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(54) SYSTEM FOR SHIELDING AND CONTROLLING SUN LIGHT OR THE LIGHT FLOW COMING FROM ARTIFICIAL SOURCES, ESPECIALLY FOR APPLICATION TO BUILDINGS

SYSTEM ZUR ABSCHIRMUNG UND STEUERUNG DES SONNENLICHTES ODER DES LICHTFLUSSES AUS KÜNSTLICHEN QUELLEN, INSBESONDERE ZUR ANWENDUNG IN GEBÄUDEN

SYSTÈME DE PROTECTION ET DE COMMANDE DE LA LUMIÈRE DU SOLEIL OU DU FLUX LUMINEUX PROVENANT DE SOURCES ARTIFICIELLES, EN PARTICULIER POUR UNE APPLICATION SUR DES BÂTIMENTS

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Description

Field of application of the invention

[0001] The present invention relates to a system for shielding and controlling sun light or the light flow coming from artificial sources, especially for application to buildings.

Background art

[0002] Different types of shielding systems from sun light are known from the technique, especially for application to buildings.

[0003] For example, systems are known characterized by discreet elements that rotate (i.e. blades) or that retract (i.e. packageable shading devices), parallel wooden or metal blade or paddle systems controlled to be oriented at variable angle, arranged in horizontal or vertical direction, applicable in front of the facades of buildings, especially at glass doors or windows. Said systems are capable of determining a shadowing of the facades depending on the angle of orientation of the blades or paddles.

[0004] Roller shielding systems (textile or formed by rigid segments), retractable curtains, blades (horizontal or vertical movable or fixed), permanent elements (canopies, recesses, niches, etc.), are also known.

[0005] Said known systems are not devoid of drawbacks: for example, they are provided with complex control systems that generally act on all the blades, with mechanical actuators subject to wear and maintenance.

[0006] The systems that do not provide an independent control and transfer their operation to the user often are under-actuated and under-used, thus nullifying the effectiveness of the systems.

[0007] The known systems not requiring the contribution of the user for their activation require the use of power and connection with control systems (e.g.: Building Management System or BMS); they require regular maintenance; they have validity limitations of the guarantee on the actuation motors, increased maintenance and replacement costs.

[0008] Moreover, said systems have known control problems in the case in which their management software is not capable of comprehending the specificity of the site and the relative profile of use of the building by the users.

[0009] Examples of said known systems are described in the patent applications EP2540951-A1, WO2009/034594-A1, EP0021892-A1, US2015/285535-A1, WO2014/045163-A2.

[0010] Therefore, the need has arisen to develop an improved alternative shielding system with respect to known systems.

Summary of the invention

[0011] Thus, it is the object of the present invention to propose a system for shielding and controlling sun light or the light flow coming from artificial sources, especially for application to buildings, aiming to overcome the aforesaid drawbacks.

[0012] An object of the present invention is a system for shielding and controlling sun light or the light flow coming from artificial sources, especially for application to buildings, characterized in that it comprises:

- a shielding system, comprising one or more side-by-side arrays of cables;
- an actuation and control system for said one or more side-by-side arrays of cables, connected to a first end of said one or more side-by-side arrays of cables;
- a tensioning/balancing system for each of said one or more side-by-side arrays of cables, connected to a second end of said one or more side-by-side arrays of cables;
- a supporting frame, said actuation and control system being connected to a side of said frame, said tensioning/balancing system being connected to an opposite side of the frame;
- said actuation/control system being adapted to operate as a function of the temperature and of the level of solar and light irradiation that hits it, and being adapted to keep the cables of said one or more arrays parallel therebetween in a substantially cylindrical configuration, in a position such as to generate the highest shadowing in a condition of highest temperature and irradiation, and being also adapted to result in a mutual torsion of the cables of the relevant array, until assuming a double cone configuration (hourglass), in a position such as to generate the highest lighting in a condition of lowest temperature and irradiation;
- said tensioning/balancing system being adapted to keep the cables of said one or more arrays either fixed to said frame or in longitudinal controlled translation with respect to said frame;
- said actuation/control system and said tensioning/balancing system cooperating so as to keep tensioned said one or more arrays of cables.

[0013] A particular object of the present invention is a system for shielding and controlling sun light or the light flow coming from artificial sources, especially for application to buildings, as better described in the claims, which form an integral part of the present description.

Brief description of the drawings

[0014] Further objects and advantages of the present invention shall be apparent from the detailed description below of an embodiment thereof (and of its variants), and with reference to the accompanying drawings given purely by mere way of non-limiting example, in which:

figures 1a and 1b show a front view of the shielding

system object of the present invention respectively in a condition of highest lighting (lowest shadowing) and of highest shadowing (lowest lighting) of the back area: the transition between highest and lowest shadowing allows a variation of permeability to radiation by the system;
figures 2 and 3 diagrammatically depict two types of movement made by the shielding system and actuation mechanism;
figures 4 and 6 respectively show an exploded and section view of the components of an embodiment of the actuation and control system of the shielding system;
figures 5 and 7 respectively show an exploded and section view of the components of an embodiment of the tensioning/balancing system of the shielding system;
figure 8 shows an enlarged view of a part of the system in figure 1b;
figure 9 shows an application and shape variant of the shielding system the object of the present invention, in the case of application on planar facade having rectangular perspective geometry;
figure 10 shows a further application and shape variant of the shielding system in the case of irregular outline and/or frame;
figure 11 shows a further application and shape variant of the shielding system in the case of application on curved surface;
figures 12a, 12b, 12c show three possible locations of the shielding system, respectively inside, outside a wall, and interposed in a double shell wall;
figure 13 shows a further application and shape variant of the shielding system in indoor room.

[0015] The same numbers and reference letters in the drawings identify the same elements or components.

Detailed description of example embodiments

[0016] The present invention relates to a system for shielding and controlling sun light or the light flow coming from artificial sources, adapted to control the sun light and/or light radiation that may pass from the front face of the system towards the rear face, thus modulating the transit of the light towards the environment or the back area in which or in front of which the system is applied.

[0017] The system comprises three main components (see now figure 1):

- a shielding system B;
- un actuation and control system A of the shielding system connected to a side of the latter;
- a tensioning/balancing system C of the shielding system connected to the opposite side of the latter with respect to the control/actuation system.

[0018] The shielding system is surrounded by a frame D enclosing it, which has the function of supporting the system. The actuation and control system A is connected to a side of the frame and the tensioning/balancing system C is connected to the opposite side.

[0019] The shielding system B comprises one or more side-by-side arrays of cables, each array constrained to an end on tensioning elements part of the actuation/control system, which are adapted to keep the cables of the array parallel to one another in substantially cylindrical configuration B1, and in a position such as to generate the highest shadowing (fig. 1a) of the back surface, with lowest transfer of light, while said tensioning elements are also adapted to generate a mutual torsion of the cables of each array, up to taking on a double cone configuration (hourglass) B2 of the array, therefore in a position such as to generate the highest lighting (fig. 1b) of the back surface, with highest transfer of light and highest transparency admissible with the geometry of the modified system.

[0020] In a possible variant, an actuation and control system A is provided for each of the arrays of cables, which, as a function of the temperature and the level of solar irradiation hitting it, controls the torsion of the cables of the relevant array in a specific position between the two aforesaid ends, that is to say of parallelism of the arrays of cables (in said condition of highest shadowing) and of double cone configuration (hourglass) in said condition of highest transparency. Therefore, the arrays of cables are controlled individually and independently of one another.

[0021] Below, a non-limiting embodiment example of an actuation and control system A is described, with specific reference to figures 4 to 7.

[0022] The actuation system (figures 4 and 8) comprises a polyhedral-shaped thermal box 1, 2, in particular in the shape of straight prism in the example illustrated.

[0023] It comprises a front side 1 in direct contact with the sun light or light flow, made by means of a transparent surface, the front side of which is adapted to receive the light radiation which therefore may enter the box.

[0024] The surfaces of the other sides of the thermal box instead are adapted to retain and absorb the incident sun light; they are for example made of metal painted with black paint, with increased absorbency over the whole spectrum of the *sun light (250-2500 nm),* and externally are protected by a layer of insulating material having variable thickness as a function of the place of installation of the system. Such technical features indeed allow having a protected environment with an internal temperature varying as a function of the incident sun light or light radiation, as a function of the capacitive function of the air contained in the system, but also of a radiating one due to the particular geometry and materials used. In particular, the thermal radiation at the infrared reintroduced by the superheated surfaces remains confined inside the thermal box, thus contributing to the increase of temperature thereof.

