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(54) **AIR - SUPPORTED STRUCTURE**

(57) An air-supported structure comprising a dome formed of at least two membranes, one of which is an outer membrane, one surface of which faces outwards and the other surface faces the inner membrane, and one membrane is an inner membrane, one surface of which faces the inner space of the structure and the other surface faces the outer membrane, and a blowing-heat-

ing unit for supplying air to the interior of the air-supported structure and creating overpressure, thus ensuring the stability and required climatic conditions in the interior of the air-supported structure, wherein the outer membrane and the inner membrane form an intermediate space and are entirely spaced apart.

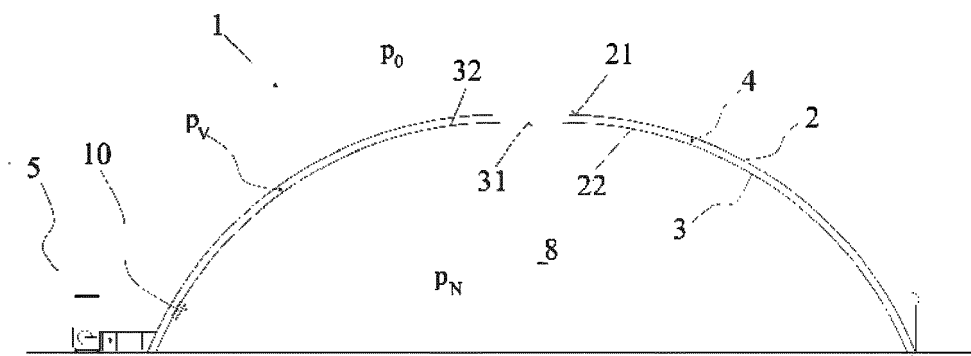


Fig. 1

Description

Subject of invention

[0001] The subject of the invention is an air-supported structure comprising a dome formed of at least two membranes.

Technical problem

[0002] The technical problem is to configure such an air-supported structure that has a dome formed of at least two membranes, wherein the dome will be configured with any external shape and at the same time will have good insulating properties.

Prior art

[0003] An air-supported structure, such as an inflatable hall, is a building formed of one membrane or several membranes. The air-supported structure is anchored to the ground and supported only by air. The air is pumped into the interior of the hall by a ventilation system that lifts the membrane, inflates it and maintains the shape and the structure of the membrane with the created overpressure relative to the ambient pressure. The overpressure inside the inflatable hall is unnoticeable to the user as it is only about 250 pascals higher than the outside air pressure. Inflatable halls are used for seasonal or permanent covering of various sports facilities, exhibition and other art spaces, as well as for the needs of industry and for military purposes. Depending on the requirements and the type of the building, the inflatable hall is formed of at least one membrane. Due to the requirements for the lowest possible energy consumption for both heating in winter and cooling in summer, the requirement for at least a two-layer overpressure shell structure is already very common. In addition, in the case of a structure consisting of two or more layers, condensate formation is also reduced.

[0004] In order to achieve the required insulating properties of the overpressure shell structure, the membranes must be substantially separated from each other so as to create a space between them filled with an insulating means such as an insulating foil or air. The inner membrane is attached to the outer membrane at regular intervals and so-called pockets are formed that extend around the circumference of the shell structure. The spots where the membranes come in contact do not have an air pocket, so these spots are not insulated and actually represent thermal bridges. Condensate forms, dripping from the membrane or flowing over the surface of the inner membrane facing the interior of the facility. In order for the outer and inner membranes in the pocket area to be truly separated from each other, an additional insulating foil, air with a certain overpressure or a combination of both must be arranged between them, wherein, if air is used, the inner membrane must be attached

to the outer membrane in an airtight manner. Such mutual attachment results in the inflatable shell construction having numerous longitudinal and/or transversal protrusions or chambers which make the outer and inner membranes and thus the surface of the structure uneven, wavy, unsmooth.

