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(54) **Shading device**

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Description

[0001] The invention relates to a device for providing shade. More in particular, the invention relates to a device which reacts to the amount of sun and controls the amount of shade it provides. Applicable on a broad variety of buildings, constructions, facades, roofs, windows as it can vary in scale, size, material and form.

[0002] Such a device according to the preamble of claim 1 is known from FR 2476200 A3.

[0003] Building environmental systems are known, which control heating, cooling and ventilation within a building. Such systems rely on a large number of sensors to measure the conditions in a building and which they use to control a number of flaps, valves and the like to direct heat and/or cold to the desired portions of a building. Such known building environmental systems are costly to install and energy consuming.

[0004] Some of the known building environmental systems use shading means arranged on the outside of the building, to block heat from the sun when it is desired to cool the building

[0005] US 5608995 describes a shading device having a solar-actuated fluid window shutter for automatic regulation of illumination that responds to variations in external sunlight. The device has a container exposed to solar radiation that causes a gas pressure change which causes fluid displacement between two transparent window panes. A transparent fluid is displaced by another fluid, which blocks part of the sunlight falling on the panes. Typically, the blocking fluid enters the space between the two transparent window panes from above, similar to the operation of blinds.

[0006] However, heat dissipated in the blocking fluid will be in direct contact with the building, such that the building is still heated despite the blocking of sunlight. Also the usage of some flammable and hazardous elements in the displacement fluids might be undesired in a building component, because of safety regulations, fire protection and / or environmental requirements.

[0007] It is an object of the invention to provide a shading device, in which the above mentioned disadvantages are reduces or even removed.

[0008] This object is achieved with a device according to claim 1.

[0009] The actuator used in the device according to the invention is a hydraulic cylinder or a pneumatic cylinder depending on whether the heat expandable medium is a fluid or a gas.

[0010] When the vessel is heated by for example sun radiation, the medium will try to expand. Because the vessel is in fluid communication with the pressure chamber of the actuator, the pressure increase due to the heating of the medium will also have its effect within the pressure chamber. As the pressure chamber is defined by the closed end of the cylinder barrel and the movable piston, the pressure will try to move the movable piston. This movement of the movable piston it then transferred via the piston rod onto shading means, in order to move the shading means towards the active, shading position.

[0011] When the sun radiation is reduced, for example because of a cloudy sky, the heat expandable medium will cool off and the pressure in the medium will drop. Due to the pressure drop, the movable piston will be moved back causing the shading means to move towards the non-active, non-shading position. This movement could be assisted by spring means to overcome internal friction within the actuator.

[0012] Another way to reduce the friction would be to use a rolling diaphragm pneumatic cylinder. In such a cylinder, the sealing between the movable piston and the cylinder barrel is by a flexible diaphragm. This reduces friction considerably, such that the force generated by the heat expandable medium can optimally be used for operating the shading means.

[0013] The heat expandable medium is preferably a gas, such as filtered air, but could also be a suitable fluid.

[0014] The device according to the invention thus provides a self-sustaining responsive shading, requiring no additional external energy or active control. The device is based on a simple natural process of heat expansion of a medium, making it a fully passive system.

[0015] In an embodiment of the device according to the invention the vessel is arranged at the actuator adjacent the pressure chamber. This provides for a compact design, in which the actuator can be directed with the vessel towards the heat source, in particular the sun.

[0016] In a preferred embodiment of the device according to the invention the shading means comprise at least one shading panel connected hingedly to the cylinder barrel by at least one hinge and wherein the piston rod is connected to the shading panel at a distance from the at least one hinge.

[0017] The shading panel could for example be an elongate panel, such as with horizontal blinds. By connection the one elongate panel to a plurality of parallel panels, the movement of the piston rod, could control a number of shading panels. So, if the sun would warm up the medium in the vessel, the elongated panels would move towards a closed position, in which the sun light is blocked from passing. If the device is mounted on the outside of a building, then the heat from the sun would be kept outside and the warming of the building by the sun would be effectively be prevented. The device of the invention could for example also be used as a parasol, wherein the device will provide shade when sufficient sun radiation is available to heat the medium in the vessel.

[0018] In another preferred embodiment of the device according to the invention the shading panel comprises at least two main rods each connected with one end to the at least one hinge, at least two control rods, hingedly arranged in a center zone each to a main rod and a shading cloth arranged to the at least two main rods.

[0019] Preferably, the shading panel is umbrella like.

[0020] With such a device according to the invention, the vessel would be arranged typically at the top of the

umbrella and be directed towards the sun. When the vessel is heated, the piston rod will cause the umbrella like shading means to unfold and provide shade.

[0021] Yet another embodiment of the device according to the invention further comprises a frame arranged to the cylinder barrel, wherein the frame has a base arranged at the distal end of the vessel.

[0022] With this frame and base, the device according to the invention can easily be mounted to a surface, which needs to be provided with shade. This could be for example a horizontal surface, such as a roof of a building or a facade of a building.

[0023] In yet another embodiment of the device according to the invention the outer surface of the vessel is provided with a heat absorbing layer. By providing a heat absorbing layer, the incident sun light can be optimally converted into heat for the heat expandable medium.

[0024] In still another embodiment of the device according to the invention the content of the vessel is at least 10 times larger than the content of the cylinder barrel.

[0025] In order to obtain a sufficient operable stroke of the piston rod, the content of the vessel is at least 10 times larger, than the content of the cylinder barrel. As a result an expansion of the medium in the vessel will have an at least 10 times bigger effect on the stroke of the piston rod.

[0026] In yet another embodiment of the device according to the invention the pressure of the heat expandable medium at ambient temperature, in the non-active, non-shading position, is higher than the ambient pressure.

[0027] By increasing the pressure of the heat expandable medium in the non-active, non-shading position, it is possible to counteract any force of the shading means exerted onto the piston rod. For example, the weight of the shading means can be compensated, such that the shading means are at an equilibrium between the non-active position and the active position. Only a small pressure increase due to the heating of the heat expandable medium is then needed to move the shading means.

[0028] In another preferred embodiment of the invention, the shutter units have an optional opening and closing mechanism that would allow the system to open or close in cases of emergency (e.g. fire) operated by manual or electrical means.

[0029] The invention further relates to a building having a facade and a plurality of devices according to the invention, wherein the vessel of each device is arranged in front of the shading means as seen in the direction towards the facade of the building.