[0025] The actuation system (Figures 4, 6, and 8) also

comprises a system for controlling the torsional movement of the relevant array of cables as a function of the temperature created inside the thermal box as a result of the introduction of light radiation.

[0026] The system for controlling the movement firstly provides an element made of a phase-transition material, such as for example a shape-memory spring 5 which, in the specific case, has activation temperatures - austenite start - and deactivation temperatures - martensite finish - and the relevant hysteresis cycle defined based on the range of temperatures in which the system is applied, and the useful life required by the designer. Said spring is capable of varying its elongation (thus simultaneously generating a force and an elongation which consists in the variation of the geometry) as a function of the temperature. As the elongation of the spring varies, it exerts a force proportional to its characteristic constant, and this force results in movements and rotations in the system.

[0027] The spring 5 is enclosed within a cylinder 3 which has the function of avoiding an unstable behaviour of the spring, thus optimising all the movement generated for moving the shield. In a non-limiting example, the cylinder may be made of plastic or metal.

[0028] The spring 5 and the cylinder 3 are inserted in the thermal box. Therefore, the spring modifies its length as a function of the temperature created inside the thermal box. In particular, it lengthens as the temperature increases. Due to a slider 4 (inserted in cylinder 3) that constrains the movement within the range of movement required, such lengthening causes a raising of an element for transmitting translation, which comprises two partially copenetrating bars 6, 10, partly inserted in the spring. A counter-spring 8 is also axially present that compresses as a function of the lengthening of the spring 5, and a head block 9. The elements 4 and 9 therefore retain the two springs axially to the transmission element 6, 10. In the neutral starting status with spring 5 relaxed, the shielding system normally is open, the cables are twisted in a double cone in a position such as to generate the highest lighting, while in condition of highest heating or of incident sun light or light flow with spring 5 elongated, the cables are parallel in a position such as to generate the highest shadowing. In condition of intermediate incident sun light or light flow with respect to the ones described above, the spring may be positioned with a partial quota of lengthening or shortening, therefore resulting in a condition of partial shadowing with respect to the highest potential of the shielding, with less torsion of the cables.

[0029] There is also a transformation system controlled by the elongation of the spring, which transforms said elongation of the spring into roto-translational motion of the cables.

[0030] The transformation system comprises:

- a first head plate 7 comprising a flange 7' fixed to the frame D, and a hollow cylinder 7" in which the system for controlling the movement (5, 6, 8, 9, 10) axially slides.
- a second head plate 12 comprising a flange 12' and a hollow cylinder 12" in which the hollow cylinder 7" of the first head plate can slide, the hollow cylinder 7" providing pins 13 that engage inside corresponding helical slots 12'" located in the hollow cylinder of the second head plate. The latter is fixed to the transmission element 10 so that an axial movement of the latter causes an axial roto-translational movement of the second head plate as a result of the helical shape of the slots 12"'. Connected on the outline of the flange 12' of the second head plate are the ends of the cables of the relevant array and they are fixed by means of a circular-crown pressing element 11 which in turn is fixed on the outline of the flange 12'. To this end, the outline of the flange 12' comprises a series of grooves for fixing the ends of the cables which may be equipped with suitable terminals of specific thickness. The roto-translation of the second head plate 12 allows a torsion of the cables and therefore, a dynamic behaviour of the shielding by adjusting the transmission of sun light and light radiation, as mentioned above.

[0031] The cable structure is important for the operation of the system because it allows the passage of the system from a cylinder geometry to an hourglass geometry (double cone): the cylinder and the hourglass (double cone) have two different side areas, and therefore a continuous material, and not subtle material like the cables, would not allow the transition of geometry unless wrinkles/warping of the material itself occurred.

[0032] The outside application of such cables could create problems due to fouling, the possibility that debris gets caught therein and wears them and due to the presence of forces that make them move and stress them in an undesired manner (such as wind). For this reason, it is preferable to insert a layer of transparent plastic material placed externally, constrained to the frame D, with a function of protection while keeping upper and lower openings to allow the passage of air. The clear layer of plastic material may be for example, made of ETFE or ECTFE, fluorine-polymer, or glass.

[0033] A tensioning/balancing system C of the shielding system is also provided for each array of cables, and therefore the arrays of cables are tensioned individually and independently of one another.

[0034] Therefore, the actuation/control system (A) and the tensioning/balancing system (C) cooperate so as to keep tensioned the arrays of cables.

[0035] In one embodiment, the tensioning system may be formed in a similar manner as the system for controlling the movement described above.

[0036] With reference to figures 5 and 7, there is a first tail plate 18 which comprises a flange 18' fixed to the frame D in a position opposite to the fixing one of the first head plate, and a hollow cylinder 18".

[0037] A second tail plate 15 comprises a flange 15'

and a hollow cylinder 15" in which the hollow cylinder 18" of the first tail plate can slide, the hollow cylinder providing pins 14 that engage inside corresponding longitudinal slits 15'" located in the hollow cylinder of the second tail plate. A bottom counter-spring 16 fixed at the ends to the two hollow cylinders is inserted in the two hollow cylinders.

[0038] The other ends of the cables of the relevant array are connected on the outline of the flange 15' of the second tail plate, and they are fixed by means of a circular-crown pressing element 17 which in turn is fixed on the outline of the flange 15', therefore in an equivalent manner as the fixing system of the head part described above.

[0039] The roto-translational movement of the arrays of cables resulting from the "head" system causes a counter-reaction of longitudinal controlled translation of the "tail" system to keep the correct tensioning of the cables.

[0040] An alternative to the "tail" system described above is simply to fix the ends of the cables directly to the frame D, for example using only the first tail plate 18. In this case, the lower end of the arrays of cables does not translate and remains fixed to the frame also following the roto-translational motion described above.

[0041] Figures 2 and 3 diagrammatically depict two types of movement made by the system of the invention described above, respectively in the case of the presence (fig. 2) of the "tail" tensioning system and of the absence of the latter (fig. 3).

[0042] The geometry of the "head" and "tail" plates preferably has a circumference, but it could also be elliptical, and it is possible that they have different diameters, thus resulting in frustoconical geometries, considering also the presence of the cables constrained to them. This particular type of geometry allows both varying the overall aspect of the system, and also creating a deformed double cone one with two cones of different height, following the rotation of the system.

[0043] The manual activation and deactivation of the system is always guaranteed by means of a mechanical transmission that allows controlling locking and releasing the movable lower tensioning element. Such system allows generating a greater force than the one generated by the shape memory spring, thus allowing the repositioning in the desired status while maintaining the integrity of all the components, and therefore without damaging them. The mechanical transmission allows the forced translation/rotation of the system by forcing the springs to extend/contract independently of the thermal or light stimuli.

[0044] In one possible variant, the frame D could be a non-closed structure, only comprising the stretches of "head" and "tail" suitably fixed in the rear-structure housing the shadowing system.

[0045] The extreme adaptability obtained with using the shielding system of the present invention is therefore apparent.

[0046] In one variant as described above, the actuation and control system provides a thermal box for each array of cables. Each thermal box with relative control element works independently.

[0047] In another possible variant, one thermal box may be provided for several arrays of cables, adapted to control individual systems for transmitting movement and rotation for each array of cables. In this case, the thermal box may be made in a similar manner as the preceding variant, as well as the transmission systems, with implementing variants within the reach of those skilled in the art.

[0048] The actuation and control system described above may be replaced by the following alternatives. There are in fact solutions with active or passive operation.

[0049] Making the thermal box described above is among the passive alternatives, but it is clear that other embodiments are possible, generalising a generic control system with a temperature-based phase transition. For example, in replacement of the shape memory spring, it is possible to use wax systems, liquid-to-solid phase transition or TBM (thermo bi metal) or thermally-activated plastics TMP (thermo moveable plastics). The environmental variation of the temperature modifies the geometry/density of the actuator and accordingly there is a variation of the layout of the system as described above.

