desired shading is obtained, e.g. according to plant's requirements, user's desire, etc. Accordingly, when less shading is needed, the ratio can increase, and *vis-versa*.

[0034] In specific embodiments, the size, in length from

top to bottom in ready-to-use 3-dimensional form, of a shading unit **110** according to the invention is from 1 to 30 cm; from 1 to 25 cm; from 1 to 20 cm; from 1 to 15 cm; from 1 to 10 cm; from 1 to 5 cm; from 2 to 30 cm; from 3 to 30 cm; from 4 to 30 cm; from 5 to 30 cm; from 10 to 30 cm; from 15 to 30 cm; from 20 to 30 cm; or from 25 to 30 cm.

[0035] In specific embodiments, the size, in length from top to bottom in folded-ready-to-use form, of a shading unit **110** according to the invention is from 30 to 70 cm; from 30 to 65 cm; from 30 to 60 cm; from 30 to 55 cm; from 30 to 50 cm; from 30 to 45 cm; from 30 to 40 cm; from 35 to 70 cm; from 40 to 70 cm; from 45 to 70 cm; from 50 to 70 cm; from 55 to 70 cm; or from 60 to 70 cm.

[0036] In yet other alternative specific embodiments, the size, in length from top to bottom in folded- ready-to-use form, of a shading unit **110** according to the invention is from 70 to 120 cm; from 80 to 110 cm; from 90 to 100 cm; or 95 cm.

[0037] In certain embodiments, the upper sections are longer than the lower sections. In alternative embodiments, the lower sections are longer than the upper sections. In other alternative embodiments, the lower- and upper- sections are of the same length. For instance, in certain embodiments, the size of the upper portion of a shading unit **110** according to the invention is from 15 to 40 cm; from 20 to 35 cm; from 25 to 30 cm; or 28 cm, in length; and the size of the lower portion of a shading unit **110** according to the invention is from 60 to 90 cm; from 65 to 85 cm; from 70 to 80 cm; or 77 cm, in length.

[0038] It should be noted that the shading units **110** of the invention are designed to be mounted on one wire **120** of a plurality of wires **120** stretched over an area that needs shading. Accordingly, the present invention provides a shading system **100** comprising:

- (a) two or more shading units **110** according to any one of the embodiments above; and
- (b) at least one hanging wire **120**.

[0039] In certain embodiments, the number of shading units **110** and the distance between two adjacent units **110** may vary according to desire, size of the area that needs shading, and/or the shading requirements/desired density of each region within the area to be shaded. In specific embodiments, the number of shading units **110** to be mounted on a single wire **120** is from 2 to 50, and the distance between two adjacent units **110** is from about 0 mm to about 30 cm; from about 10 mm to about 25 cm; from about 20 to about 20 cm; from about 20 to about 30mm; from about 25 to about 30mm; from about 5 to about 25mm; from about 5 to about 20mm; from about 5 to about 15mm; from about 5 to about 10mm; or at least about 10mm. In certain embodiments, the shading units **110** are spread throughout the entire length of each wire **120**.

[0040] In certain embodiments, the mounting of the shading units **110** on the wire **120** is carried out prior to

the hanging / securing of the wire **120** in place, e.g., while the wire **120** still lays on the ground or hang / secured to an anchoring point only on one side. In alternative embodiments, the mounting of the shading units **110** on the wire **120** is carried out after the wire **120** has been hang / secured in place and stretched.

[0041] Each one of the shading units **110** according to any of the embodiments above is designed to be mounted onto a single hanging wire **120**. Accordingly, in certain embodiments, the system of the invention further comprises a mounting mechanism(s) designed to enable the hanging each individual shading unit **110** onto the hanging wire **120**. The mounting mechanism may be an independent mechanism or an integral part of each shading unit **110**, optionally fabricated together therewith (see e.g. Figs. 9 and 10). Non limiting examples of such mounting mechanism(s) are holes in the shading units **110** through which the wire **120** can pass; hooks (Fig. 10); clamps; etc.

[0042] In order to prevent movement of the shading units **110** along/across the wire **120**, the shading units **110** according to any of the embodiments above may, in certain embodiments, further include an integral stopping mechanism, such as a unique fold of the material from which the shading units **110** is made of, that generate friction and prevent movement of the unit **110** when mounted on the wire **120**. Alternatively, an external stopper **114** may be used. Accordingly, in certain embodiments, the system **100** further comprises one, two or more stoppers **114** designed to affix the shading units **110** to the hanging wire **120** and prevent movement thereof along the wire **120**. In certain embodiments, such stoppers **114** may be mounted on the wire **120** after it has been hanged/secured in place and stretched and after mounting the shading units **110** thereon. In specific embodiments, such stoppers **114** constitute part of the shading unit **110** itself. In alternative embodiments, when a plurality of hanging wires **120** constitute a net, the prevention of the movement of the shading units **110** across the hanging wire **120** is achieved by hanging/mounting each shading unit **110** at a different intersection point of the wires **120** in the net, such that each shading unit **110** is mounted onto one wire (see e.g. Fig. 11) while the crossing wire within the net is passed between the connectors **121** thereby preventing sliding of the unit **110** sideways. In specific embodiments, such a configuration may also limit the tilting angle of the unit **110** forwards and/or backwards.

[0043] The wires **120** used in the system **100** of the invention are made from any suitable material, and can be made of, e.g., plastic, rope, metal etc. The wires **120** are designed to be affixed to adequate support, such as a wall, a poll, a tree, etc. Accordingly, in certain embodiments, the shading system **100** of the invention according to any of the embodiments above further comprises wall fixation units for affixing the hanging wire(s) **120** to such a support. The type and number of the wall fixation units can vary according to the type of support to which

the wire is designed to be secured, and according to the number of wires **120** that are to be hung.

[0044] The supports should be strong enough to withstand pulling powers applied by the wire **120** stretched between. In order to reduce possible pulling powers, it is possible to use springs- either as an integral mechanism of the wall fixation units being used to affix the wire **120** to the support, or as an independent unit/mechanism. Accordingly, in certain embodiments, the shading system **100** of the invention further comprises springs at one or both ends of each one of the hanging wire(s) **120** designed to eliminate/reduce pulling forces applied on the wire **120** when hung/ secured to the supports.

[0045] In certain embodiments of the system **100** according to any one of the embodiments above, a plurality of hanging wires **120** are elements of a net that is designed to be hung over the area to be shaded. In alternative embodiments, a plurality of (independent) hanging wires **120** are designed to be hung, e.g., in parallel (or essentially in parallel) to one another over the area to be shaded. It should be noted that the size of the net of wires, or the amount and length of each one of the wires **120** within a shading system **100** can be modified according to need and the area to be shaded. As such, a net can have any shape and size, such as rectangular, triangular, parallelogram, round, etc.

[0046] In certain embodiments of the system **100** according to any one of the embodiments above, the at least one hanging wire(s) **120** or net of wires is made of a rigid but flexible wire, such as a metal wire. Such configuration enables flexible installation in complexed area and enable simple adjustments of the length, size and angles of the hanging wire(s) **120**. In alternative embodiments, the wire(s) **120** or net of wires is made of a rigid and non-flexible material, such as an iron rod (optionally an iron-bar net). Such configuration reduces the pressure and pulling effect on the wire, but requires more complicated supports and constructions. It is also less susceptible to adjustments to the area. Nevertheless, it might be favorable when an existing construction already exists, such as a balcony and pergola.

[0047] In certain embodiments, the hanging wire/net **120** is designed to be hung over the area to be shaded at any angle from the ground, e.g. parallel to the ground or not. In specific embodiments, part of the hanging wire/net **120** is designed to be hung over the area to be shaded essentially parallel to the ground and the rest of it is designed to be hung diagonally to the ground, e.g. to provide or prevent sun rays penetration during sunrise and sunset. In specific embodiments, the hanging wire/net **120** is designed to be hung essentially completely diagonally to the ground. The hanging angle is determined according to the sun direction and shading needs.

[0048] In certain embodiments, the number of hanging wires **120** and the distance between two adjacent wires **120** may vary according to desire, size of the area that needs shading, and/or the shading requirements/desired density. In specific embodiments of the shading system

100 of any of the embodiments above, the number of hanging wires **120** to be stretched across an area is from 2 to 50 or more, and the distance between two adjacent wires **120** is from about 15 cm to about 80 cm; from about 30 cm to about 70 cm; from about 40 cm to about 70 cm; from about 30 cm to about 60 cm; from about 40 cm to about 60 cm; or about 55 cm.

[0049] Unless otherwise indicated, all numbers used in this specification are to be understood as being modified in all instances by the term "about". Accordingly, unless indicated to the contrary, the numerical parameters set forth in this specification are approximations that may vary by up to plus or minus 10% depending upon the desired properties to be obtained by the present invention.

[0050] In certain embodiments, the shading system **100** of the invention comprises: (a) a plurality of essentially parallel wires/strings **120** stretched over an area to be shaded; and (b) a plurality of shading units **110** attached to each wire/string **120** and hanging down (towards the ground) from the wire/string **120**, wherein each unit **110** has a certain degree of rotational movement, e.g. when the wind blows, the unit **110** is free to move/tilt in the direction of the wind, while remaining connected to the wire/string **120**.

[0051] One of the purposes of the shading system **100** of the invention is to offer shading urban areas without being affected by strong winds and gravitational effect of large . As explained above, hanging a large shading sheet above an area is susceptible to strong winds that might pull up/down and collapse the entire construction. Contrary to that, the structure of the present shading system **100** causes winds to simply rotationally move the shading units **110** without destabilizing the entire construction and without applying moment forces thereon (or applying extremely reduced moment forces compared to standard shading sheets).

[0052] Accordingly, in certain embodiments of the system **100** and shading units **110** of any of the embodiments above, each shading unit **110** further comprises a hinge that enables, when mounted on the wire **120**, the tilting/rotation/dangling of the unit **110** on the wire **120**, e.g. when wind is blowing. In alternative embodiments, the system **100** further comprises such hinges that are independent from the shading units **110**, and onto which the shading units **110** are to be mounted and attached therewith to the wire **120** to thereby enable the tilting/rotation/dangling of the unit **110** on the wire **120**.

[0053] In certain embodiments, each shading unit **110** is covered-with an additional material designed to reduce the sound caused when two adjusting units **110** hit one another during tilting, and/or when wind blows over it, and/or to increase the units' **110** weight such as to reduce their mobility and their tilting. In specific embodiments, each shading unit **110** further comprises a weight to increase its weight such as to reduce mobility and tilting.

[0054] It should be noted that the tilting/rotation/dangling of the shading unit **110** on the wire **120** is also ben-

eficiary in terms of reducing heat-load and moisture underneath the shading system **100**: as illustrated in Fig. 4A, due to the spaces between the shading units **110** mounted on the wire(s) **120**, warm air can freely move up from the shaded area thereby reducing both the heat-load and the moisture at the shaded area. Such flow of hot air might be increased when the shading units **110** tilt/rotate/dangle (e.g. due to wind blowing), thereby further reducing the heat-load at the shaded area (see. Fig. 4B). In certain embodiments, the rising of the hot air causes the shading units **110** to tilt/rotate/dangle.

[0055] The term "free" as used herein in relation to the tilting of the shading units **110** means that the tilting is not manually or electronically controlled but is carried out by the movement of air (e.g. wind or hot air).