[0030] These and other features of the invention will be elucidated in conjunction with the accompanying drawings.

Figure 1 shows a perspective view of a first embodiment of the device according to the invention.

Figures 2A and 2B show a cross-sectional view of the embodiment of figure 1 in two different positions

Figure 3 shows a schematic perspective view of a first embodiment of a building according to the invention.

Figure 4 shows a schematic perspective view of a second embodiment of a building according to the invention.

Figure 5 shows a schematic cross-sectional view of the building according to figure 3 during a period of time.

Figure 6 shows a perspective view of a second embodiment of the device according to the invention.

Figures 7A and 7B show a cross-sectional view of the embodiment of figure 6 in two different positions.

[0031] Figure 1 shows a perspective view of a first embodiment 1 of the device according to the invention. This device 1 has a cylindrical frame 2 with a base 3. On top of the frame 2 a vessel 4 is arranged. Furthermore a number of main rods 5 is hingedly arranged to the frame, which main rods 5 are controlled by control rods 6. A shading cloth 7 is arranged between the main rods 5.

[0032] Figures 2A and 2B show a cross-sectional view of the device 1 of figure 1 in a non-active, non-shading position (figure 2A) and an active, shading position (figure 2B).

[0033] The device 1 has an actuator arranged in the frame 2, which actuator has a cylinder barrel 8 with a closed end 9, a piston 10 movable within the cylinder barrel 8 and a piston rod 11 connected to the movable piston 10. The free end of the piston rod 11 is connected to the control rods 6.

[0034] The closed end 9 together with part of the cylinder barrel 8 and the movable piston 10 form the pressure chamber 12, which is in direct contact with the vessel 4. In the figure the wall of the closed end 9 is integrated and connected with the vessel 4 via a large opening. However, if the vessel 4 would be arranged at a distance from the barrel 8, this end 9 would be closed and connected to the vessel 4 via for example a conduit.

[0035] When the heat expandable medium inside of the vessel 4 is heated by the sun S, then the medium would expand and move the piston 10 downward. As a result, the main rods 5 will hinge upwardly, such that the umbrella like shading cloth 7 is expanded to provide shade.

[0036] Figure 3 shows a schematic perspective view of a first embodiment of a building 20 according to the invention. This building 20 has a facade 21 which is provided with a plurality of device 1 according to figure 1.

[0037] When the facade 21 is illuminated by the sun S, the devices 1 will assume an active position (as shown in figure 2B). Only where a tree T casts its shadow on the facade, the devices 1 will keep there non-active position (as shown in figure 2A).

[0038] Figure 4 shows a schematic perspective view of a second embodiment of a building 30 according to

the invention. This building 30 is provided over its full outer surface with a plurality of devices 1. When the sun S illuminates the building 30, the devices 1 will move towards the active position, except for the devices 1, which are in the shadow of the building B.

[0039] Figure 5 shows a schematic cross-sectional view of the building 20 according to figure 3 during a period of time. The facade 21 is provided with a number of devices 1.

[0040] The shown period of time starts at 11.00 and ends at 18.00. At 11.00 the facade 21 is fully illuminated by the sun S and all devices 1 are expanded. At 13.00 the sun moves away from the facade 21, such that gradiently less sun shines on the facade 21. As a result, the devices 1 will slowly collapse, such that around 18.00, when no sun shines on the facade 21, all devices 1 are in non-active state.

[0041] Figure 6 shows a perspective view of a second embodiment 40 of the device according to the invention. This device 40 also has a vessel 41 connected to a cylinder barrel 42 with a movable piston 43 and a connected piston rod 44.

[0042] The actuator 42, 43, 44 is arranged in a cylindrical frame 44 having a large base 45. This large base 45 is provided with a number of guide rails 46, along which main rods 47 are guided. These main rods 47 are also connected to the piston rod 44. A shading cloth (not shown) can be arranged between the main rods 47.

[0043] Figures 7A and 7B show a cross-sectional view of the device 40 in a non-active, non-shading position (figure 7A) and an active, shading position (figure 7B). The advantage of the large base 45 with the guide rails 46, is that the device 40 can withstand high wind loads.

Claims

1. Device (1; 40) for providing shade, which device (1; 40) comprises:

   - an actuator having a cylinder barrel (8; 42), a piston (10; 43) movable within the cylinder barrel (8; 42) and a piston rod (11; 44) connected to the movable piston (10; 43); and
   - shading means (7) operable between an active, shading position and a non-active, non-shading position, wherein the piston rod (11; 44) is coupled to the shading means (7) for controlling the position of the shading means (7) **characterized in that**
   - the cylinder barrel (8; 42) is a cylinder barrel (8; 42) with a closed end (9);
   - the device (1; 40) comprises a vessel (4; 41) filled with a heat expandable medium; and
   - the pressure chamber (12), defined by the closed end (9) of the cylinder barrel (8; 42) and the movable piston (10; 43), of the actuator is in fluid connection with the vessel (4; 41).

2. Device (1; 40) according to claim 1, wherein the vessel (4; 41) is arranged at the actuator adjacent the pressure chamber (12).

3. Device (1; 40) according to claim 1 or 2, wherein the shading means (7) comprise at least one shading panel (7) connected hingedly to the cylinder barrel (8; 42) by at least one hinge and wherein the piston rod (11; 44) is connected to the shading panel (7) at a distance from the at least one hinge.

4. Device (1; 40) according to claim 3, wherein the shading panel (7) comprises at least two main rods (5; 47) each connected with one end to the at least one hinge, at least two control rods (6), hingedly arranged in a center zone each to a main rod and a shading cloth (7) arranged to the at least two main rods (5; 47).

5. Device (1; 40) according to claim 4, wherein the shading panel (7) is umbrella like.

6. Device (1; 40) according to any of the claims 2 - 5, further comprising a frame (2) arranged to the cylinder barrel (8; 42), wherein the frame (2) has a base (3; 45) arranged at the distal end of the vessel (4; 41).

7. Device (1; 40) according to any of the preceding claims, wherein the outer surface of the vessel (4; 41) is provided with a heat absorbing layer.

8. Device (1; 40) according to any of the preceding claims, wherein the content of the vessel (4; 41) is at least 10 times larger than the content of the cylinder barrel (8; 42).