[0050] Active alternatives, but that do not contemplate using the thermal box, may include electromechanical actuators. The activation of such actuators occurs following an electric input regulated by one or more control sensors and systems and originating from electric network or photovoltaic system.

[0051] The possibility of active control also allows an activation per individual element or pattern at the option of the user.

[0052] Another variant is a solar panel system which generates actuation current.

[0053] The thermal box may have various shapes, be thermally insulated or not, according to the application, based also on the speed of variation of the temperature so as to follow the thermal radiation curve. A system for slowing down or speeding up the trend of the thermal curve may also be introduced in the thermal box, such as for example, a flap that opens or closes autonomously or controlled to cause the hot air to exit or not.

[0054] The cables may be made of extensible or non-extensible material. The material of the cables may be for non-limiting example made of polypropylene, polyester or nylon.

[0055] In a preferred use, the shielding system is applied externally to the facade of a building, positioned in front of the part of transparent shell (widows/doors) so as to modulate the daylighting of the indoor room and at the same time control the solar contributions.

[0056] The normal shape of the facades of the building, and therefore of the system, is planar (fig. 9). Such sys-

tem however may take on different shapes depending on the ones of the surface to which it is applied. For example, it may take on a curved shape to allow the application also on facades of buildings having plan curvature (fig. 11), or an irregular shape of the outline for windows having non-rectangular perspective geometry (fig. 10).

[0057] The system may be placed, with respect to the facade of the building, internally (fig. 12a), externally (fig. 12b) or in gap of facade having double shell (fig. 12c).

[0058] The system may also be applied internally to rooms to vary the transparency/shadowing of transparent internal partition walls, for non-limiting example in the case of a study used as an office (fig. 13).

[0059] Variants are possible to the non-limiting example described, without however departing from the scope of protection of the present invention, comprising all the equivalent embodiments for those skilled in the art.

[0060] The elements and the features illustrated in the various preferred embodiments may be combined with one another without however departing from the scope of protection of the present invention.

[0061] The advantages coming from the application of the present invention are clear.

[0062] The solar shielding system proposed has a dynamic and adaptive behaviour towards the different environmental conditions by providing localised solar protection based on the external temperature and the levels of sun light present on the surface of facade. The innovation also consists in the hourglass shape of the solar shielding which sets it out from the other known movable shielding systems: while the latter are normally characterized by discreet elements that rotate (i.e. blades) or that are retracted (i.e. roller blinds), the solar shielding system proposed transfers a simple translational movement in a rotation of a component that transforms an hourglass into a cylinder and vice versa. The hourglass shape additionally is particularly interesting because it allows ensuring an optimal view of the outdoor environment while effectively shielding the radiation - especially in the summer and for increased angles of solar height.

[0063] It is possible with the system of the present invention to achieve a punctual control of the levels of sun light or light radiation, both active and passive according to the type of control, to increase the comfort of the users and at the same time to meet different needs.

[0064] In the passive variants, the translational movement of the arrays of cables is for example, provided by a system of shape memory springs which activation does not require electric energy or any electronic control, rather it takes advantage of the incident sun light on the facade of the building which causes an increase of the temperature of the thermal box in which the springs are enclosed.

[0065] Those skilled in the art are capable of making the object of the invention from the above-indicated description without introducing further construction details.

Claims

1. System for shielding and controlling sun light or the light flow coming from artificial sources, especially for application to buildings, **characterized in that** it comprises:

   - a shielding system (B), comprising one or more side-by-side arrays of cables;
   - an actuation and control system (A) for said one or more side-by-side arrays of cables, connected to a first end of said one or more side-by-side arrays of cables;
   - a tensioning/ balancing system (C) for each of said one or more side-by-side arrays of cables, connected to a second end of said one or more side-by-side arrays of cables;
   - a supporting frame (D), said actuation and control system (A) being connected to a side of said frame, said tensioning/ balancing system (C) being connected to an opposite side of the frame;
   - said actuation/control system (A) being adapted to operate as a function of the temperature and of the level of solar and light irradiation that hits it, and being adapted to keep the cables of said one or more arrays parallel therebetween in a substantially cylindrical configuration (B1), in a position such as to generate the highest shadowing in a condition of highest temperature and irradiation, and being also adapted to determine a mutual torsion of the cables of the relevant array, until assuming a double cone configuration (hourglass) (B2), in a position such as to generate the highest lighting in a condition of lowest temperature and irradiation;
   - said tensioning/ balancing system (C) being adapted to keep the cables of said one or more arrays either fixed to said frame, or in longitudinal controlled translation with respect to said frame;
   - said actuation/control system (A) and said tensioning/ balancing system (C) cooperating so as to keep tensioned said one or more arrays of cables.

2. Shielding system according to claim 1, wherein said actuation/control system (A) comprises:

   - at least one thermal box (1, 2) comprising a front side (1), with respect to the origin of the light, adapted to receive the light radiation that can enter the thermal box, and comprising other sides adapted to retain the light radiation inside the thermal box;
   - at least one system for controlling the torsional movement of said one or more arrays of cables, as a function of the temperature created inside said thermal box as a result of the introduction

of said light radiation inside the thermal box, said system for controlling the torsional movement comprising an element made of a phase-transition material placed inside the thermal box able to alter its length as a function of the temperature,
- a transformation system, controlled by the elongation of said element made of a phase-transition material, able to transform said elongation into said mutual torsional motion of said one or more arrays of cables.

3. Shielding system according to claim 2, wherein said element made of a phase-transition material is a shape memory spring (5) or a wax system, a liquid-to-solid phase transition or TBM (thermo bi metal) system or thermally-activated plastics TMP (Thermo moveable plastics).

4. Shielding system according to claim 2 or 3, wherein said transformation system comprises:

- a first plate (7) comprising a first flange (7') fixed to said frame (D), and a first hollow cylinder (7") in which said system for controlling the movement (5, 6, 8, 9, 10) axially slides;
- a second plate (12) comprising a second flange (12') and a second hollow cylinder (12") in which said first hollow cylinder (7") can slide, said first hollow cylinder comprising pins (13) that engage inside corresponding helical slots (12"') located in said second hollow cylinder, said first ends of said array of cables being connected to said second flange (12'), so that an axial movement of the first plate causes an axial roto-translational movement of the second plate;
- an element for transmitting translation (6, 10), adapted to slide inside said first and second hollow cylinders, and connected between said element made of a phase-transition material and said second plate.

5. Shielding system according to any one of the preceding claims, wherein said tensioning/ balancing system (C) comprises:

- a third plate (18) comprising a third flange (18'), fixed to the frame (D), and a third hollow cylinder (18");
- a fourth plate (15) comprising a fourth flange (15') and a fourth hollow cylinder (15") in which said third hollow cylinder (18") can slide, said third hollow cylinder providing pins (14) that engage inside corresponding longitudinal slits (15'") located in said fourth hollow cylinder, said second ends of said array of cables being connected to said fourth flange (15');
- a bottom counter-spring (16), inside said third and fourth hollow cylinders, fixed to the ends of said third and fourth hollow cylinders.

6. Shielding system according to any one of claims from 1 to 4, wherein said tensioning/ balancing system (C) comprises means for fixing said second ends of said array of cables directly to said frame (D).

7. Shielding system according to any one of the preceding claims, comprising a layer made of protective transparent plastic material constrained to the frame (D).