[0056] In certain embodiments, the present invention further provides a shading system **100** comprising: (a) a plurality of shading units **110** designed to be sequentially connected to one another to create a string of shading units, each shading unit **110** comprises: (i) upper- and lower- sections, wherein the arch/angle between the two sections is between 91° and 179°; and (ii) optionally, a right- and a left- sections, wherein the arch/angle between the two sections is between 91° and 179°, and (b) a plurality of connecting elements **115** for connecting one shading unit to the next or to an adequate support. In specific embodiments, each shading unit comprises at least one connecting element and constitute a single unit.

[0057] In specific embodiments, the above-mentioned shading system **100** further comprises at least one spring at one or both ends of each of the string of shading units **110** designed to eliminate/reduce pulling forces applied thereon when attached/connected to the adequate support.

[0058] Reference is now made to Figs. 7A-7C and 8 illustrating a shading system **100** according to one embodiment of the invention, wherein the system comprises independent shading units **110** connected to one another in a consecutive manner with a connection element **115** and securing means **116** such as a bolt or pin, or any other attachment mechanism, such as a ratchet mechanism. In certain embodiments, the connection elements **115** are made of elastic or semi-rigid material enabling flexibility to the generated line of shading units as well as to each shading unit **110** in terms of front & back and sideways movement when hung. Such flexibility assists in preventing tearing of the line of shading units due to moment forces applied thereon, e.g. due to wind. In addition, the flexibility of movement of each shading unit **110** enable it to tilt in the wind and both reduce moment forces applied on the line and aids in cooling the shaded area as explained above.

[0059] In certain embodiments, the connection element **115** further comprises a spring or a spring-like mechanism to provide movement flexibility to the attached shading unit **110** (see e.g. Figs. 3A-3C).

[0060] Reference is now made to Figs. 9A-9C illustrating a shading system **100** according to one embodiment

of the invention, wherein the system comprises independent shading units **110** connected to a net of wires **120** in a consecutive manner via an integral connection element with a flexible/elastic/spring-like portion enabling flexibility of each shading unit **110** in terms of front & back and sideways movement once hung. Such flexibility assists in preventing tearing of the wires in the net due to moment forces applied thereon, e.g. due to wind. In addition, the flexibility of movement of each shading unit **110** enables it to tilt in the wind and both reduce moment forces applied on the line and aid in cooling the shaded area as explained above. The connection of each shading unit **110** to the net of wires **120** is carried out by any suitable means, such as a securing means like a bolt or pin, or other attachment mechanism, such as a ratchet mechanism. In certain embodiments, each shading unit **110** is mounted-on/connected-to only to one of the wires within the net of wires **120**. In alternative embodiments, each shading unit **110** is mounted-on/connected-to one intersection of the wires in the net. In a further specific embodiment, the shading unit **110** is mounted-on/connected-to an intersection of the wires in the net such that it cannot move along the wire since it is blocked by the crossing wire at the connection point (see e.g. Fig. 11A).

[0061] Notably, the number of shading units connected together to form a line of shading units varies according to the length of the area to be covered. Notably, it is possible to use connection elements at different lengths in order to generate different distances between adjacent shading units **110** along the generated line to control the generated shading effect. Alternatively, or in addition, two connecting elements **115** may be joined together to generate a larger distance between two successive shading units **110**. In addition, the number of lines of shading units is determined according to the area to be covered/shaded, and the distance between the lines/wires is determined according to the size/width of the shading units **110** and the desired shading effect.

[0062] In certain embodiments, each shading unit **110** is connected to the next shading unit **110** using two parallel connecting elements **115** to generate two parallel lines (see e.g. Fig. 7C). Alternatively, each shading unit **110** is connected to the next shading unit **110** using a single line connecting element **115** to generate a single line (see e.g. Fig. 8).

[0063] Reference is now made to Figs. 10-12 illustrating one possible embodiment of a shading system **100** and shading units **110** according to the invention. As illustrated, the system **100** comprises independent shading units **110** connected to a net of wires **120** in a consecutive manner via a connector **121** that is an integral part of the shading units **110** and which allows forward and backward movement of each unit **110** independently from the other units. As illustrated, the shading units **110** have a curved shape- both horizontally and vertically, creating a spoon-like form that in addition to an aesthetic appearance, also assists in structural strength and overlapping for shading purposes. As seen, each shading

unit **110** further includes holes/perforations that enable passage of wind and heat therethrough. It should be noted that some or all of the holes have a partial cover thereover (see Fig. 10B and 11A) that assist in capturing wind and movement/tilting of the units **110**.

[0064] The present invention further provides a method for shading a desired and essentially horizontal area, the method comprising the steps of: (a) hanging and stretching net of hanging wires **120**, or one or more hanging wires **120** essentially in parallel to one another, in accordance with the sun's movement direction; (b) mounting shading units **110** according to any of the embodiments above onto the net or the wires **120**; and c) optionally, affixing each shading unit **110** to the wire **120**, e.g. using stoppers **114**.

[0065] In another embodiment, the present invention provides a method for shading an essentially horizontal area, the method comprising the steps of: (a) providing a shading system **100** in which the shading units **110** are already mounted/connected to the hanging wires **120** or net of wires; (b) hanging and stretching one or more hanging wires **120** in parallel to one another in accordance with the sun's movement direction; (c) optionally, mounting additional shading units **110** onto the wires **120** according to need; and (d) optionally, affixing each one of the additional shading units **110** to the wire **120** using, e.g., stoppers **114**.

[0066] In certain embodiments of the method according to the invention, the spacing between the shading units **110** is determined according to shading needs and desired shading coverage. As illustrated in Figs. 5, 6A and 6B, shading percentage can be controlled and changed within a single shading area by changing the spaces between the shading units **110**.

[0067] The present invention further provides a shading system **100** comprising (a) a plurality of shading units **110** designed to be sequentially connected to one another to create a string of shading units, each shading unit **110** comprises: (i) upper- and lower-sections, wherein the arch/angle between the two sections is between 91° and 179°; and (ii) optionally, a right- and a left- sections, wherein the arch/angle between the two sections is between 91° and 179°; and (b) a plurality of connecting elements **115** for connecting one shading unit **110** to the next or to an adequate support.

[0068] In specific embodiments of the above system **100**, the at least one of the plurality of the connecting elements **115** is an integral part of each shading unit **110** of the plurality of shading units **110** and is connected/located at the upper section thereof.

[0069] In further specific embodiments, the above system **100** further comprises: (i) springs at one or both ends of each one of the string of shading units designed to eliminate/reduce pulling forces applied thereon when attached/connected to the adequate support; and/or (ii) a spring element between each shading unit **110** and the connecting elements **115** (in specific embodiments, the connecting elements **115** are flexible and act as a spring

mechanism).

[0070] In specific embodiments, the present invention provides a method for shading an area using the above mentioned shading system **100**, the method comprising the steps of: (a) providing the shading system as described above; (b) connecting the shading units **110** in a sequential manner to create a line of shading units **110**, optionally by using connection elements **115** and securing means **116**; and (c) hanging and stretching the line of shading units **110** between two adequate support points, optionally in accordance with the sun's movement direction.

[0071] In certain embodiments, the distance and angle (see e.g. angle α in Fig. 3C) between two adjacent shading units is determined according to shading needs and shading unit's dimensions. In certain embodiments, angle α is in between 46° and 89° , such as 50° , 55° , 60° , 65° , 70° , 75° , 80° or 85° .

Claims

1. A shading system **100** for shading a ground area below, the system **100** comprising:

- a) at least one hanging wire **120**;
- b) a plurality of shading units **110**, each one of said plurality of shading units **110** comprising an upper section and a lower section that are not on the same plane; and
- c) a plurality of mounting connectors **121**,

wherein said at least one hanging wire **120** is adapted to be hung above said ground area, and each one of said plurality of shading units **110** is adapted to be mounted onto a single hanging wire **120** of said at least one hanging wire **120** via one or more mounting connectors **121** connected to the upper section of each shading unit **110**, such that each shading unit **110** can tilt with air movement.

2. The shading system **100** of claim 1, wherein a shading unit **110** further comprises a right section and a left section that are not on the same plane.
3. The shading system **100** of claim 1 or 2, wherein a shading unit **110** of said plurality of shading units **110** further comprises one or more mounting connectors **121** on the upper section, as an integral part thereof.
4. The shading system **100** of any one of claims 1-3, wherein some or all of said plurality of shading units **110** are perforated.
5. The shading system **100** of any one of claims 1-4, wherein some or all of said plurality of shading units **110** are permanently mounted on said at least one hanging wire **120**.

6. The shading system **100** of any one of claims 1-5, wherein a plurality of hanging wires **120** are elements of a net.

7. The shading system **100** of any one of claims 1-5, wherein a plurality of hanging wires **120** are hung in parallel to one another.

8. A shading unit **110** adapted for use with the shading system of any one of claims 1-7, for mounting onto a single hanging wire **120**, said shading unit **110** comprising an upper section and a lower section that are not on the same plane.

9. A method for shading a ground area, the method comprising the steps of:

a) hanging and stretching one or more hanging wires **120** essentially in parallel to one another; and

b) mounting shading units **110** comprising an upper section and a lower section that are not on the same plane, onto said wires **120** via one or more mounting connectors **121** connected to the upper section of each shading unit **110**, such that each shading unit **110** can tilt with air movement.

10. The method of claim 9 for shading a ground area, wherein some or all of said plurality of shading units **110** are permanently mounted on said at least one hanging wire **120**, the method further comprising the steps of mounting additional shading units **110** onto said wires **120** according to need.

11. A shading system **100** comprising

- a) a plurality of shading units **110** designed to be sequentially connected to one another to create a string of shading units, each shading unit **110** comprising an upper section and a lower section that are not on the same plane; and
- b) a plurality of connecting elements **115** for connecting the upper section of one shading unit **110** to the upper section of the next shading unit **110** or to a support,

wherein each one of said plurality of shading units **110** can tilt with air movement.

12. The shading system **100** of claim 11, wherein at least one of said plurality of said connecting elements **115** is an integral part of each shading unit **110** of said plurality of shading units **110** and is connected/located at said upper section thereof.
13. The shading system **100** of claim 11 or 12, further comprising a spring element between each shading

unit **110** and said connecting elements **115**.

- 14.** A method for shading an area, the method comprising the steps of:

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a) providing the shading system of any one of claims 11-13;

b) connecting said shading units **110** to one another in a sequential manner to create a line of shading units **110**, optionally by using connection elements **115** and securing means **116**; and

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c) hanging and stretching said line of shading units **110** between two adequate support points.