9. Device (1; 40) according to any of the preceding claims, wherein in the non-active, non-shading position the pressure of the heat expandable medium at ambient temperature is higher than the ambient pressure.

10. Building (20; 30) having a facade (21) and a plurality of devices (1; 40) according to the any of the preceding claims, wherein the vessel (4; 41) of each device (1; 40) is arranged in front of the shading means (7) as seen in the direction towards the facade (21) of the building (20; 30).

Patentansprüche

1. Vorrichtung (1; 40) zur Bereitstellung von Schatten, welche Vorrichtung (1; 40) umfasst:

   - einen Stellantrieb mit einer Zylinderrohre (8; 42), einen in der Zylinderrohre (8; 42) bewegbaren Kolben (10; 43) und eine mit dem beweg-

baren Kolben (10; 43) verbundene Kolbenstange (11; 44); und

- Beschattungsmittel (7), die zwischen einer aktiven, schattenspendenden Position und einer nicht aktiven, nicht schattenspendenden Position betreibbar sind, wobei die Kolbenstange (11; 44) mit den Beschattungsmitteln (7) verbunden ist, um die Position der Beschattungsmittel (7) zu steuern,

dadurch gekennzeichnet, dass

- die Zylinderrohre (8; 42) eine Zylinderrohre (8; 42) mit einem geschlossenen Ende (9) ist;
- die Vorrichtung (1; 40) einen mit einem wärmedehnbaren Medium gefüllten Behälter (4; 41) umfasst; und
- die durch das geschlossene Ende (9) der Zylinderrohre (8; 42) und den bewegbaren Kolben (10; 43) definierte Druckkammer (12) des Stellantriebs in Fluidverbindung mit dem Behälter (4; 41) steht.

2. Vorrichtung (1; 40) nach Anspruch 1, wobei der Behälter (4; 41) an dem Stellantrieb benachbart zu der Druckkammer (12) angeordnet ist.

3. Vorrichtung (1; 40) nach Anspruch 1 oder 2, wobei die Beschattungsmittel (7) mindestens ein Beschattungspaneel (7) umfassen, das durch mindestens ein Scharnier scharnierbeweglich mit der Zylinderrohre (8; 42) verbunden ist, und wobei die Kolbenstange (11; 44) in einem Abstand von dem mindestens einen Scharnier mit dem Beschattungspaneel (7) verbunden ist.

4. Vorrichtung (1; 40) nach Anspruch 3, wobei das Beschattungspaneel (7) mindestens zwei Hauptstangen (5; 47), die jede mit einem Ende mit dem mindestens einen Scharnier verbunden sind, mindestens zwei Steuerstangen (6), die jede scharnierbeweglich in einem Mittelbereich an einer Hauptstange angeordnet sind, und ein an den mindestens zwei Hauptstangen (5; 47) angeordnetes Beschattungstuch (7) umfasst.

5. Vorrichtung (1; 40) nach Anspruch 4, wobei das Beschattungspaneel (7) schirmartig ist.

6. Vorrichtung (1; 40) nach einem der Ansprüche 2 bis 5, weiter ein an der Zylinderrohre (8; 42) angeordnetes Gestell (2) umfassend, wobei das Gestell (2) eine Basis (3; 45) aufweist, die am distalen Ende des Behälters (4; 41) angeordnet ist.

7. Vorrichtung (1; 40) nach einem der vorstehenden Ansprüche, wobei die Außenfläche des Behälters (4; 41) mit einer wärmeabsorbierenden Schicht versehen ist.

8. Vorrichtung (1; 40) nach einem der vorstehenden Ansprüche, wobei der Inhalt des Behälters (4; 41) mindestens 10 Mal größer als der Inhalt der Zylinderrohre (8; 42) ist.

9. Vorrichtung (1; 40) nach einem der vorstehenden Ansprüche, wobei in der nicht aktiven, nicht schattenspendenden Position der Druck des wärmedehnbaren Mediums bei Umgebungstemperatur höher als der Umgebungsdruck ist.

10. Gebäude (20; 30), das eine Fassade (21) und eine Vielzahl von Vorrichtungen (1; 40) nach einem der vorstehenden Ansprüche aufweist, wobei der Behälter (4; 41) jeder Vorrichtung (1; 40) vor dem Beschattungsmittel (7), gesehen in der Richtung zur Fassade (21) des Gebäudes (20; 30), angeordnet ist.

Revendications

1. Dispositif (1 ; 40) pour fournir de l'ombre, lequel dispositif (1; 40) comprend:

- un actionneur ayant un corps de cylindre (8 ; 42), un piston (10 ; 43) mobile à l'intérieur du corps de cylindre (8 ; 42) et une tige de piston (11 ; 44) raccordée au piston mobile (10 ; 43) ; et
- des moyens d'ombrage (7) opérant entre une position d'ombrage active et une position de non-ombrage non active, dans lequel la tige de piston (11 ; 44) est couplée aux moyens d'ombrage (7) pour commander la position des moyens d'ombrage (7),

caractérisé en ce que :

- le corps de cylindre (8 ; 42) est un corps de cylindre (8 ; 42) avec une extrémité fermée (9) ;
- le dispositif (1 ; 40) comprend un récipient (4 ; 41) rempli d'un agent thermo-expansible ; et
- la chambre de pression (12) définie par l'extrémité fermée (9) du corps de cylindre (8 ; 42) et le piston mobile (10 ; 43) de l'actionneur est en communication fluidique avec le récipient (4 ; 41).

2. Dispositif (1 ; 40) selon la revendication 1, dans lequel le récipient (4 ; 41) est agencé dans l'actionneur de manière adjacente à la chambre de pression (12).

3. Dispositif (1 ; 40) selon la revendication 1 ou 2, dans lequel les moyens d'ombrage (7) comprennent au moins un panneau d'ombrage (7) articulé sur le

corps de cylindre (8 ; 42) par au moins une charnière et dans lequel la tige de piston (11 ; 44) est raccordée au panneau d'ombrage (7) à une certaine distance de la au moins une charnière.

4. Dispositif (1 ; 40) selon la revendication 3, dans lequel le panneau d'ombrage (7) comprend au moins deux tiges principales (5 ; 47) raccordées chacune à une extrémité de la au moins une charnière, au moins deux tiges de commande (6) articulées dans une zone centrale chacune à une tige principale et une toile d'ombrage (7) agencée sur les au moins deux tiges principales (5 ; 47).