Patentansprüche

1. System zur Abschirmung und Steuerung des Sonnenlichts oder des von künstlichen Quellen kommenden Lichtstroms, insbesondere zur Anwendung an Gebäuden, **dadurch gekennzeichnet, dass** es umfasst:

- ein Abschirmsystem (B), bestehend aus einer oder mehreren nebeneinanderliegenden Kabelanordnungen,
- ein Betätigungs- und Steuersystem (A) für die eine oder mehrere nebeneinanderliegende Kabelanordnung(en), das mit einem ersten Ende der einen oder mehreren nebeneinanderliegenden Kabelanordnung(en) verbunden ist,
- ein Spann-/Ausgleichssystem (C) für jede der einen oder mehreren nebeneinander liegenden Kabelanordnungen, das mit einem zweiten Ende der einen oder mehreren nebeneinander liegenden Kabelanordnungen verbunden ist,
- einen Stützrahmen (D), wobei das Betätigungs- und Steuersystem (A) mit einer Seite des Rahmens verbunden ist, wobei das Spann-/Ausgleichssystem (C) mit einer gegenüberliegenden Seite des Rahmens verbunden ist,
- wobei das Betätigungs-/Steuersystem (A) so ausgelegt ist, dass es in Abhängigkeit von der Temperatur und der Höhe der auf es auftreffenden Sonnen- und Lichteinstrahlung arbeitet, und so ausgelegt ist, dass die Kabel der einen oder mehreren Anordnungen dazwischen parallel in einer im Wesentlichen zylindrischen Konfiguration (BI) gehalten werden, in einer Position, die so beschaffen ist, dass sie die höchste Abschattung in einem Zustand höchster Temperatur und Bestrahlung erzeugt, und die außerdem so beschaffen ist, dass sie eine gegenseitige Verdrehung der Kabel der betreffenden Anordnung bestimmt, bis sie eine Doppelkegel-Konfiguration (Sanduhr) (B2) annimmt, in einer Position, die so beschaffen ist, dass sie die höchste Beleuchtung in einem Zustand niedrigster Temperatur

und Bestrahlung erzeugt,
- wobei das Spann-/Ausgleichssystem (C) so ausgelegt ist, dass es die Kabel der einen oder mehreren Anordnungen entweder an dem Rahmen befestigt oder in einer kontrollierten Längsverschiebung in Bezug auf den Rahmen hält,
- das Betätigungs-/Steuerungssystem (A) und das Spann-/Ausgleichssystem (C) so zusammenwirken, dass sie die Spannung einer oder mehrerer Kabelanordnungen aufrechterhalten.

2. Abschirmsystem nach Anspruch 1, wobei das Betätigungs-/Steuerungssystem (A) umfasst:

- mindestens einen Thermokasten (1, 2), der eine bezüglich des Lichtursprungs vordere Seite (1) aufweist, die geeignet ist, die Lichtstrahlung zu empfangen, die in den Thermokasten eintreten kann, und welcher andere Seiten aufweist, die geeignet sind, die Lichtstrahlung im Inneren des Thermokastens zurückzuhalten,
- mindestens ein System zur Steuerung der Torsionsbewegung des einen oder der mehreren Kabelgruppe/n in Abhängigkeit von der Temperatur, die im Inneren des Thermobehälters infolge der Einführung der Lichtstrahlung in das Innere des Thermobehälters erzeugt wird, wobei das System zur Steuerung der Torsionsbewegung ein Element aus einem Phasenübergangsmaterial umfasst, das im Inneren des Thermobehälters angeordnet und in der Lage ist, seine Länge in Abhängigkeit von der Temperatur zu verändern,
- ein Transformationssystem, das durch die Dehnung des aus einem Phasenübergangsmaterial hergestellten Elements gesteuert wird und in der Lage ist, die Dehnung in die gegenseitige Torsionsbewegung der einen oder mehreren Kabelanordnungen umzuwandeln.

3. Abschirmsystem nach Anspruch 2, wobei das aus einem Phasenübergangsmaterial hergestellte Element eine Formgedächtnisfeder (5) oder ein Wachssystem, ein Flüssig-zu-Fest-Phasenübergangs- oder TBM-System (Thermobimetall) oder thermisch aktivierte Kunststoffe TMP (Thermobewegliche Kunststoffe) ist.

4. Abschirmsystem nach Anspruch 2 oder 3, wobei das Transformationssystem umfasst:

- eine erste Platte (7) mit einem ersten Flansch (7'), der an dem Rahmen (D) befestigt ist, und einem ersten Hohlzylinder (7"), in dem das System zur Steuerung der Bewegung (5, 6, 8, 9, 10) axial gleitet,
- eine zweite Platte (12), die einen zweiten Flansch (12') und einen zweiten Hohlzylinder (12") umfasst, in dem der erste Hohlzylinder (7") gleiten kann, wobei der erste Hohlzylinder Stifte (13) umfasst, die in entsprechende schraubenförmige Schlitze (12"') eingreifen, die sich in dem zweiten Hohlzylinder befinden, wobei die ersten Enden der Anordnung von Kabeln mit dem zweiten Flansch (12') verbunden sind, so dass eine axiale Bewegung der ersten Platte eine axiale Rotations-Translations-Bewegung der zweiten Platte bewirkt,
- ein Element zum Übertragen der Translation (6, 10), das so ausgelegt ist, dass es im Inneren des ersten und zweiten Hohlzylinders gleitet, und das zwischen dem aus einem Phasenübergangsmaterial hergestellten Element und der zweiten Platte angeschlossen ist.

5. Abschirmsystem nach einem der vorstehenden Ansprüche, wobei das genannte Spann-/Ausgleichssystem (C) umfasst:

- eine dritte Platte (18) mit einem dritten Flansch (18'), der am Rahmen (D) befestigt ist, und einem dritten Hohlzylinder (18"),
- eine vierte Platte (15) mit einem vierten Flansch (15') und einem vierten Hohlzylinder (15"), in dem der dritte Hohlzylinder (18") gleiten kann, wobei der dritte Hohlzylinder Stifte (14) bereitstellt, die in entsprechende Längsschlitze (15"') eingreifen, die in dem vierten Hohlzylinder angeordnet sind, wobei die zweiten Enden der Kabelanordnung mit dem vierten Flansch (15') verbunden sind,
- eine untere Gegenfeder (16) im Inneren des dritten und vierten Hohlzylinders, die an den Enden des dritten und vierten Hohlzylinders befestigt ist.

6. Abschirmsystem nach einem der Ansprüche von 1 bis 4, wobei das Spann-/Ausgleichssystem (C) Mittel zur Befestigung der zweiten Enden der Kabelanordnung direkt am Rahmen (D) aufweist.

7. Abschirmsystem nach einem der vorstehenden Ansprüche, bestehend aus einer Schicht aus schützendem transparentem Kunststoffmaterial, das am Rahmen befestigt ist (D).

Revendications

1. Système de protection contre la lumière du soleil ou le flux lumineux provenant de sources artificielles et de commande de ceux-ci, notamment pour une application sur des bâtiments, **caractérisé en ce qu'**il comprend :

- un système de protection (B), comprenant un

ou plusieurs réseaux de câbles côte à côte ;
- un système d'actionnement et de commande (A) pour lesdits un ou plusieurs réseaux de câbles côte à côte, connecté à une première extrémité desdits un ou plusieurs réseaux de câbles côte à côte ;
- un système de mise en tension/équilibrage (C) pour chacun desdits un ou plusieurs réseaux de câbles côte à côte, connecté à une seconde extrémité desdits un ou plusieurs réseaux de câbles côte à côte ;
- un cadre de support (D), ledit système d'actionnement et de commande (A) étant connecté à un côté dudit cadre, ledit système de mise en tension/équilibrage (C) étant connecté à un côté opposé du cadre ;
- ledit système d'actionnement/commande (A) étant adapté pour fonctionner en fonction de la température et du niveau d'irradiation solaire et lumineuse qui le frappe, et étant adapté pour garder les câbles desdits un ou plusieurs réseaux parallèles entre eux dans une configuration sensiblement cylindrique (B1), dans une position de nature à générer l'occultation la plus élevée dans une condition de température et d'irradiation les plus élevées, et étant également adapté pour déterminer une torsion mutuelle des câbles des réseaux concernés, jusqu'à ce qu'ils adoptent une configuration à double cône (sablier) (B2), dans une position de nature à générer l'éclairage le plus élevé dans une condition de température et d'irradiation les plus basses ;
- ledit système de mise en tension/équilibrage (C) étant adapté pour garder les câbles desdits un ou plusieurs réseaux soit fixés au cadre, soit en translation commandée longitudinale par rapport audit cadre ;
- ledit système d'actionnement/commande (A) et ledit système de mise en tension/équilibrage (C) coopérant de façon à garder en tension lesdits un ou plusieurs réseaux de câbles.