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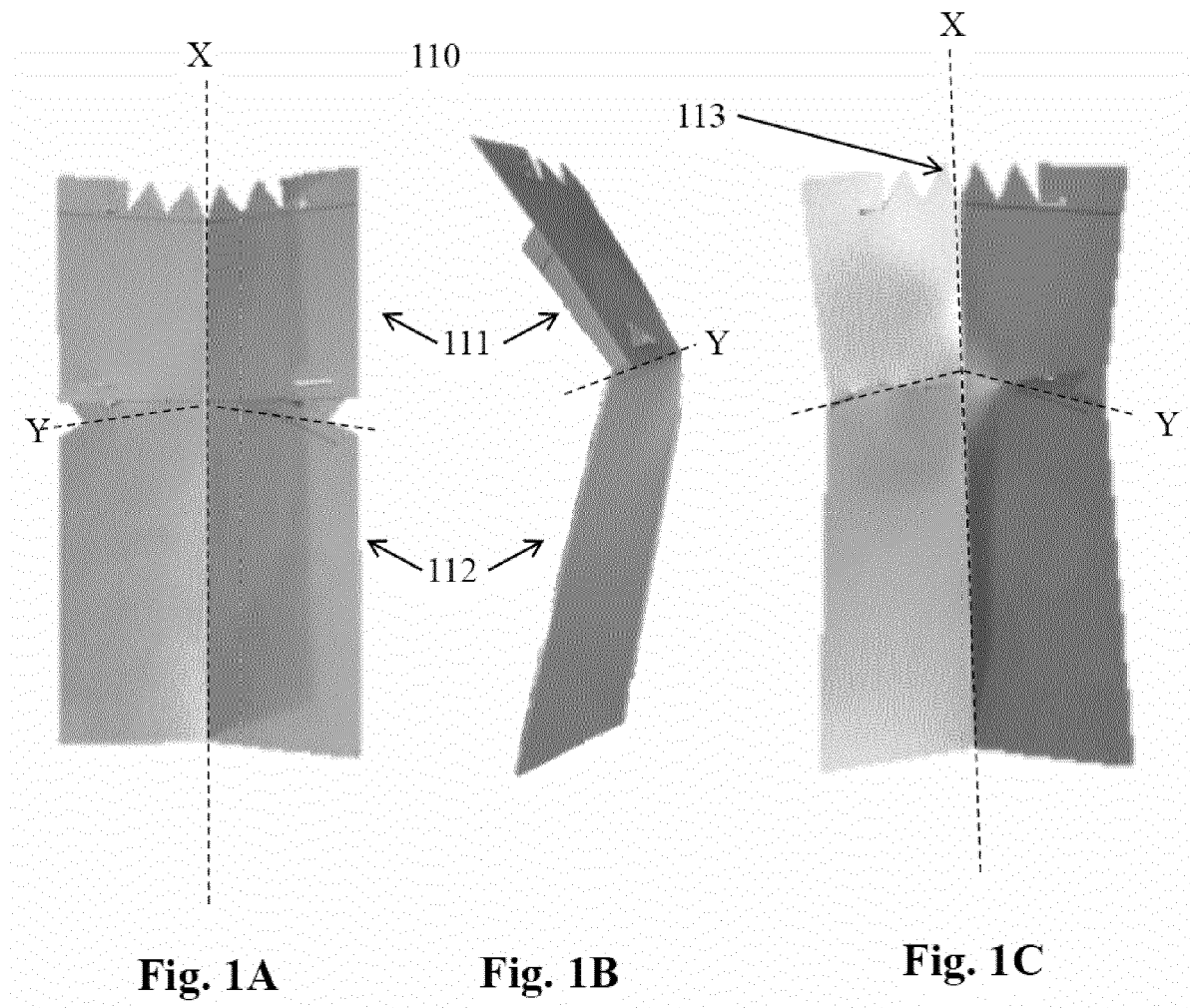
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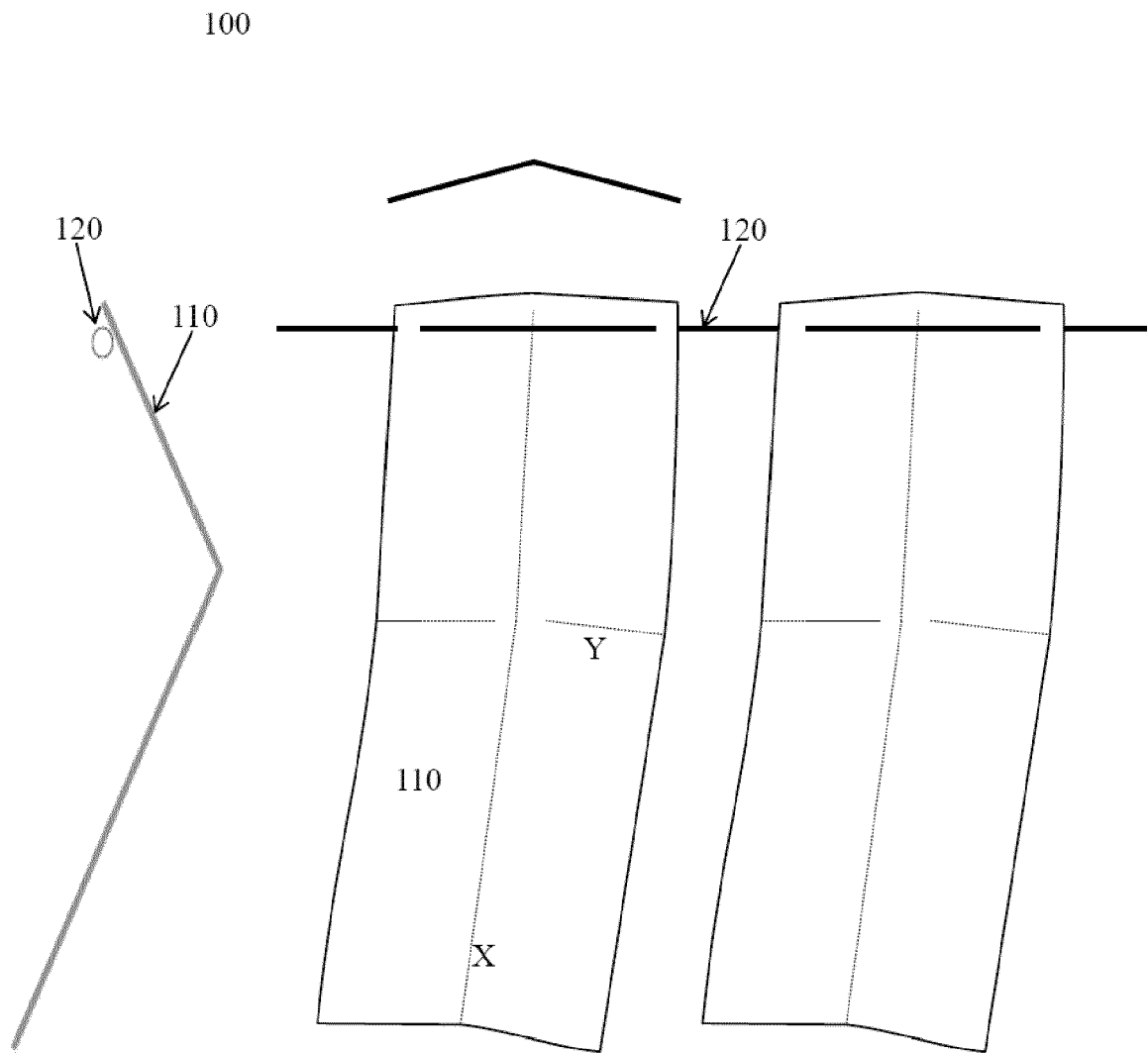