5. Dispositif (1 ; 40) selon la revendication 4, dans lequel le panneau d'ombrage (7) est similaire à un parapluie.

6. Dispositif (1 ; 40) selon l'une quelconque des revendications 2 à 5, comprenant en outre un châssis (2) agencé sur le corps de cylindre (8 ; 42), dans lequel le châssis (2) a une base (3 ; 45) agencée à l'extrémité distale du récipient (4 ; 41).

7. Dispositif (1 ; 40) selon l'une quelconque des revendications précédentes, dans lequel la surface externe du récipient (4 ; 41) est pourvue d'une couche absorbant la chaleur.

8. Dispositif (1 ; 40) selon l'une quelconque des revendications précédentes, dans lequel le contenu du récipient (4 ; 41) est au moins 10 fois plus important que le contenu du corps de cylindre (8 ; 42).

9. Dispositif (1 ; 40) selon l'une quelconque des revendications précédentes, dans lequel, dans la position de non-ombrage non active, la pression de l'agent thermo-expansible à température ambiante est plus élevée que la pression ambiante.

10. Edifice (20 ; 30) ayant une façade (21) et une pluralité de dispositifs (1 ; 40) selon l'une quelconque des revendications précédentes, dans lequel le récipient (4 ; 41) de chaque dispositif (1 ; 40) est agencé devant les moyens d'ombrage (7) comme on peut l'observer dans la direction de la façade (21) de l'édifice (20 ; 30).