2. Système de protection selon la revendication 1, dans lequel ledit système d'actionnement/commande (A) comprend :

- au moins une boîte thermique (1, 2) comprenant un côté avant (1), par rapport à l'origine de la lumière, adaptée pour recevoir le rayonnement lumineux qui peut entrer dans la boîte thermique, et comprenant d'autres côtés adaptés pour retenir le rayonnement lumineux à l'intérieur de la boîte thermique ;
- au moins un système de commande du déplacement en torsion desdits un ou plusieurs réseaux de câbles, en fonction de la température créée à l'intérieur de ladite boîte thermique suite à l'introduction dudit rayonnement lumineux à l'intérieur de la boîte thermique, ledit système de commande du déplacement en torsion comprenant un élément constitué d'un matériau à transition de phase placé à l'intérieur de la boîte thermique capable de modifier sa longueur en fonction de la température,
- un système de transformation, commandé par l'allongement dudit élément constitué d'un matériau à transition de phase, capable de transformer ledit allongement en un mouvement de torsion mutuelle desdits un ou plusieurs réseaux de câbles.

3. Système de protection selon la revendication 2, dans lequel ledit élément constitué d'un matériau à transition de phase est un ressort à mémoire de forme (5) ou un système de cire, un système de transition de phase liquide à solide ou TBM (bimétal thermique) ou un plastique activé thermiquement TMP (thermoplastique mobile).

4. Système de protection selon la revendication 2 ou 3, dans lequel ledit système de transformation comprend :

- une première plaque (7) comprenant une première bride (7') fixée audit cadre (D), et un premier cylindre creux (7'') dans lequel ledit système de commande de déplacement (5, 6, 8, 9, 10) coulisse axialement ;
- une deuxième plaque (12) comprenant une deuxième bride (12') et un deuxième cylindre creux (12'') dans lequel ledit premier cylindre creux (7'') peut coulisser, ledit premier cylindre creux comprenant des broches (13) qui s'engagent à l'intérieur de fentes hélicoïdales (12''') correspondantes situées dans ledit deuxième cylindre creux, lesdites premières extrémités dudit réseau de câbles étant connectées à ladite deuxième bride (12'), de sorte qu'un déplacement axial de la première plaque provoque un déplacement de translation en rotation axiale de la deuxième plaque ;
- un élément de transmission de translation (6, 10), adapté pour coulisser à l'intérieur desdits premier et deuxième cylindres creux, et connecté entre ledit élément constitué d'un matériau à transition de phase et ladite deuxième plaque.

5. Système de protection selon l'une quelconque des revendications précédentes, dans lequel ledit système de mise en tension/équilibrage (C) comprend :

- une troisième plaque (18) comprenant une troisième bride (18'), fixée au cadre (D), et un troisième cylindre creux (18'') ;
- une quatrième plaque (15) comprenant une quatrième bride (15') et un quatrième cylindre

creux (15'') dans lequel ledit troisième cylindre creux (18'') peut coulisser, ledit troisième cylindre creux fournissant des broches (14) qui s'engagent à l'intérieur de fentes longitudinales (15''') correspondantes situées dans ledit quatrième cylindre creux, lesdites secondes extrémités dudit réseau de câbles étant connectées à ladite quatrième bride (15') ;
- un contre-ressort de dessous (16), à l'intérieur desdits troisième et quatrième cylindres creux, fixé aux extrémités desdits troisième et quatrième cylindres creux.

6. Système de protection selon l'une quelconque des revendications 1 à 4, dans lequel ledit système de mise en tension/équilibrage (C) comprend des moyens de fixation desdites secondes extrémités dudit réseau de câbles directement audit cadre (D).

7. Système de protection selon l'une quelconque des revendications précédentes, comprenant une couche constituée d'un matériau plastique transparent protecteur contrainte sur le cadre (D).