Fig. 2B

Fig. 2A

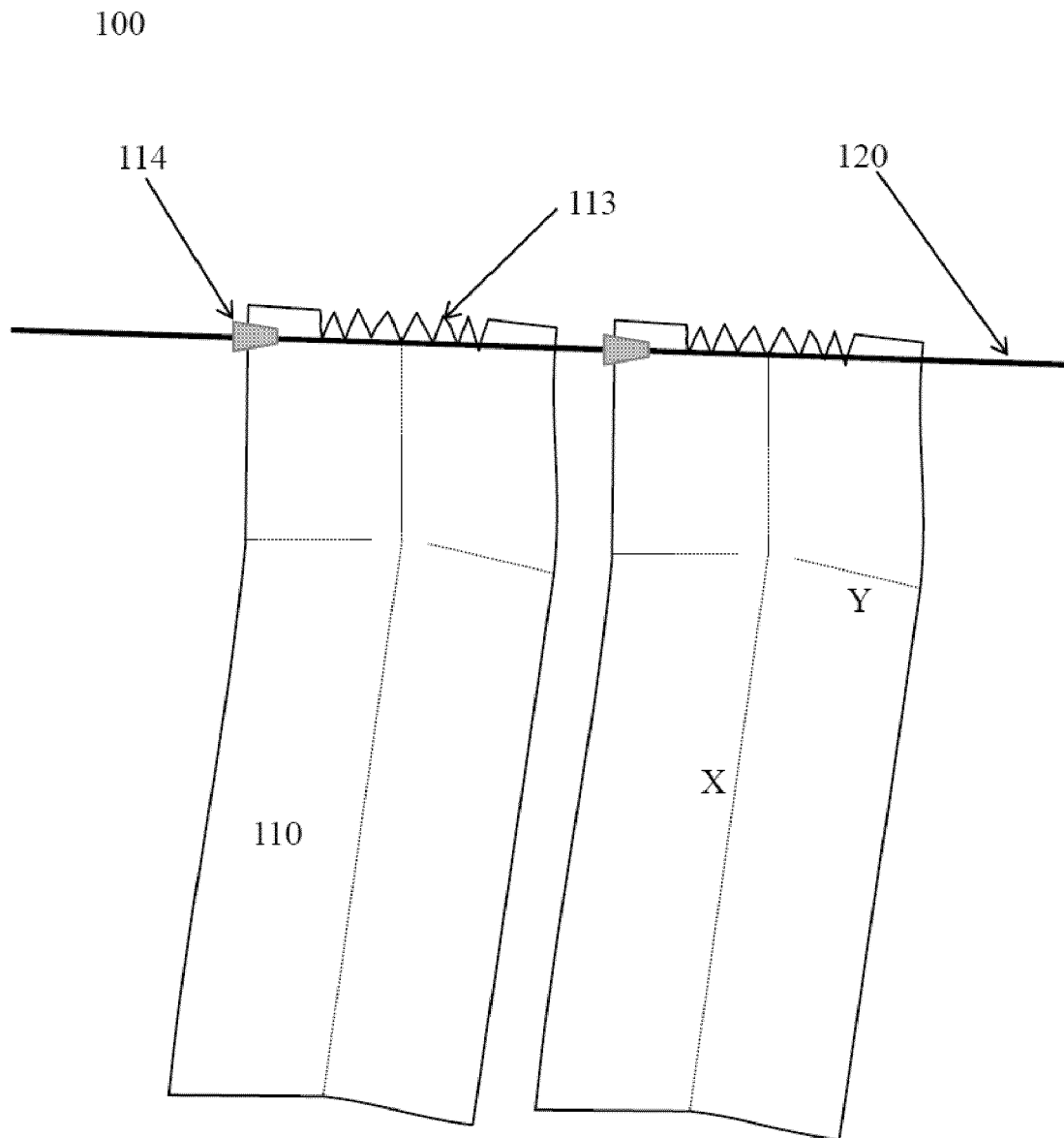


Fig. 2C

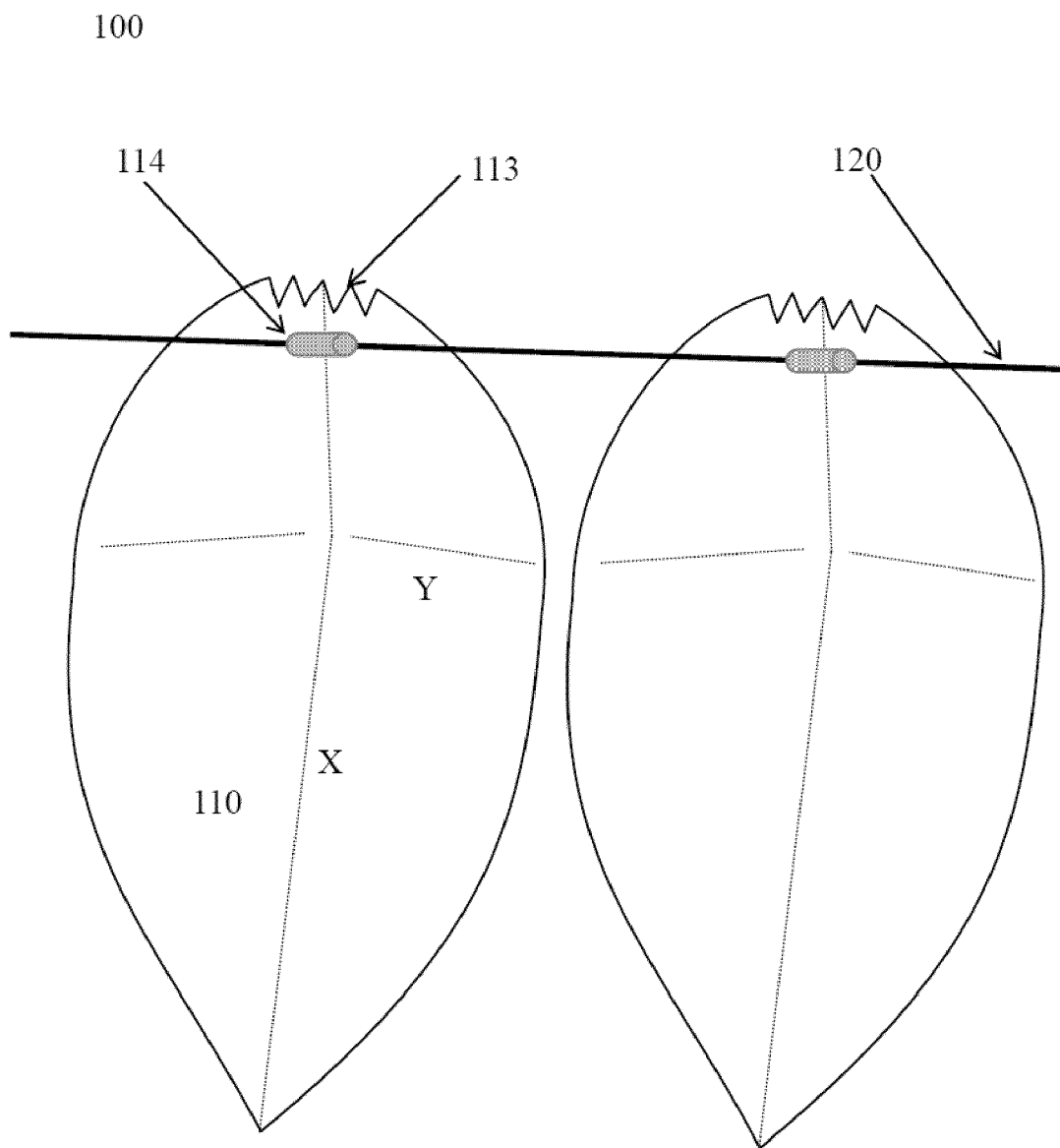


Fig. 2D

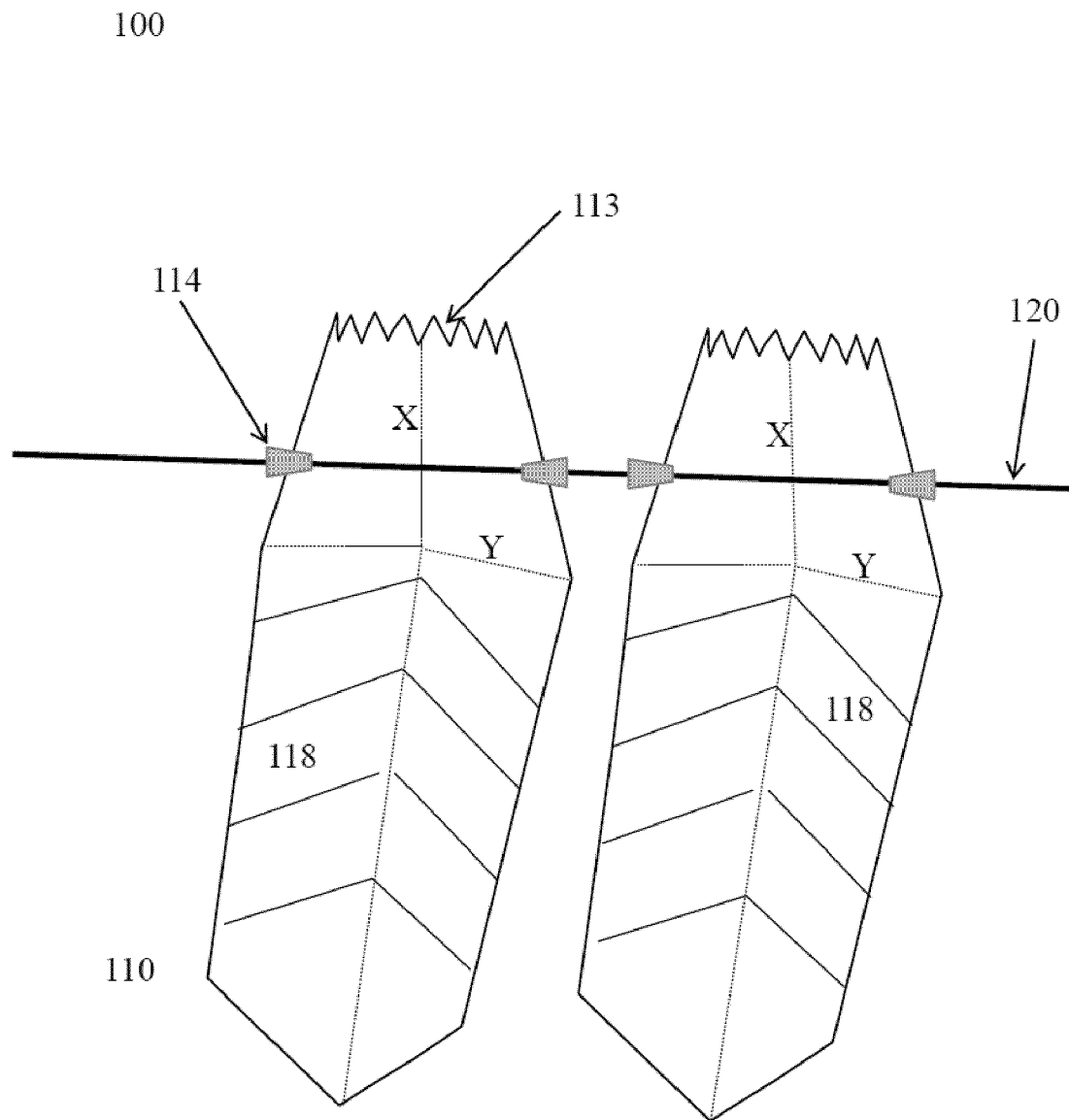


Fig. 2E

100

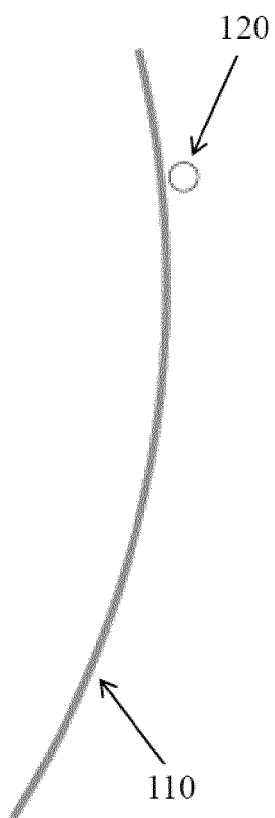


Fig. 2G

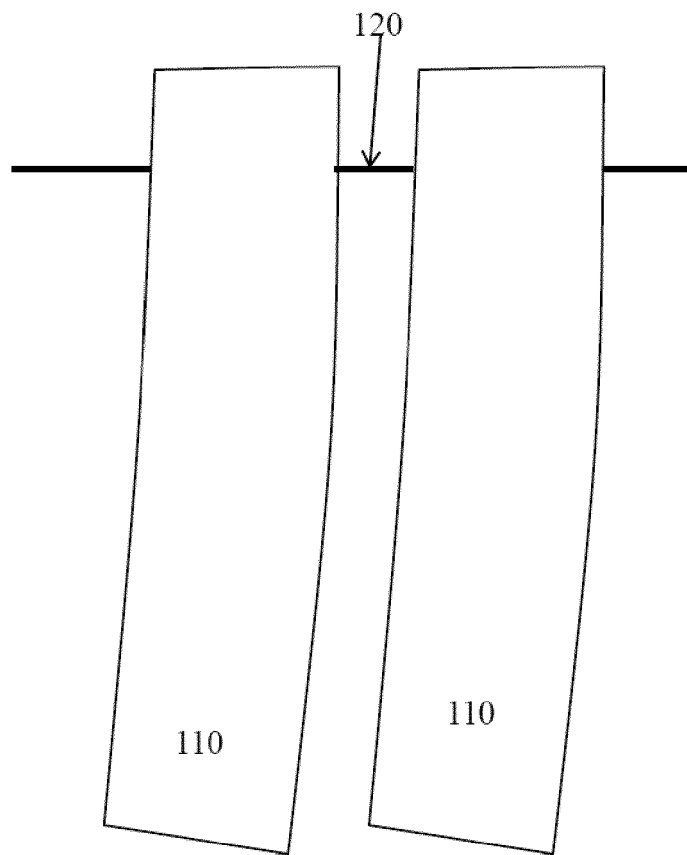


Fig. 2F

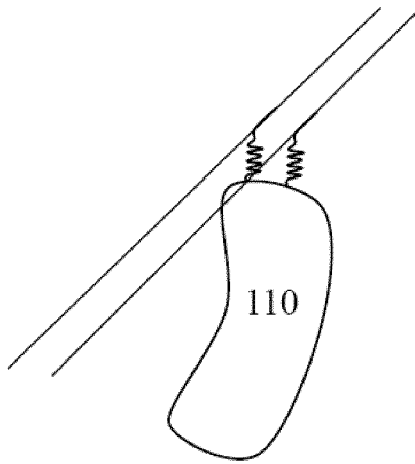