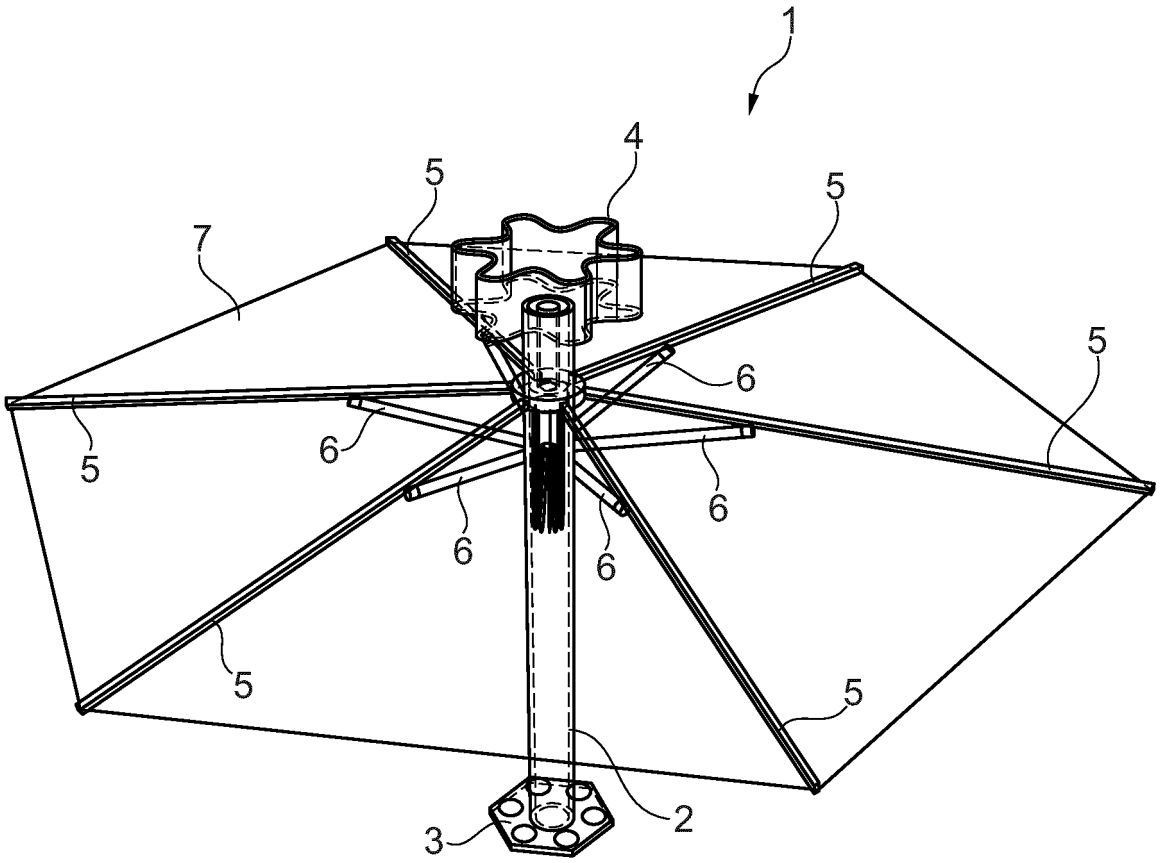


Fig. 1

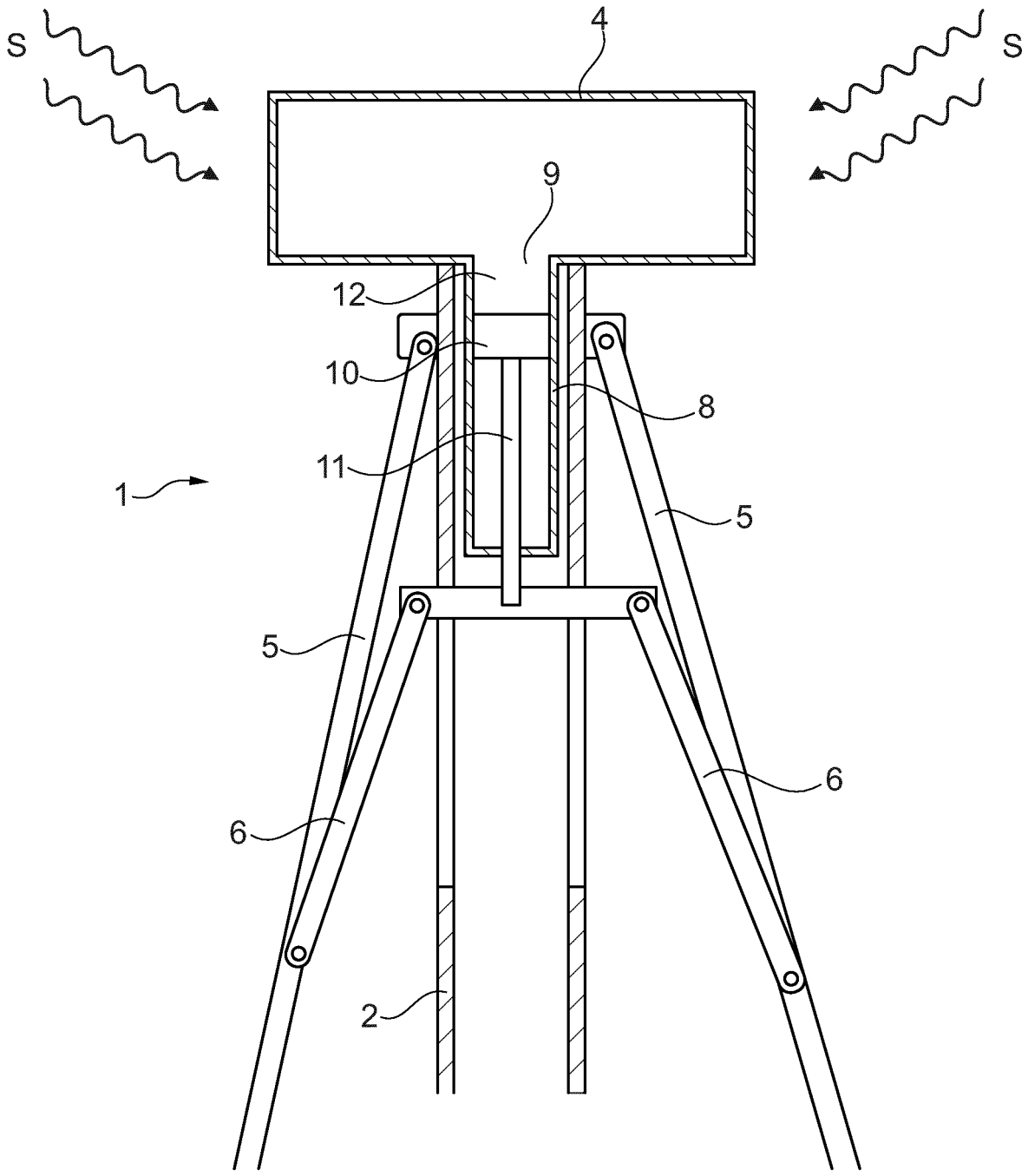


Fig. 2A

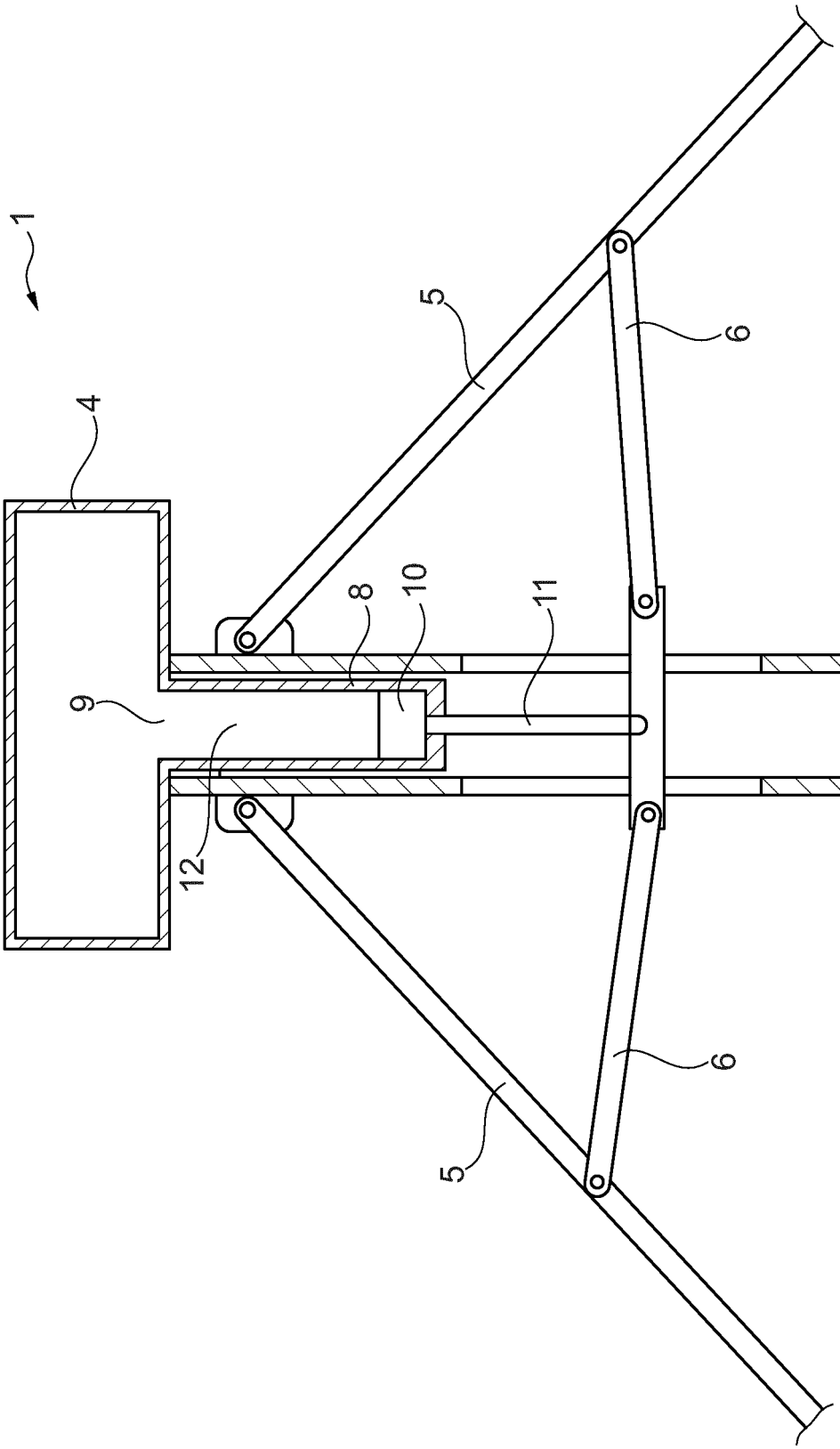