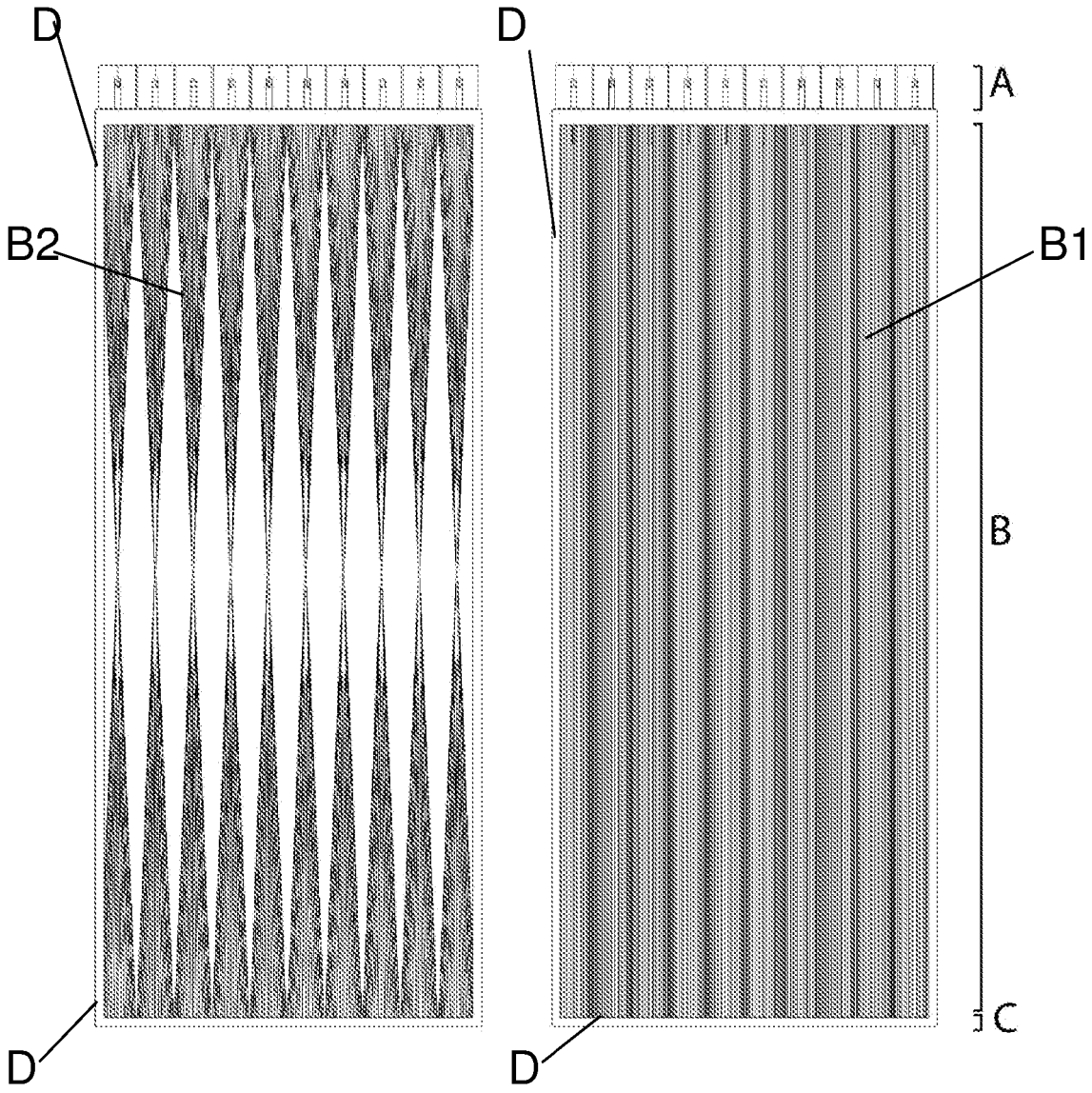

FIG. 1a

FIG. 1b

FIG. 1

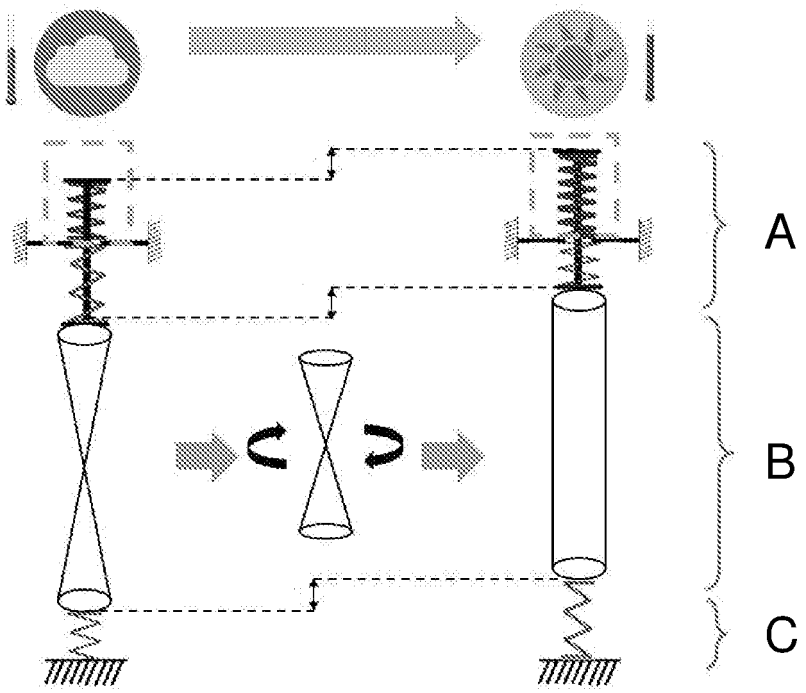

FIG. 2

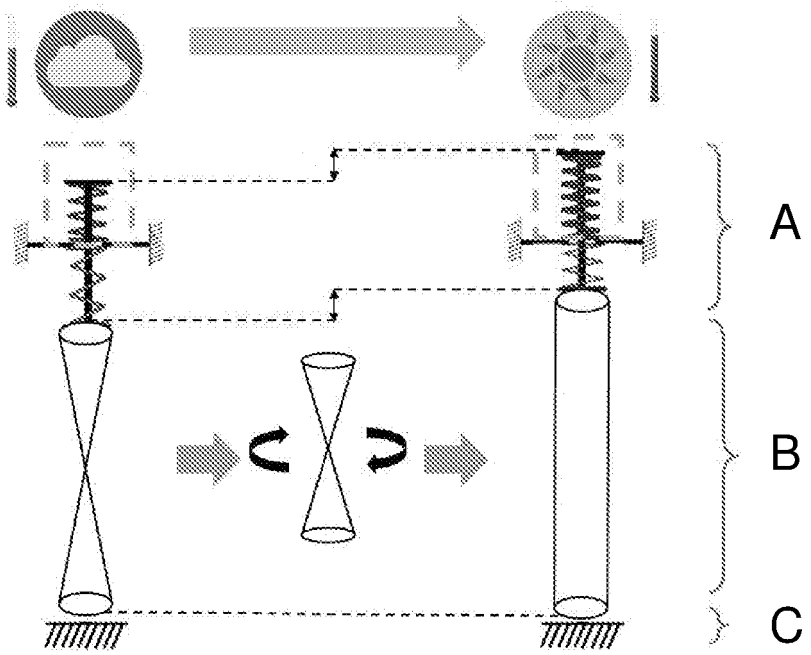

FIG. 3

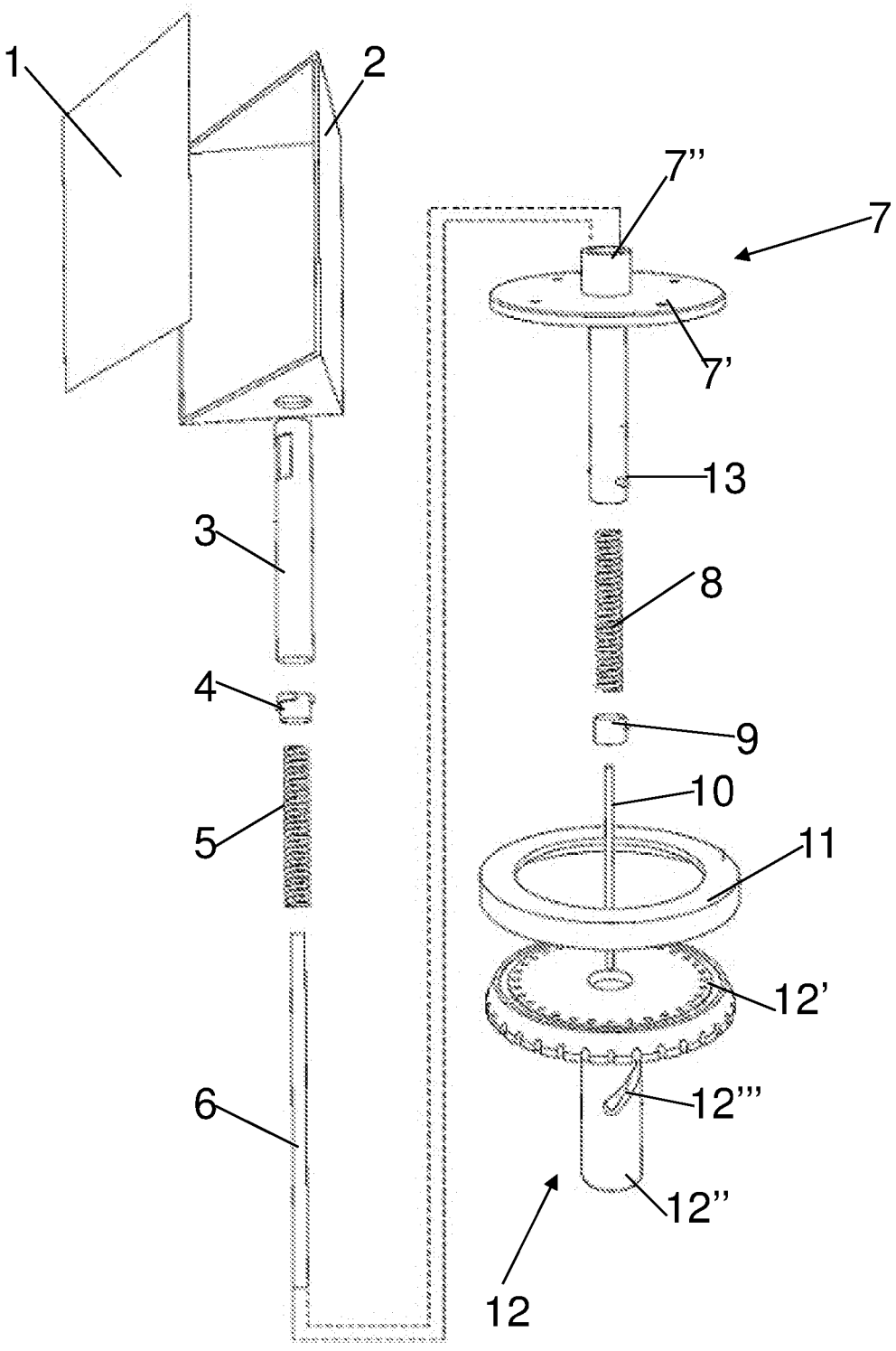

FIG. 4

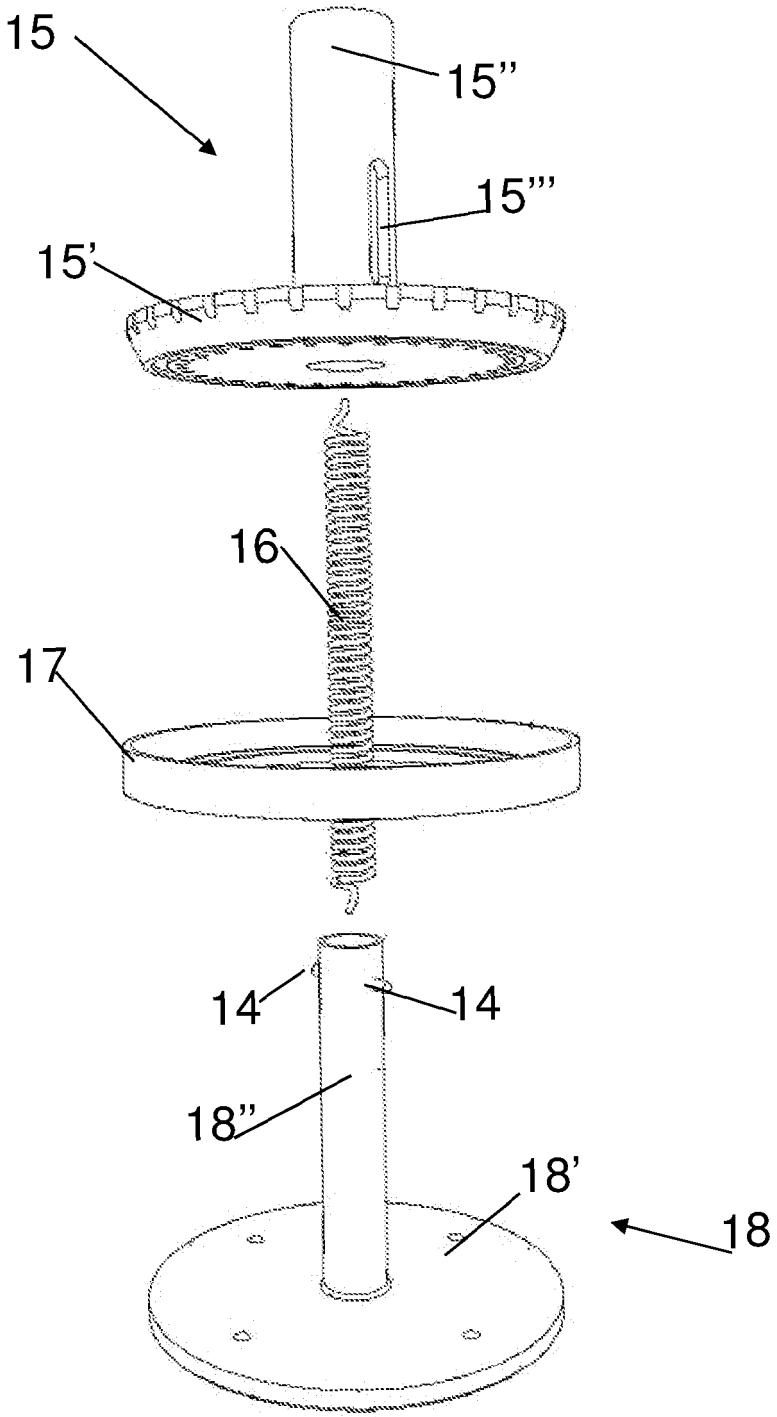

FIG. 5