Fig. 3A

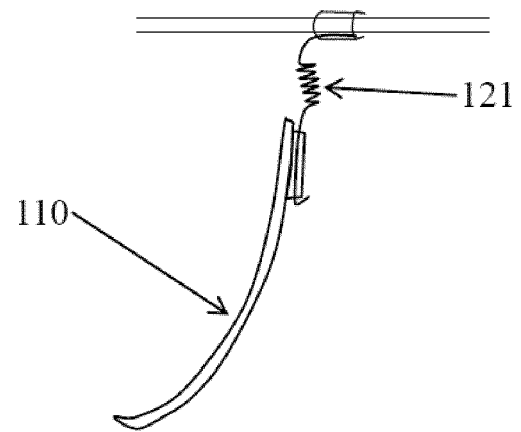


Fig. 3B

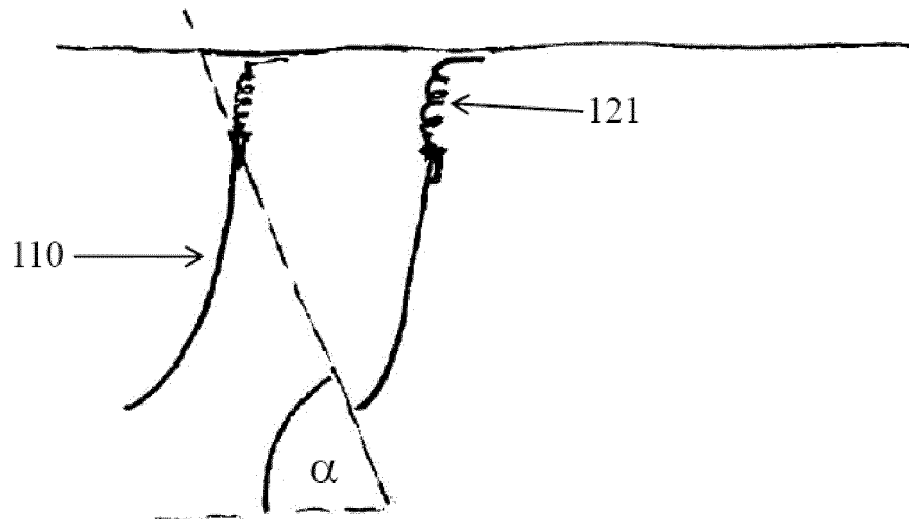


Fig. 3C

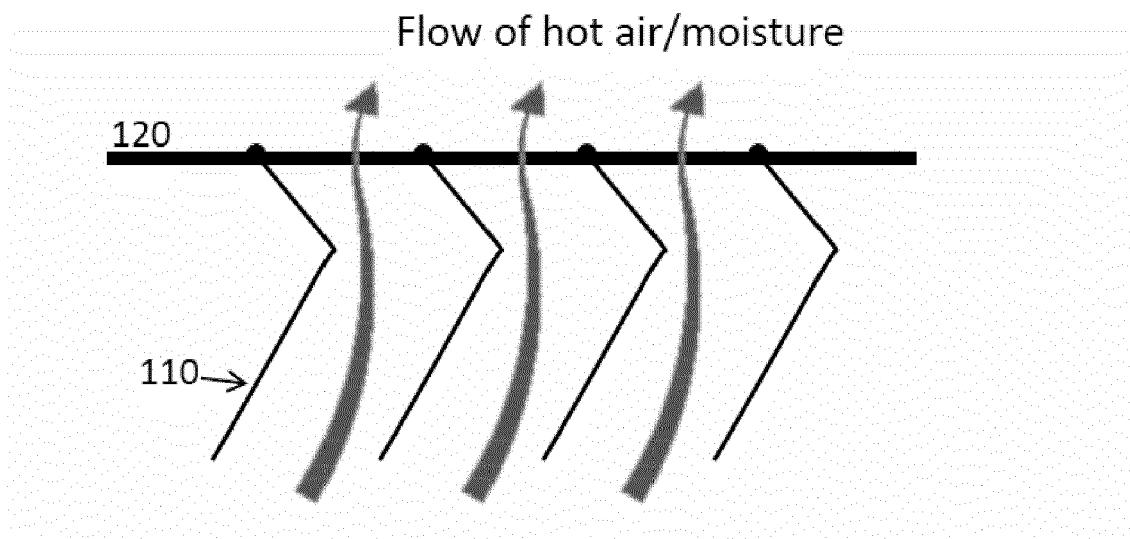


Fig. 4A

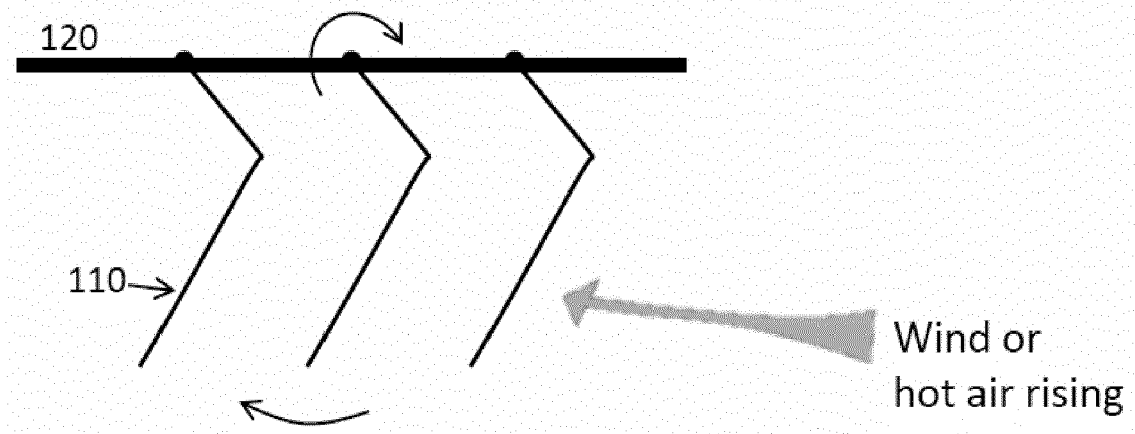


Fig. 4B

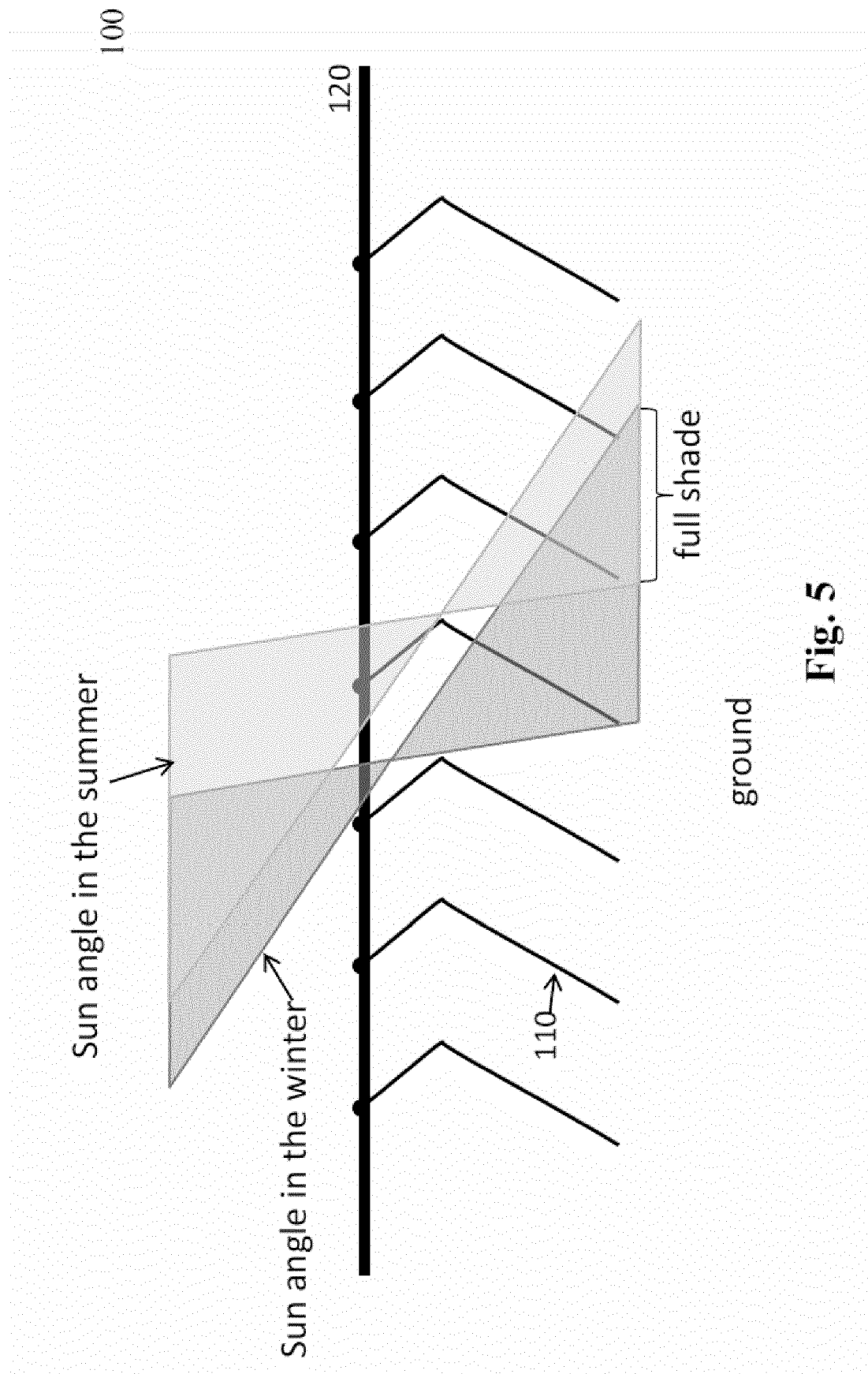


Fig. 5

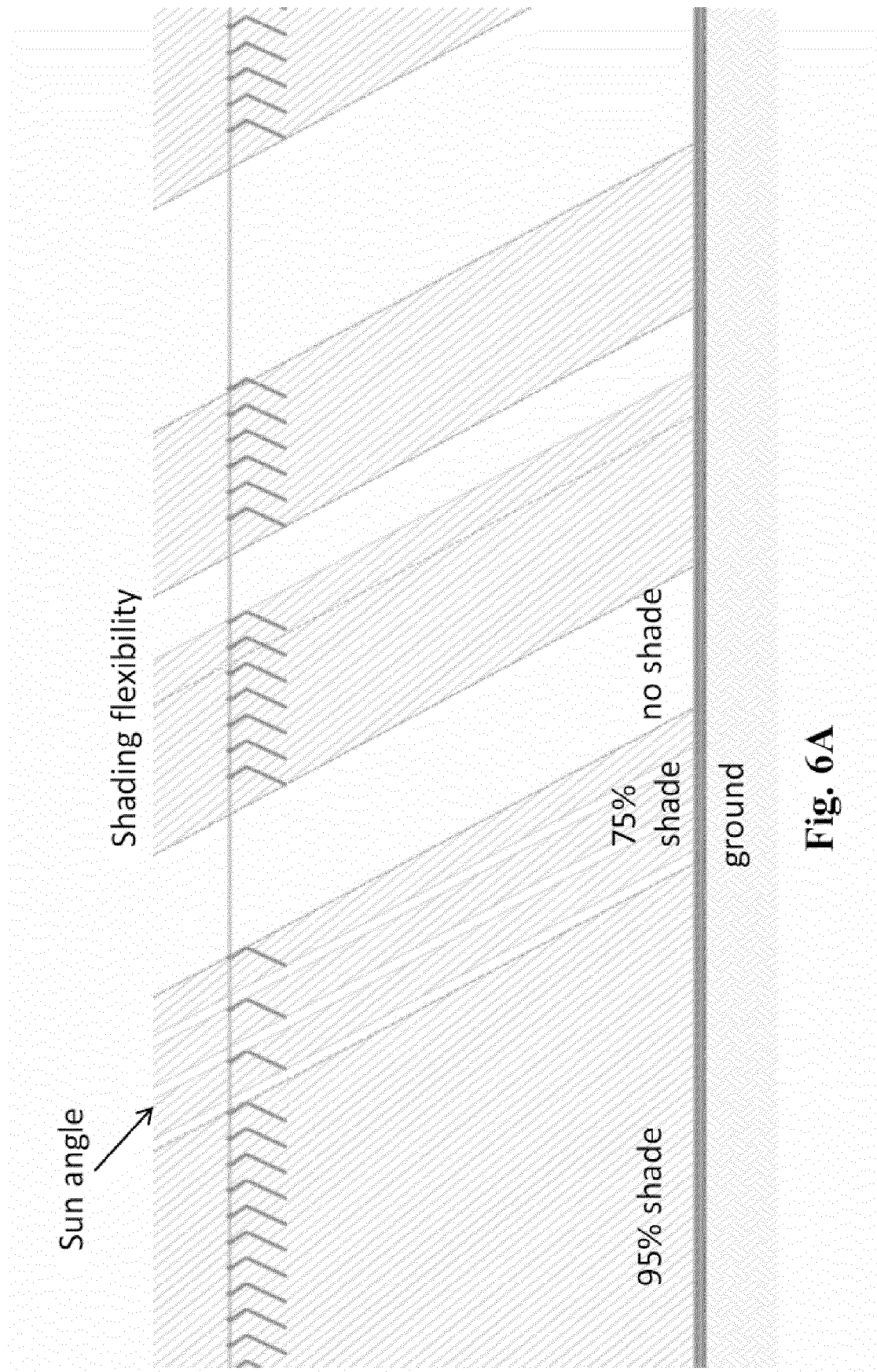