[0005] Due to its "puffy" surface, the external appearance of the inflatable shell structure thus created gives users an impression of a cheap industrial warehouse, although such a building may be intended for entirely different purposes. An inflatable shell structure of this type is undesirable due to its appearance, especially in urban areas.

[0006] Air-supported structures of any shape are known, but they are formed of a single membrane and thus do not meet the energy-related requirements.

[0007] In the case of an air-supported structure with a dome with two membranes and of a non-geometric shape, such a dome is configured to look "puffy" and does not achieve the desired shape due to failure to achieve uniform deformation after the required pressure is reached inside the structure.

Solution to the technical problem

[0008] The technical problem is solved by an air-supported structure, the main characteristics of which are given in the first independent patent claim. Additional features are given in further dependent claims.

[0009] An air-supported structure comprising a dome formed of at least two membranes, one of which is an outer membrane, one surface of which faces outwards and the other surface faces the inner membrane, and one membrane is an inner membrane, one surface of which faces the inner space of the structure and the other surface faces the outer membrane, and a blowing-heating unit for supplying air to the interior of the air-supported structure and creating overpressure, thus ensuring the stability and required climatic conditions in the interior of the air-supported structure, wherein the outer membrane and the inner membrane are spaced apart over their entire surface so as to form an intermediate space and surround it, each membrane being supported by air, the pressure of which is greater than the ambient pressure.

[0010] The inner membrane comprises an opening, in which an air flow and pressure control unit is arranged in an airtight manner, by means of which air is supplied and controlled from the space in the structure to the intermediate space between the inner and outer membrane and the pressure in the intermediate space is controlled. The pressure in the intermediate space is higher than the pressure in the inner space of the structure, with the pressure of the inner space being higher than the outer air pressure.

[0011] The air flow and pressure control unit is arranged in the inner membrane, preferably in the area of the air supply to the interior of the structure space, in order to achieve a sufficiently large air flow into the inter-

mediate space between the outer and inner membranes.

[0012] Because the outer and inner membranes are not bonded, an individual membrane does not form folds and does not have an appearance of an inflated balloon. On the contrary, the surface of each membrane is smooth.

[0013] The distance between the outer and inner membranes depends on the insulation requirements, as a larger distance means a thicker layer of insulating means, in this case air, and can be of any type. The distance between the outer and inner membranes can also be uneven because it is created solely by the overpressure of the air in this intermediate space. As a result, the outer membrane may be configured to be irregular in shape while the inner membrane is smooth. In the case where the outer membrane is of any shape that fits into the surroundings, the inner membrane can be smaller and of a size that corresponds to the purpose of the facility. This also reduces the space that needs to be heated in winter or cooled in summer. As a result, energy consumption is reduced.

[0014] An advantage of the air-supported structure according to the invention is also that the space between the membranes can be used to install various installation lines, which are otherwise arranged inside the facility and thus visible.

[0015] A further advantage of the air-supported structure according to the invention is also that heated air flows into the interspace from the interior, which heats the outer membrane and thus melts snow, which must be removed from the dome in winter due to loads.

[0016] The invention will be illustrated in more detail with an embodiment and drawings representing in

Fig. 1 Air-supported structure, cross view

Fig. 2 Air-supported structure, view in projection

[0017] An air-supported structure 100 comprises a dome 1, in the embodiment consisting of two membranes, an outer membrane 2 and an inner membrane 3, and a blowing-heating unit 5 that ensures the stability and required climatic conditions inside the air-supported structure by supplying air to an interior 8 of the air-supported structure. There may be more than two membranes forming the dome.

[0018] The dome 1, which is formed of two membranes in the embodiment, has the outer membrane 2, one surface 21 of which faces outwards and the other surface 22 faces an intermediate space 4 between the membranes, and the outer membrane 3, one surface 31 of which faces the inner space 8 of the dome 1 and the other surface 32 faces the intermediate space 4 between the membranes 2, 3.