Fig. 2B

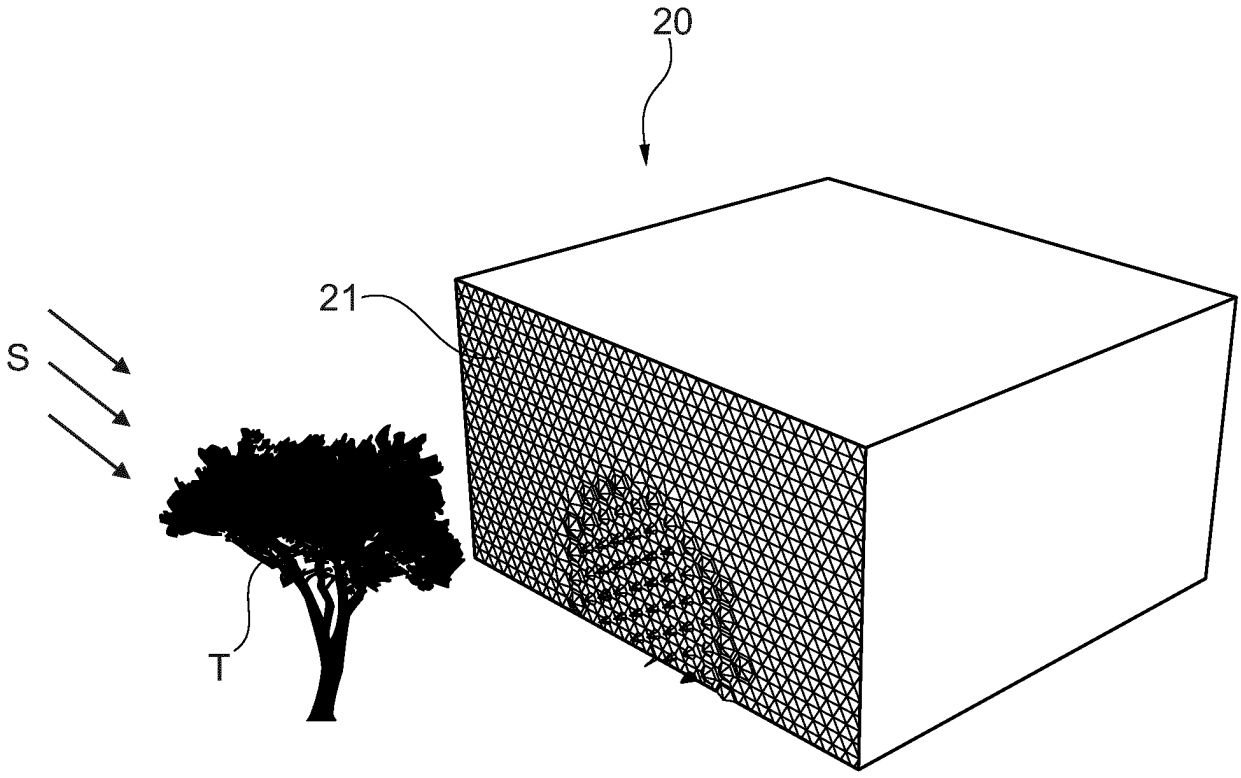


Fig. 3

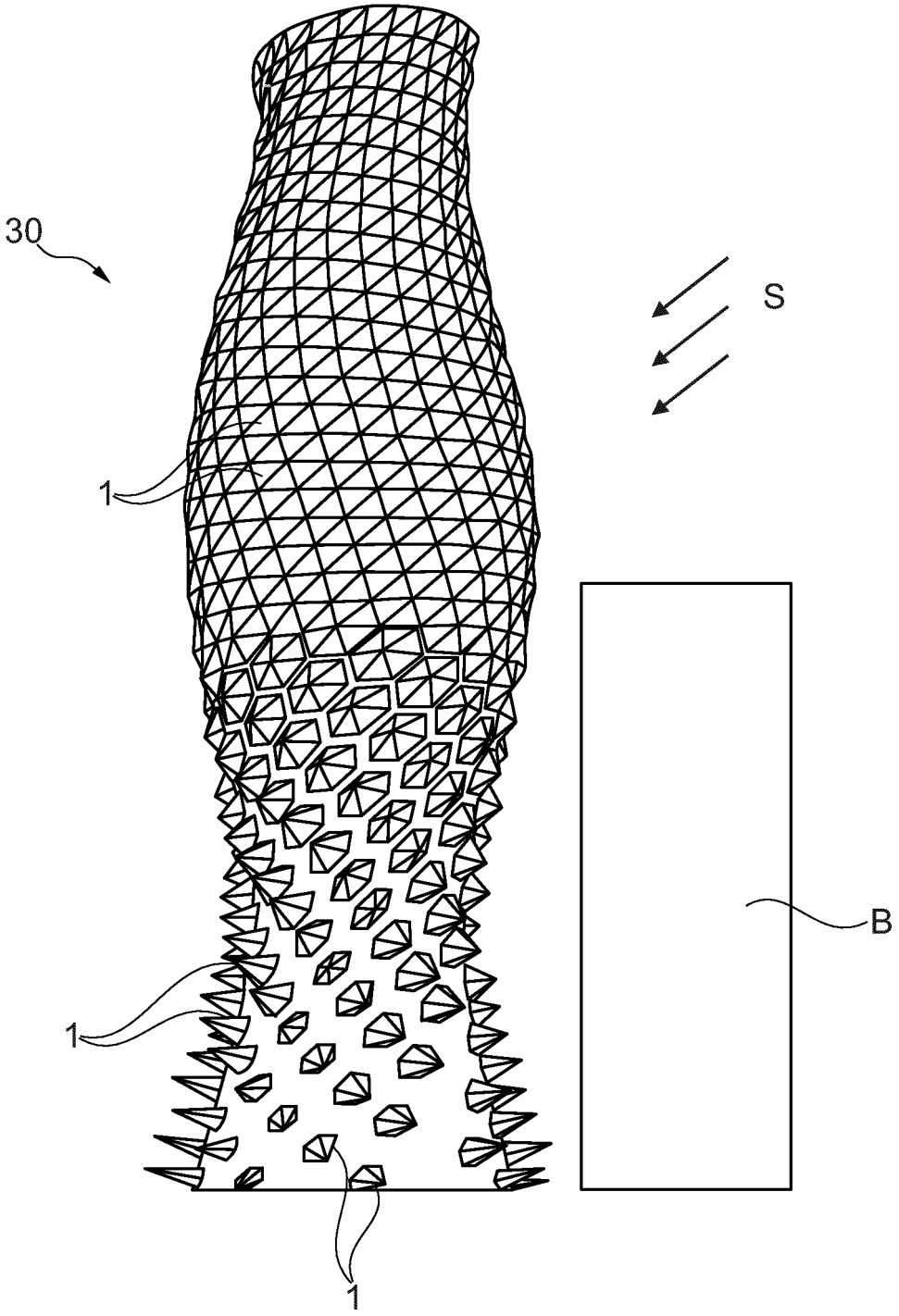


Fig. 4