Fig. 6A

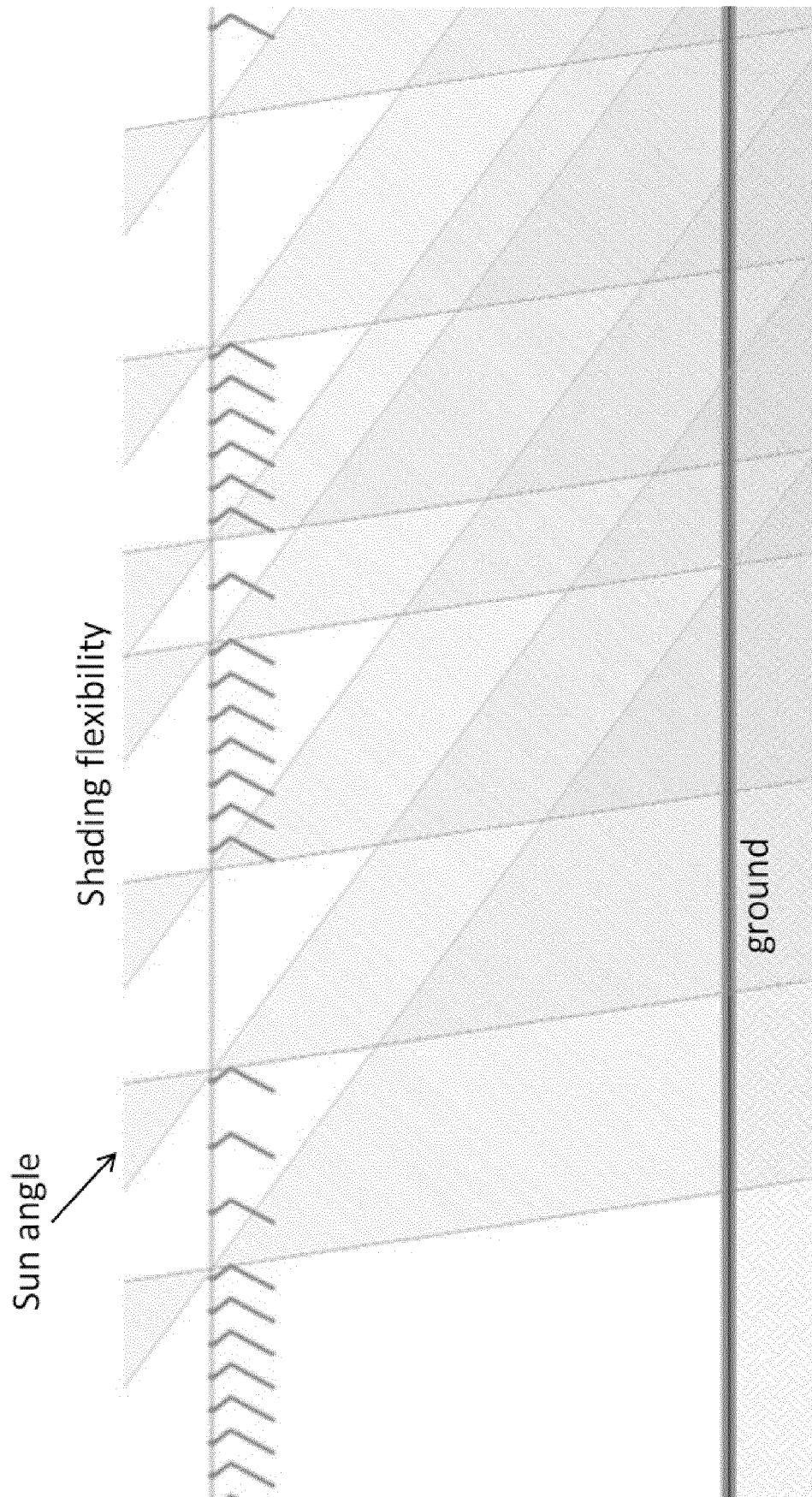


Fig. 6B

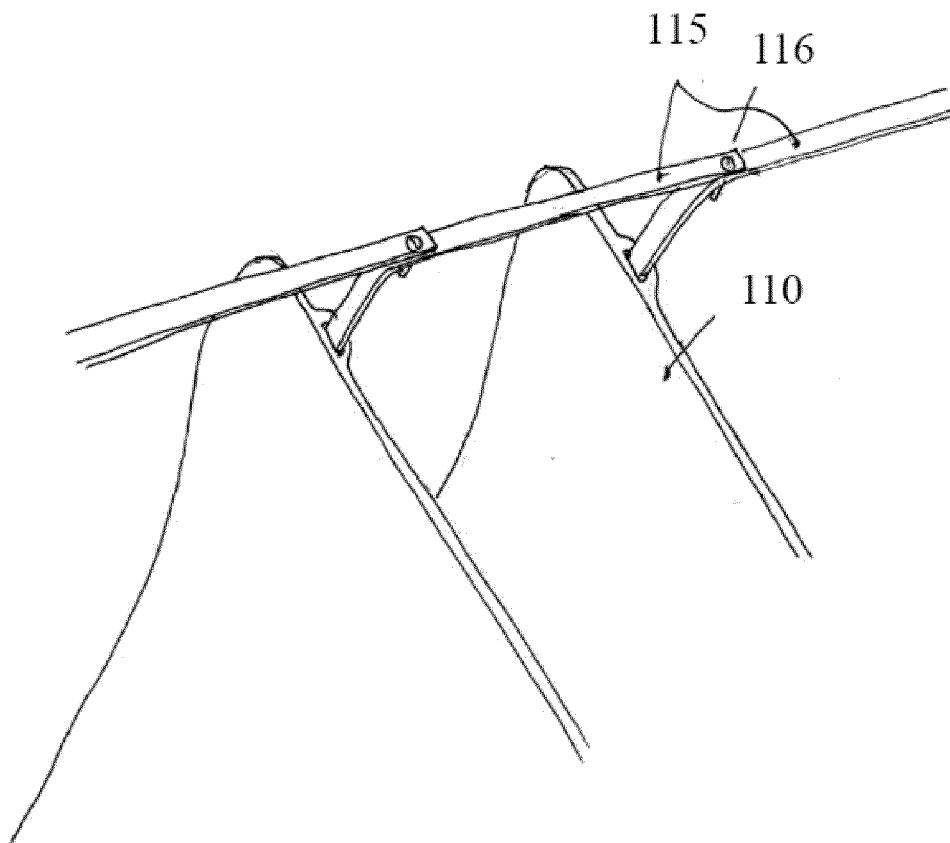


Fig. 7A

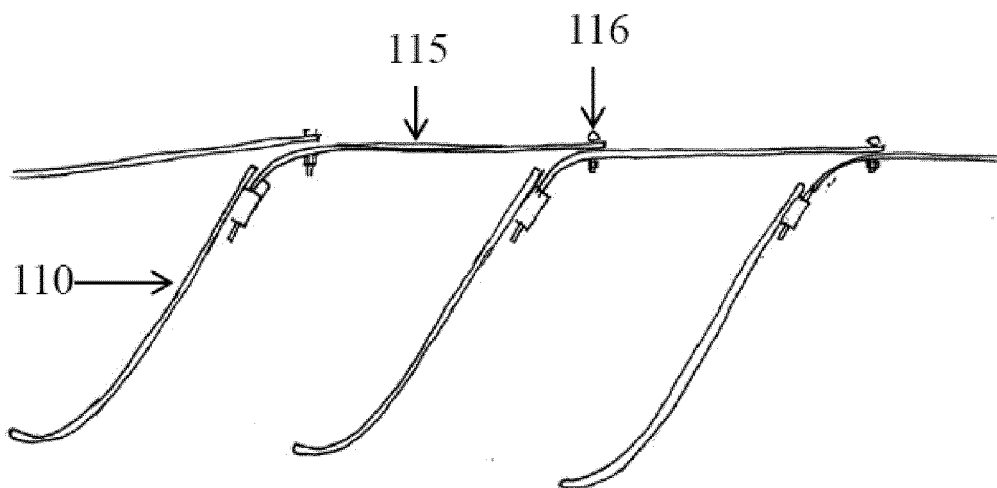


Fig. 7B

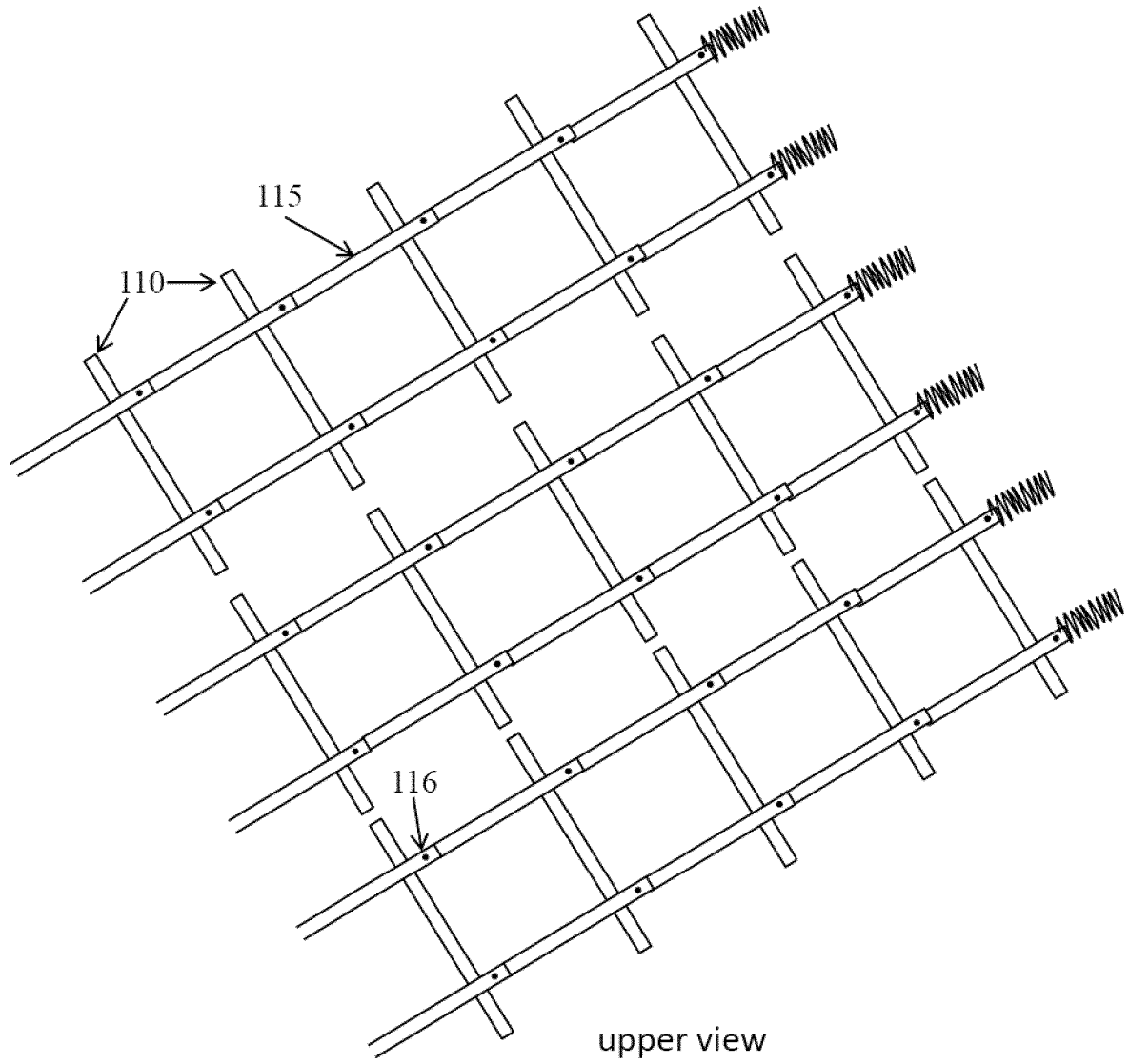


Fig. 7C

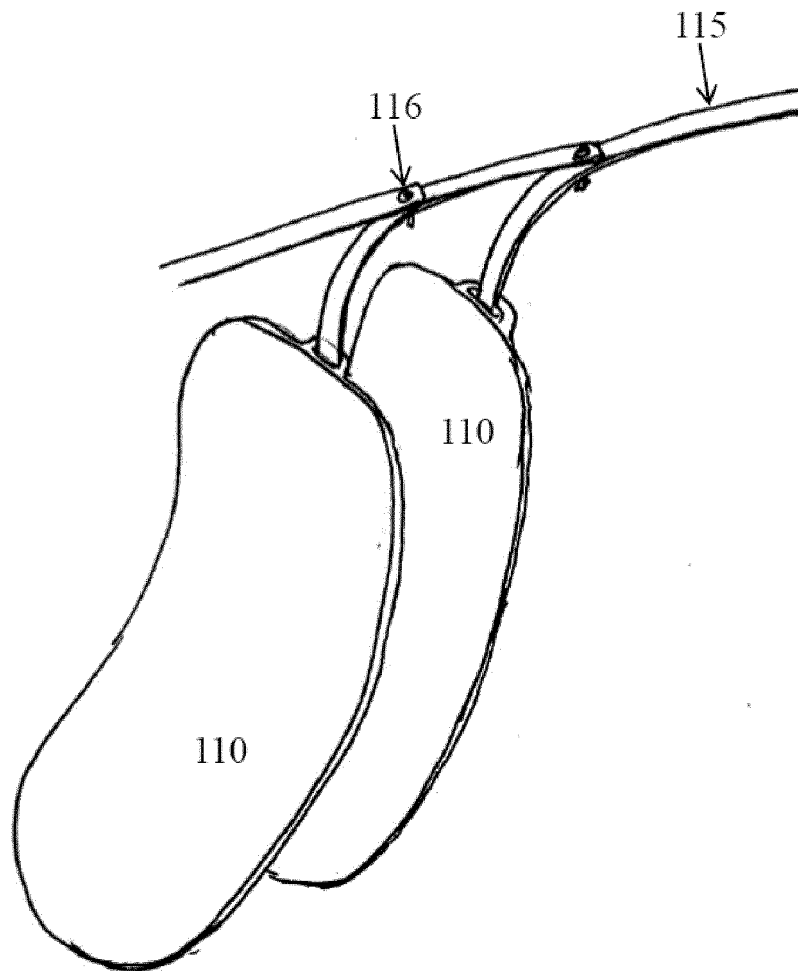


Fig. 8

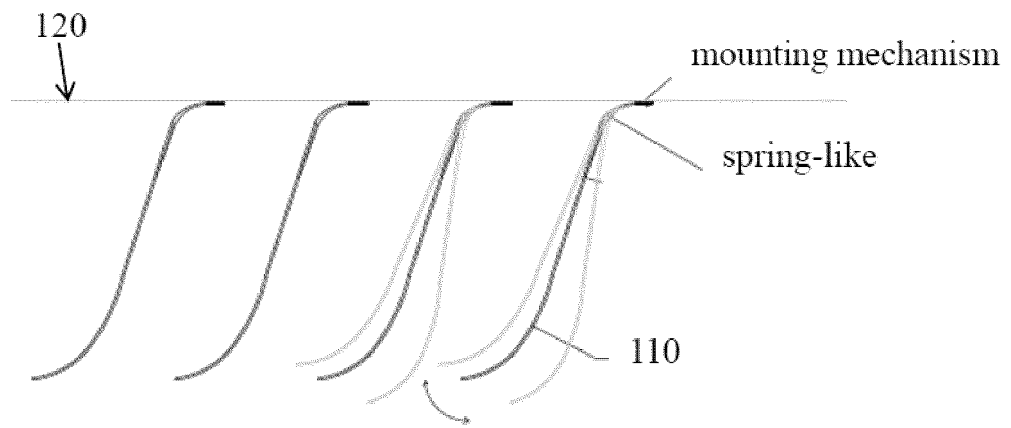


Fig. 9A