[0019] The dome 1 is fixed either to the pre-fabricated foundations or directly to the ground by means of an anchoring system (not the subject of the invention and not shown). In order to ensure the required conditions inside the dome 1 and to minimize energy consumption, the

dome 1 is anchored to the ground in a way to ensure minimal air loss so that each membrane 2, 3 is anchored to the ground separately. The dome 1 has circumferentially arranged entrances (not the subject of the invention) in the area where the dome 1 contacts the ground, the shape and number of which depend on the needs. It goes without saying that the entrances are formed in an airtight manner.

[0020] The installation and stability of the dome is achieved by the blowing-heating unit 5 arranged outside the dome 1 in its vicinity. The blowing-heating unit 5 draws air from the surroundings and supplies it through the ducts to the interior 8 of the structure, i.e. to the space between the ground and the membrane. Due to the supply of air to the inner space 8 of the structure, an overpressure p_n is created in the space, which causes the membrane to move away from the ground and float in the air.

[0021] Each membrane 2, 3 is formed of strips 6, 7 of a certain width and length, which are bonded together in an airtight manner along the longitudinal edge, the bonding method being carried out in any known manner, such as sewing, welding, gluing or other known bonding method. The length of each strip 6 corresponds to the total width of the outer membrane 2. The length of each strip 7 corresponds to the total width of the inner membrane 3.

[0022] The membrane is made of a suitable material, usually a composite material with properties that meet the requirements for air-supported structures. The membrane material is not the subject of the present invention.

[0023] The inner membrane 3 comprises an opening 9 which is preferably arranged in the area of air blowing into the space 8, but can also be arranged anywhere on the inner membrane 3. The inner membrane 3 is reinforced in the area of the opening 9 with additional layers of material. In the opening 9 there is arranged, in an airtight manner, an air flow and pressure control unit 10 in the form of a pressure control louver which regulates the air flow from the space 8 to the intermediate space 4 between the inner 3 and the outer membrane 2 and regulates the pressure p_v in the intermediate space 4, which must be higher than the pressure p_n in the space 8, wherein the pressure p_n of the space 8 is higher than the external air pressure p_0 . For better air intake, the air flow and pressure control unit 10 has, at its upper portion, i.e. the portion more distant from the ground, an added air deflector 11. The pressure control louver 10 is in communication with the blowing-heating unit 5 and is controlled by a control system which is part of the blowing-heating unit 5. The pressure control louver 10 provides for sufficient pressure p_v in the intermediate space 4 throughout the use of the air-supported structure, which pressure p_v causes and maintains the distance between the outer 2 and the inner membrane 3 and prevents them from coming in contact. This achieves a constant air pocket that has insulating properties. Since there is no contact between the outer 2 and the inner membrane 3, no thermal bridges are formed. As a result, there are no

energy losses or condensate formation.

[0024] The pressure control louver 10 can maintain any required pressure p_v of the intermediate space 4 and supply any required amount of air to the intermediate space 4. Therefore, the outer membrane 2 can be of any shape as conceived by the architect and/or the client, while the inner membrane 3 is of a size that optimally meet the needs. Due to the optimisation of the inner space 8, the energy consumption is lower and at the same time the thickness of the insulating air layer in the intermediate space is greater.

[0025] An additional advantage of such an air-supported structure is that due to the absence of contacts between the outer 2 and the inner membrane 3, the inner membrane 3 is smooth, without bulges and waves. Such a surface of the inner membrane 3 gives users additional possibilities of its use, for example projections.

3, **characterised in that** the air flow and pressure control unit (10) is arranged on the inner membrane (3) in the area where the air is blown into the space (8).

5. An air-supported structure according to any preceding claim, **characterised in that** the air flow and pressure control unit (10) is a pressure control louver.