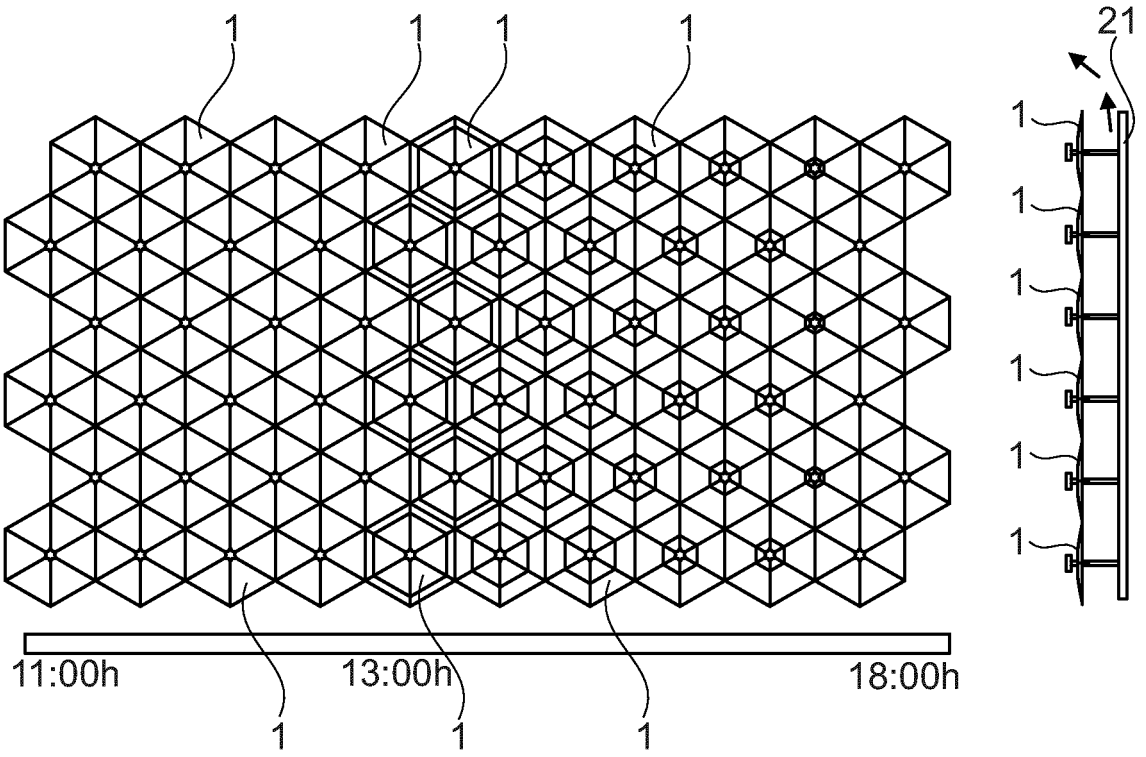


Fig. 5

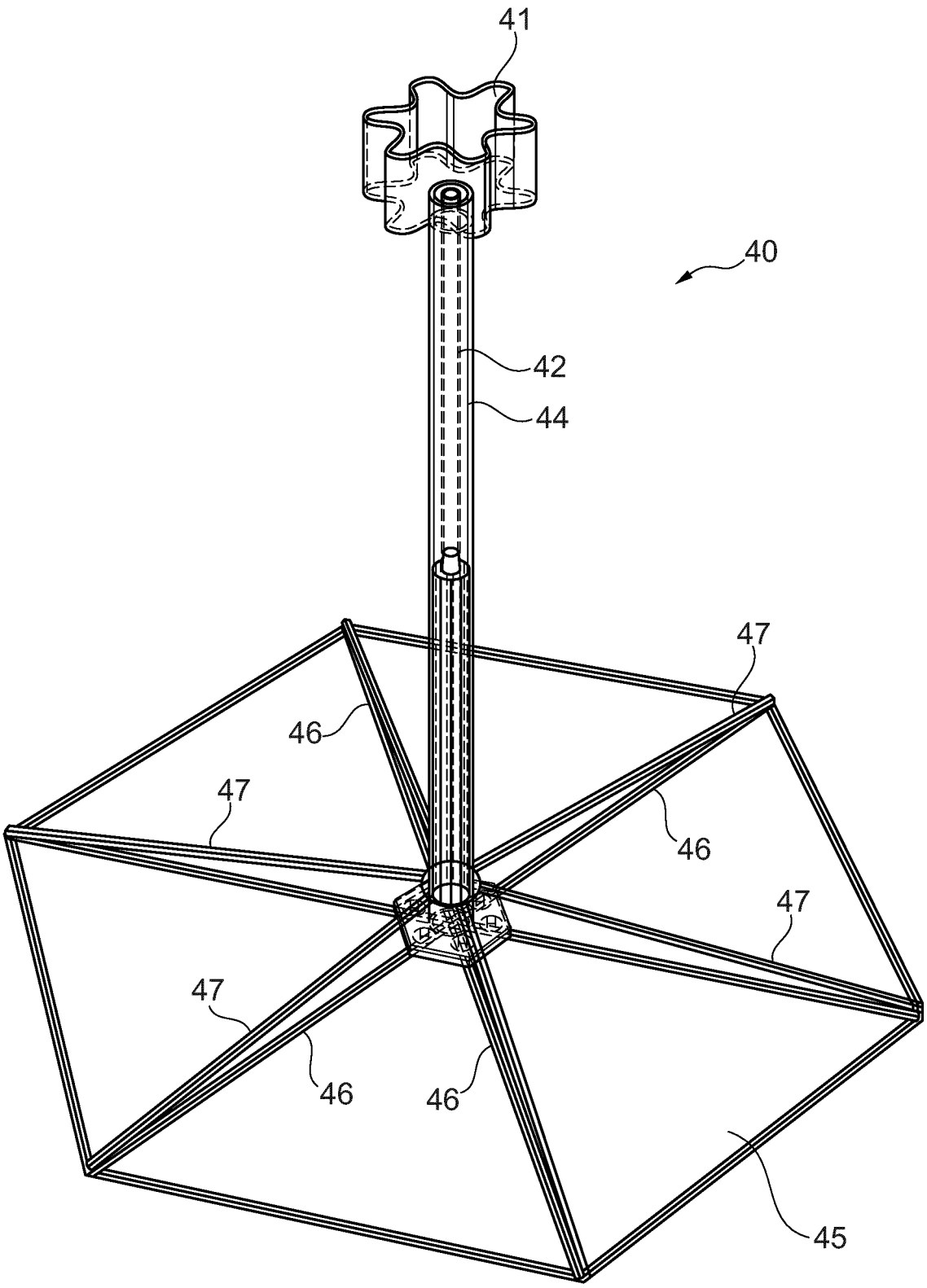


Fig. 6

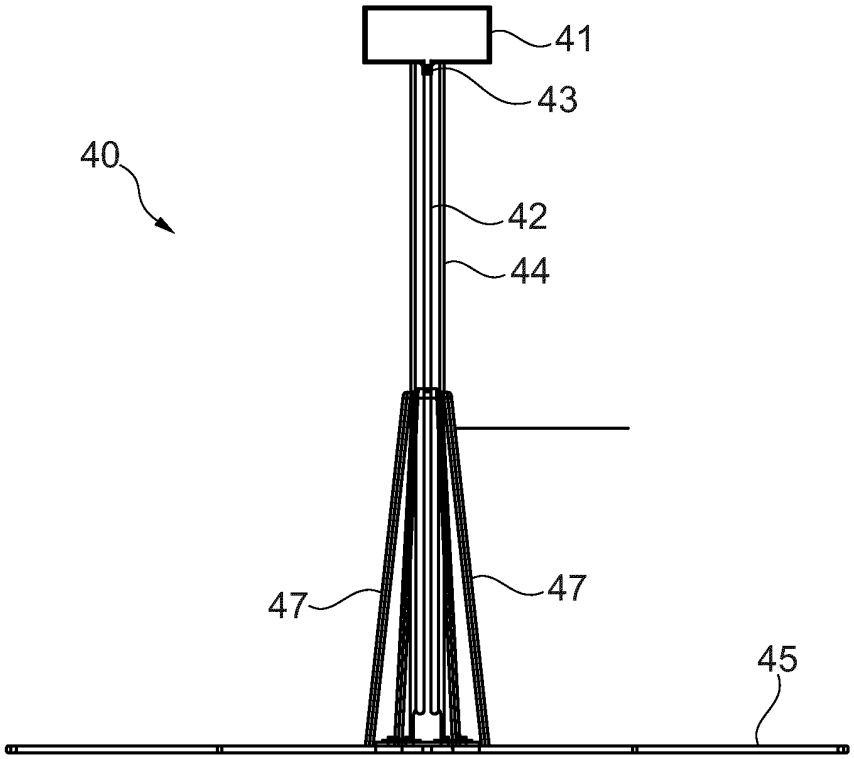


Fig. 7A