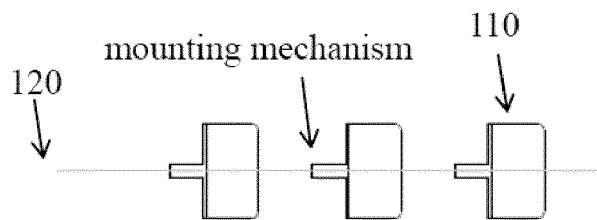


Fig. 9B

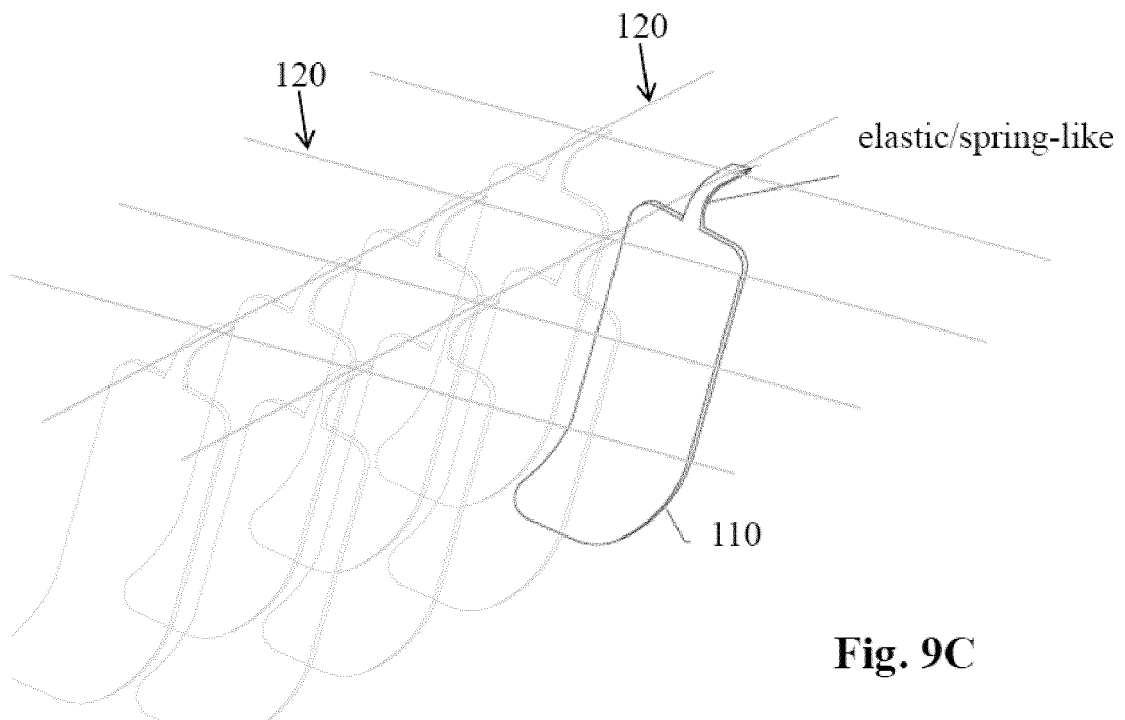


Fig. 9C

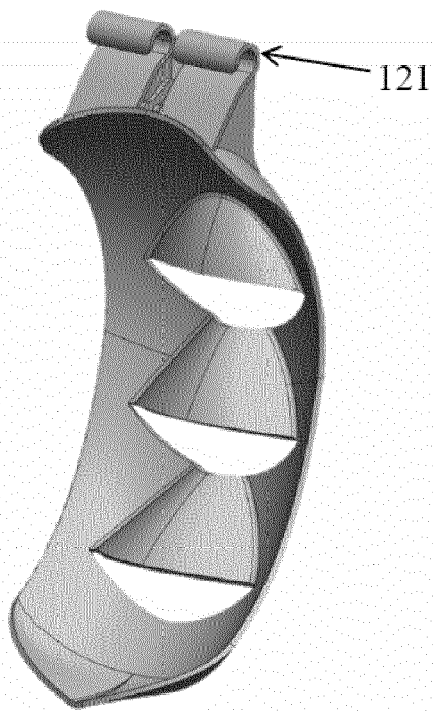


Fig. 10A

110

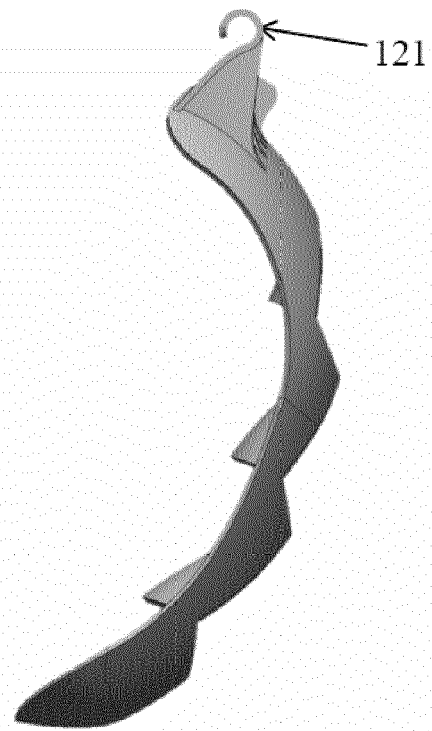


Fig. 10B

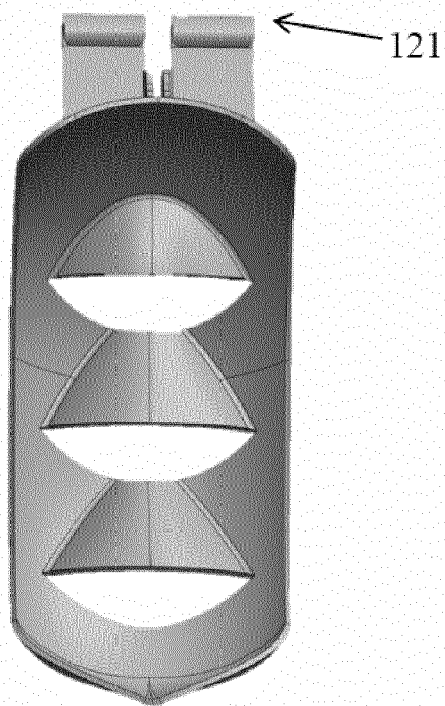


Fig. 10C

110

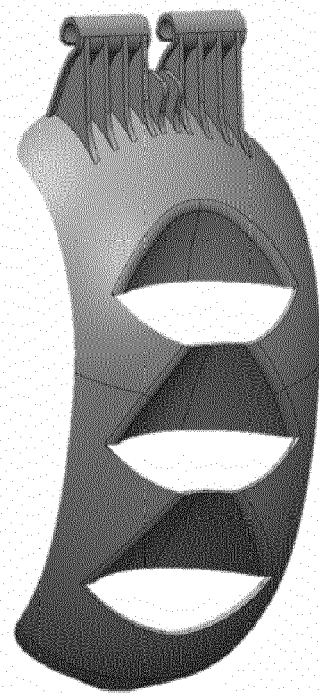