Claims

1. An air-supported structure comprising
a dome formed of at least two membranes, one of which is an outer membrane, one surface of which faces outwards and the other surface faces the inner membrane, and one membrane is an inner membrane, one surface of which faces the inner space of the structure and the other surface faces the outer membrane, and
a blowing-heating unit for supplying air to the interior of the air-supported structure and creating overpressure, thus ensuring the stability and required climatic conditions in the interior of the air-supported structure,
characterised in that the outer membrane (2) and the inner membrane (3) are spaced apart over their entire surface so as to form an intermediate space (4), each membrane (2, 3) being supported by air, the pressure of which is greater than the ambient pressure.
2. An air-supported structure according to claim 1, **characterised in that** the inner membrane (3) comprises an opening (9), in which an air flow and pressure control unit (10) is arranged in an airtight manner, by means of which air is supplied and controlled from the space (8) in the structure to the intermediate space (4) between the inner (3) and outer membrane (2) and the pressure (p_v) in the intermediate space (4) is controlled.
3. An air-supported structure according to claim 2, **characterised in that** the pressure (p_v) in the intermediate space (4) is higher than the pressure (p_n) in the space (8), wherein the pressure (p_n) of the space (8) is higher than the external air pressure (p_0).
4. An air-supported structure according to claims 2 or

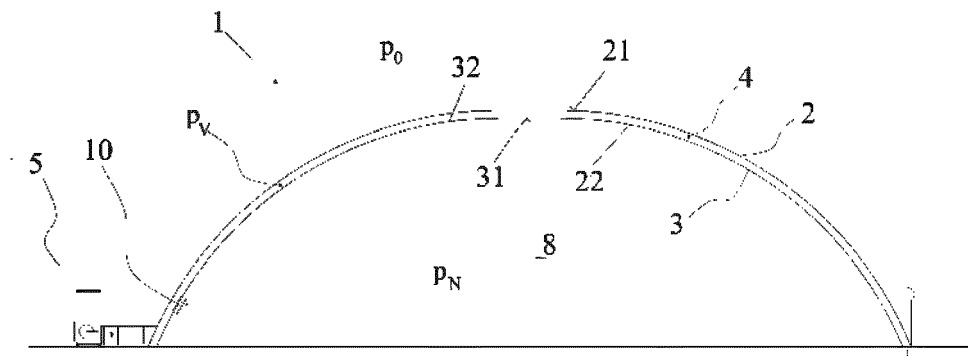


Fig. 1

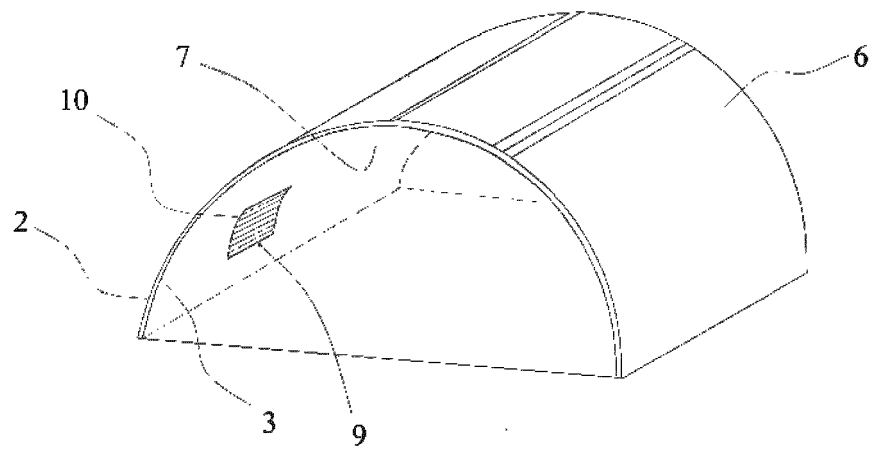


Fig. 2



EUROPEAN SEARCH REPORT

Application Number
EP 20 00 0397

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DOCUMENTS CONSIDERED TO BE RELEVANT			
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A	* page 2, last paragraph *	3	
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 19 February 2021	Examiner Valenta, Ivar
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 20 00 0397

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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