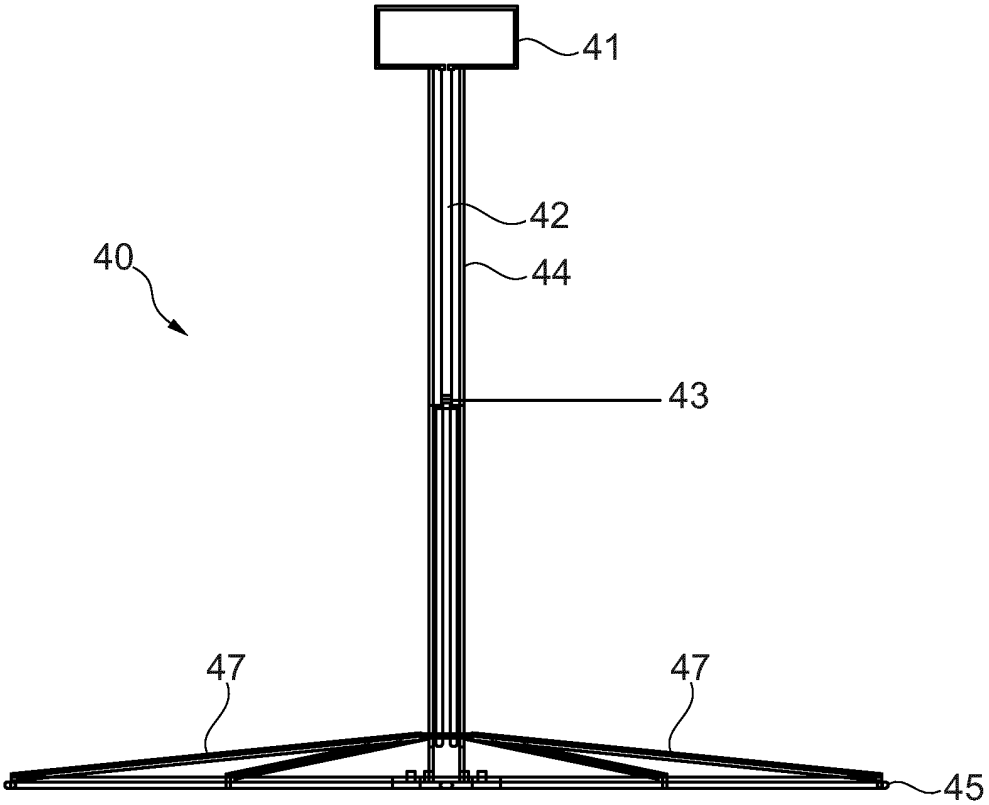


Fig. 7B

REFERENCES CITED IN THE DESCRIPTION

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