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(54) **INFLATABLE AIRBAG**

(57) The invention relates to an inflatable airbag aimed at restraining impacts from falling bodies, finding application as an inflatable equipment for outdoor or indoor sports, entertainment and training purposes, rescue operations from heights, for individual or collective use.

According to present invention the inflatable airbag (1) is equipped with at least one main inflatable chamber (2) with at least one air inlet (2.6) and outlet (2.6), air pressure regulation valve (2.7) and plurality many perpendicularly fixed inflatable shock absorbing chambers (3), connected in their base to the inflatable main chamber (2), and with at least one protective cover (4), positioned above the shock absorbing air chambers (3), where the shock absorbing chambers (3) have a height of 70-95% of the height of the main chamber (2) and are opened in their base and fixed to the face side of the connecting base - "skirt" (3.3) with a centrally positioned air opening (3.1) with a diameter from 10cm to 25 cm, joined by a movable or fixed fastening between its back and the surface of the main air chamber (2), so that the distance between the shock absorbing chambers (3) is

not less than 1cm and not more than 15 cm, and the protective cover (4) is fastened by movable or fixed side parts (5) and/or side skirts (6), connected between themselves by angle connections (5.1) and (6.1), respectively, and is fastened to the main air chamber (2) by an elastic connection.

The inflatable airbag developed under this invention has a robust, effective and optimized construction which provides a high absorption level of the falling body energy and a high level of safety. The accurate selection of the elements, their dimensions and material provide a maximum protection from wearing of the inflatable airbag construction and warrant its high level of strength, efficacy and safety during use.

The inflatable airbag according to this invention finds application in the construction of facilities for indoor and outdoor sports, entertainment and training activities, including water and any air sports, for security measures during accidents, including rescue and firefighting activities etc.

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## Description

### FIELD OF THE INVENTION

**[0001]** The invention relates to an inflatable airbag aimed at absorbing impacts from falling bodies, finding application as an inflatable equipment for outdoor or indoor sports, entertainment and training purposes, rescue operations from heights, for individual or collective use.

### BACKGROUND OF THE INVENTION

**[0002]** Inflatable airbags are widely used to restrain impacts. They bring to a minimum the risk of injury and ensure the personal safety of the user during various activities/movements (accidental or not), which require landing from the air to the ground.

**[0003]** It is known from WO2010112953 A1 an inflatable jumping pit consisting of a flat elastic structure with a cover, where the pit is provided on one side with uniformly distributed elastic inflatable ridges (shock absorbing chambers), positioned to the pit surface. The described ridges are fixed on one side to the upper surface of the pit using glue and/or seal and/or seams, and are open in their base which is in contact with the mattress. The ridges have been constructed as parallel cylinders, each of them contacting perpendicularly the pit surface. The cover encloses the upper and side surfaces of the pit together with the ridges completely corresponding to the pit surface. It is made of layered elastic foam material covered on top with a layer of elastic material highly resistant to bursting and mechanical perforation.

**[0004]** It is also known from DE102014013389B4 an airbag intended for prevention from injuries, consisting of: at least one inflatable main chamber with internally distributed one or more sectors with openings, and with at least one air inlet and outlet and with multiple inflatable projections (shock absorbing chambers) connected in their base to the first inflatable main chamber so that the airflow from the shock absorbing chamber goes to at least one inflatable main chamber. The described airbag includes also a connecting device parallel to the main chamber and perpendicular to the projections in the form of a strip or a band, which connects at least two inflatable projections so that the movement of the inflatable projection leads to a movement of at least another projection. It includes also a protective cover (fastened by a Velcro connection or an adhesive or a welded connection) which provides a fixed connection between the multiple inflatable projections and keeps the other ends of the projections in a fixed position to one another. The protective cover may be included separately without a connecting device.

**[0005]** The distance between the described projections of the airbag is the same, selected so as to be as much as the surface of the projection or to vary from 10% to over 90% of the length of the relevant projection. The projections have the form of a cylinder, pyramid,

cone or cuboid and are fixed to the main chamber by gluing and/or welding. The protective cover forms the basic and the side surfaces of the airbag, being fixed by an elastic strip to the main chamber or by means of rubber "shoes". The airbag may be connected sequentially or in parallel to other airbags, to form different modules of an airbag and have many individual chambers with supportive elements and openings for air exchange between them.