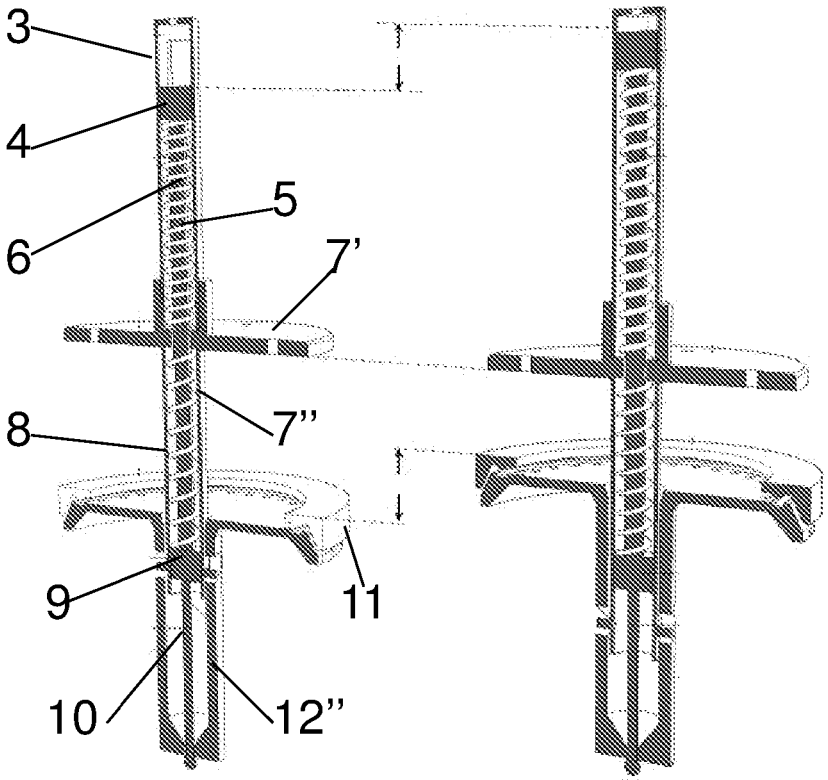

FIG. 6

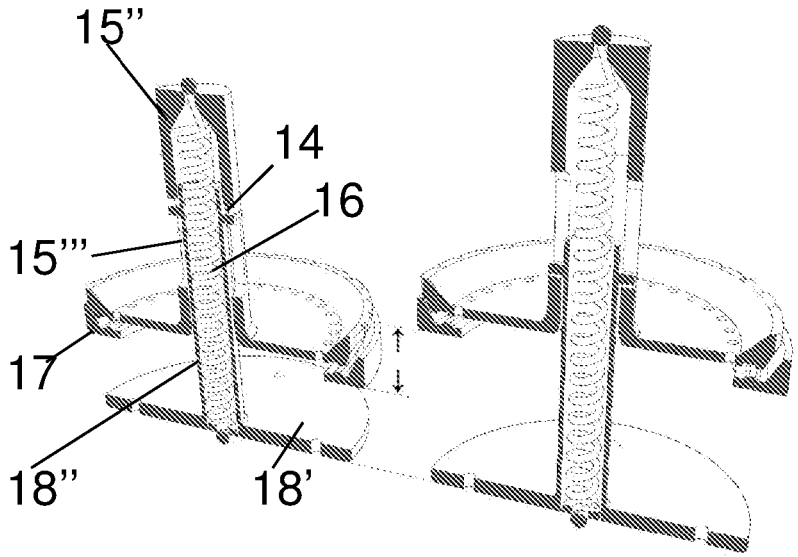

FIG. 7

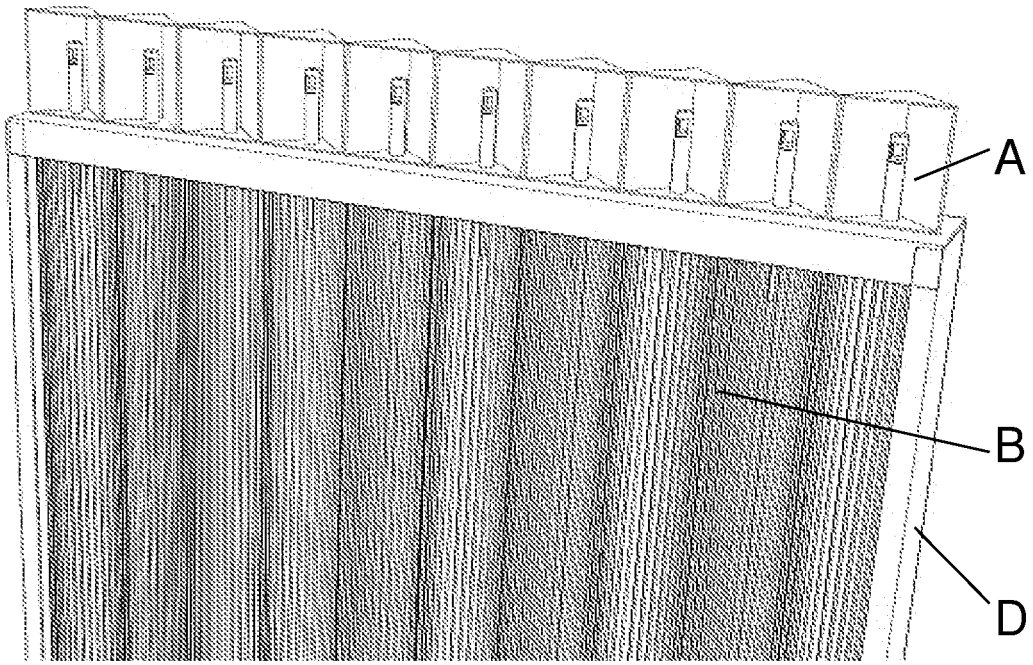

FIG. 8

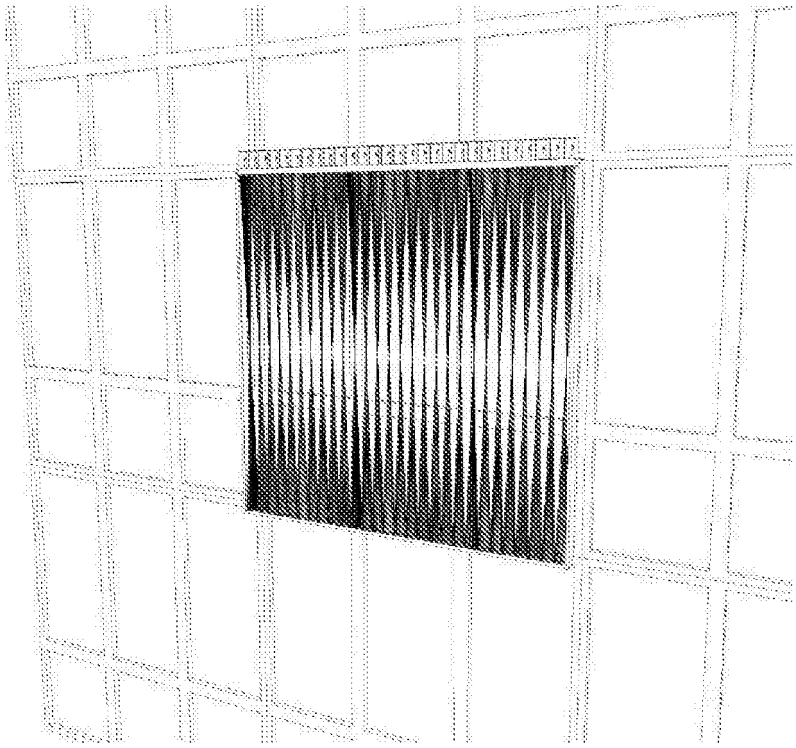

FIG. 9

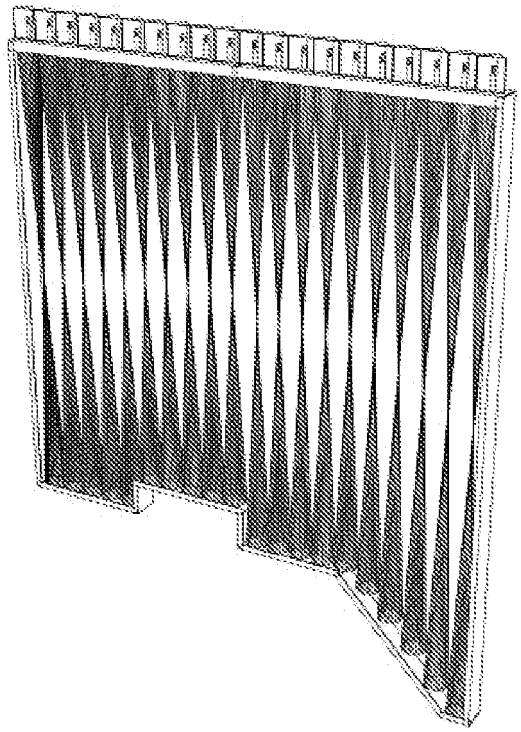

FIG. 10

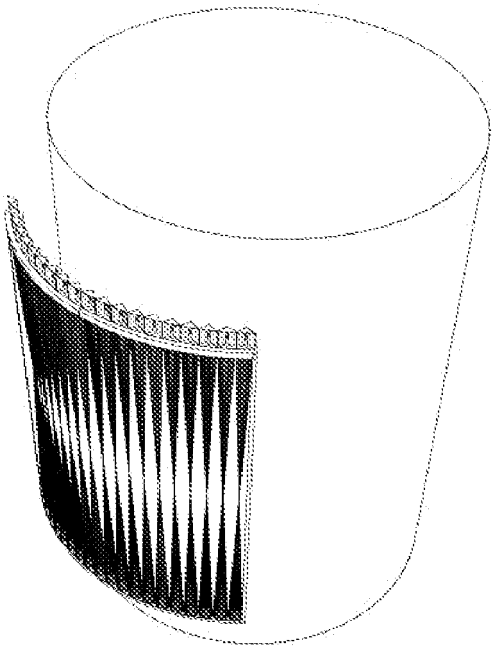

FIG. 11