Fig. 10D

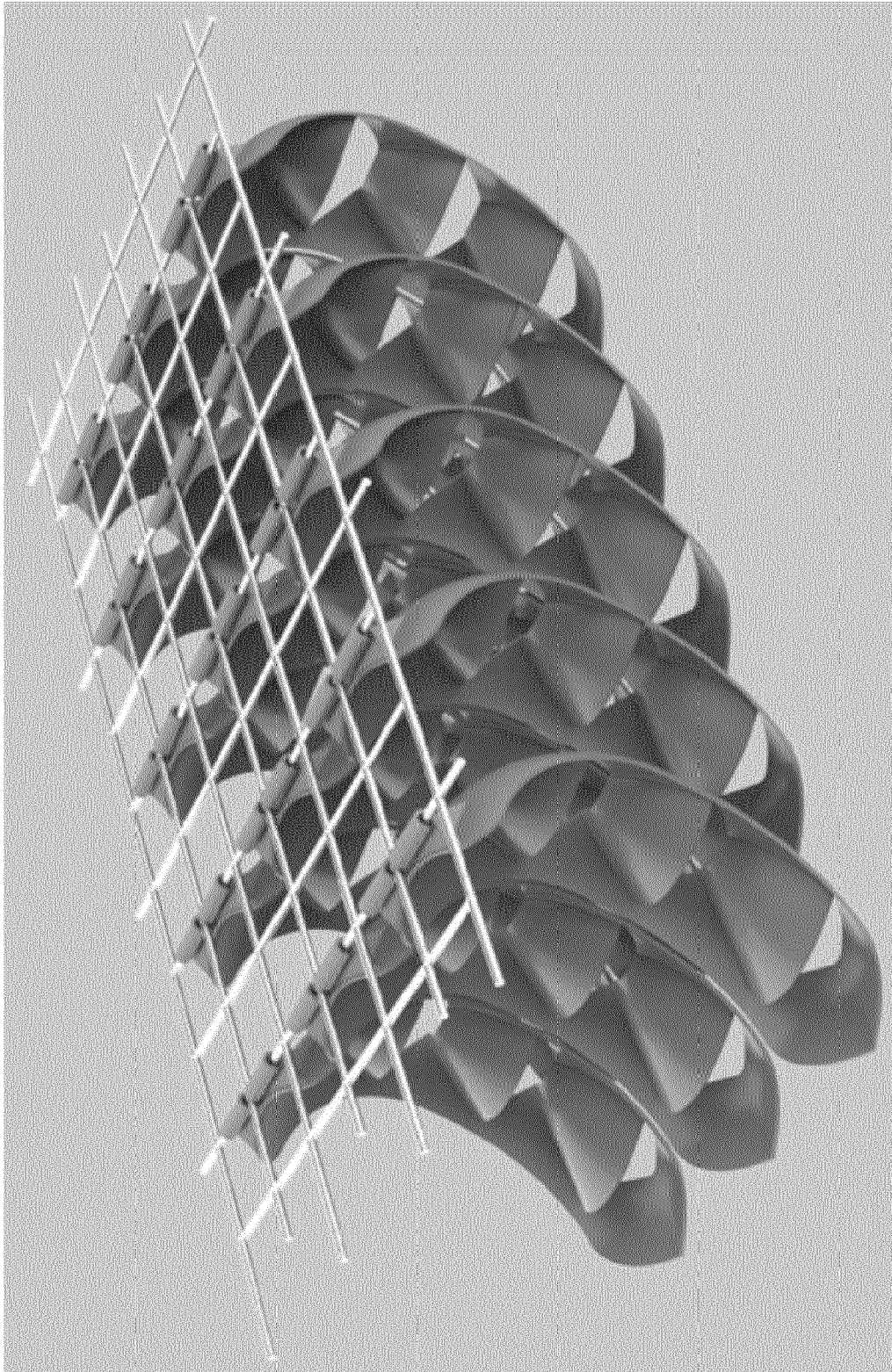


Fig. 11A

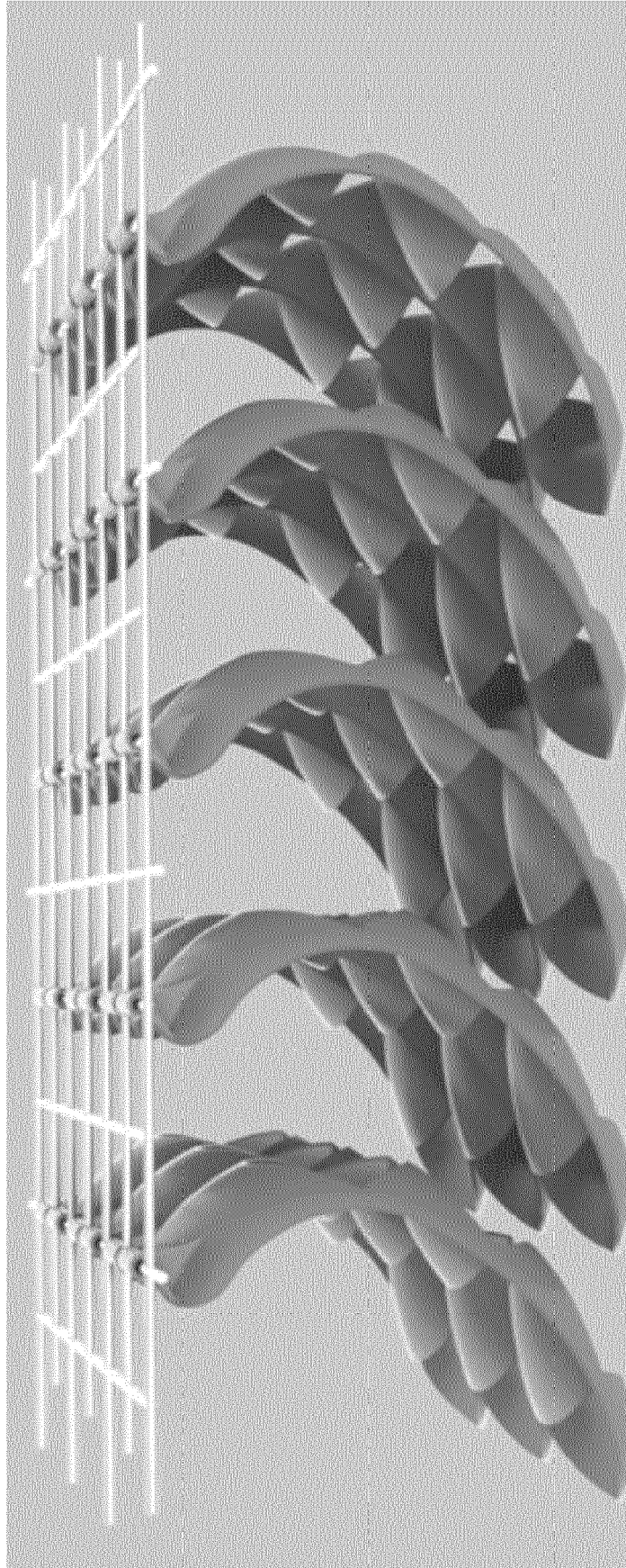


Fig. 11B

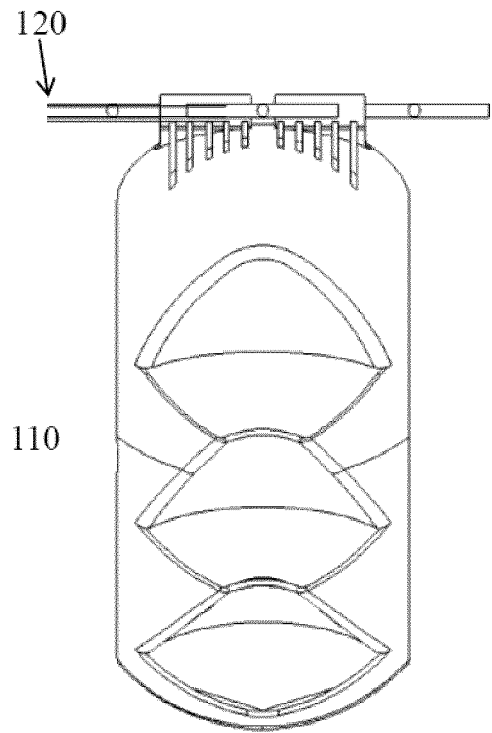


Fig. 12A

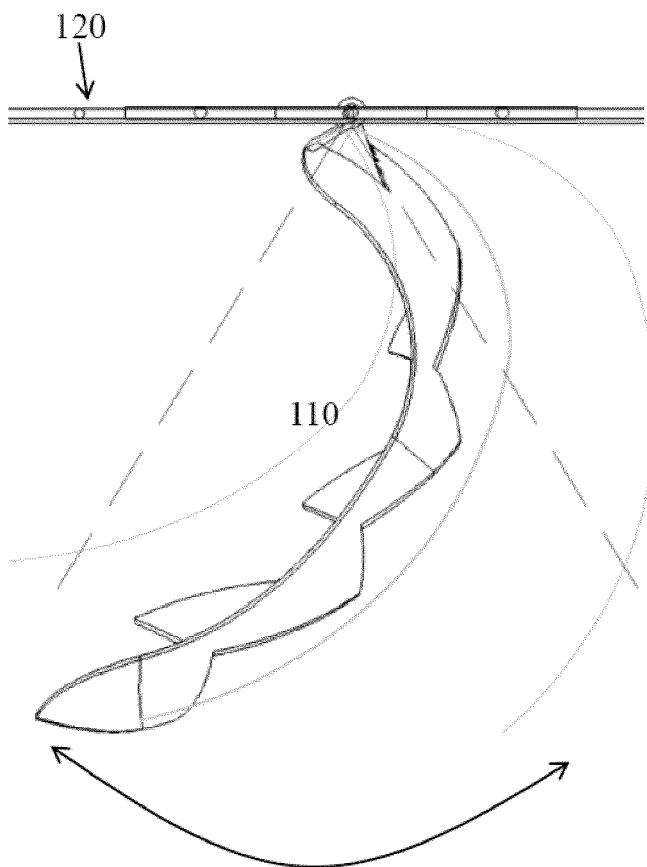


Fig. 12B

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 203761903 [0004]
- WO 2011055476 A [0004]