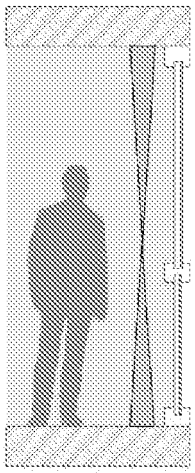

FIG. 12a

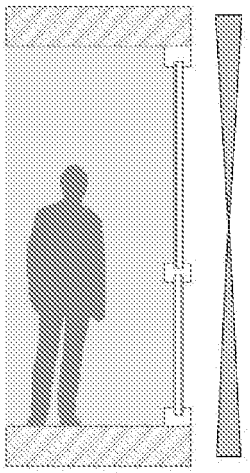

FIG. 12b

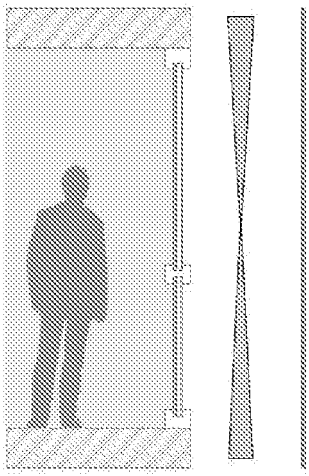

FIG. 12c

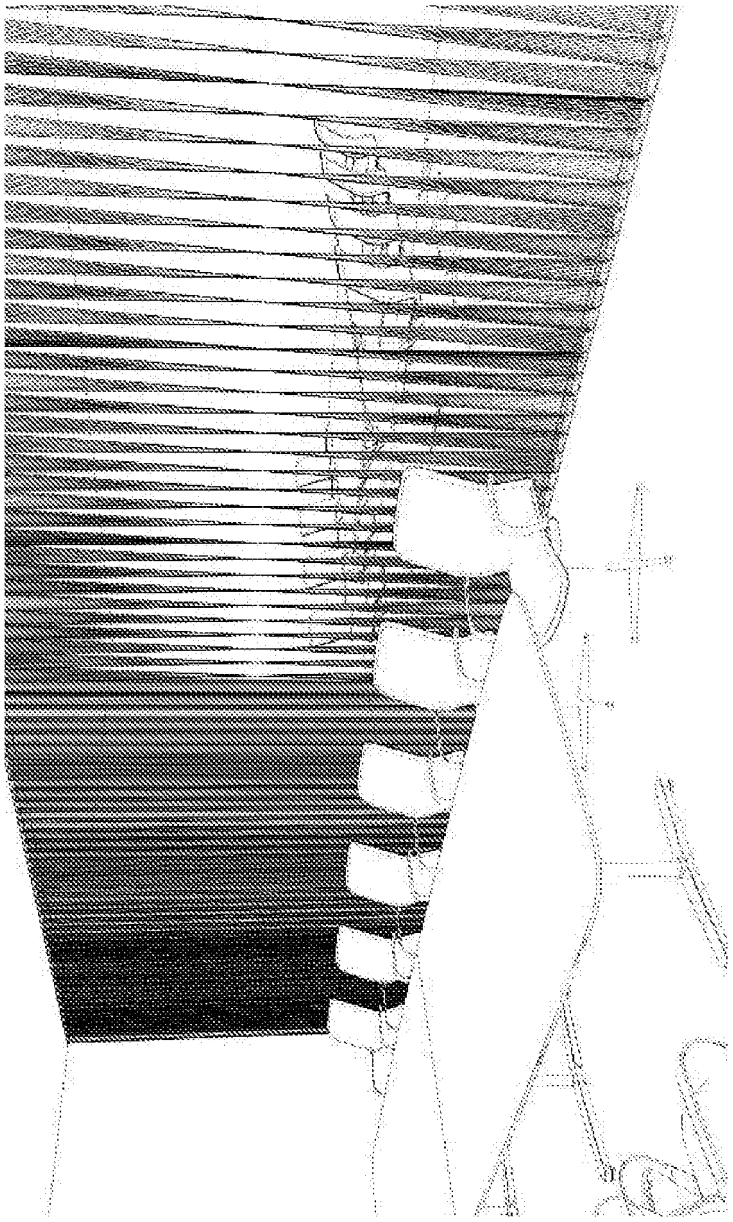

FIG. 13

REFERENCES CITED IN THE DESCRIPTION

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