**[0006]** The diameter of the air vents of the main chamber is not described in the cited prior art. This diameter together with the height of the projections is of particular constructive significance, since they define the feature of shock absorbance, i.e. the damping force which is in direct dependence and reflects in the hardness of the inflatable surface. The higher hardness of the airbag surface makes possible the bouncing back of the body and hides a risk of injury.

**[0007]** Another disadvantage is the existing large distance between two adjacent projections /10-90% of projection height/, which obligatorily requires a connecting device in between. Otherwise, this distance will be a sufficient prerequisite for loss of resistance and falling of the user between the projections and risk of injury, respectively, which makes the airbag not sufficiently reliable.

**[0008]** What is particularly important for these constructions is also the connection between the inflatable projections and the main chamber as well as their contact surface of joining, which distributes the load and provides the bond strength.

**[0009]** The the present invention is to provide a safe and effective inflatable airbag, eliminating the above-mentioned problems as well as to increase the uniformity of load distribution of the falling body on the working surface, resulting in maximum absorbance and restraining the impact of the falling body, thus ensuring a high level of safety during its use.

### SUMMARY OF THE INVENTION

**[0010]** The peresen invention has been created with an object in providing an inflatable airbag, which is equipped with at least one main inflatable chamber with internally distributed one or more transverse ribs with openings, connecting the upper and lower base of the main chamber, forming one or more sectors respectively, with at least one air inlet and at least one air outlet positioned on the external side of the side walls of the main chamber, as well as with at least one air valve for air pressure regulation.

**[0011]** Perpendicularly fixed to the main air chamber on the side of the impact there are multiple parallel to each other shock absorbing chambers which are opened in their base and are fixed to the face side of the connecting base, named "skirt", which is fastened with its back to the surface of the main chamber by a flexible connection - self-adhesive band or zip, or is firmly fixed by sewing, gluing or welding, so that the distance be-

tween the shock absorbing chambers to be not less than 1 cm and not more than 15 cm. The height of the shock absorbing chambers (h) is directly dependent on the height of the main chamber (H) and is from 70 to 95% of the height of the main chamber (H).

**[0012]** Openings are positioned on the skirts and centrally for the shock absorbing chambers, and they coincide with their respective openings on the main chamber, through which the ventilator-supplied airflow moves. The diameter of these openings is from 10 cm to 25 cm.

**[0013]** The upper free ends of the shock absorbing air chambers are covered with a protective cover with side parts and/or side skirts fastened to the protective cover by a flexible connection of a self-adhesive strip, hook-and-loop or a zip or by a fixed connection by sewing, gluing or welding, and are jointly connected to the main air chamber by an elastic connection through openings so that the cover repeats entirely and fixes lastingly the three-dimensional form of the cushion.

**[0014]** The openings for the flexible elastic connections for fastening the protective cover to the main chamber are positioned simultaneously on strips in the upper end, under the side parts and the side skirts of the protective cover as well as the opening are positioned on strips fixed along the external edge of the upper and lower side of each side part of the main chamber.

**[0015]** One or more air-permeable areas are positioned on the side parts and/or the side skirts of the protective cover, with a possibility to cover also the whole surface of the side skirt. The connection between the side parts and/or the side skirts of the protective cover is accomplished by angle connections, which are strengthening elements of trapezoidal or rectangular form, joined by a flexible connection of self-adhesive strips or a zip, or by a fixed connection by sewing, gluing or welding.

**[0016]** The shock absorbing chambers may have the form of a cylinder, cube, cone, parallelepiped or other irregular three-dimensional forms.

The base binding "skirt" may have a square, rectangular, polygonal or oval form. The air bag created according to the present invention is made of a polyester cloth with a one-sided or two-sided coating of polyvinylchloride, polyurethane, acryl etc.

**[0017]** The airbag according to the present invention can be connected sequentially or in parallel to other identical airbags - one or more modules, this way forming various configurations of airbags in one inflatable facility. In such case the connection is accomplished by the connective elements of the protective cover and with coinciding of the relevant air inlets/outlets between separate modules.

**[0018]** The inflatable airbag developed under this invention has a stable, effective and optimized construction which provides a high absorption level of the falling body energy and a high level of safety.

The shock absorbing chamber positioned extremely close to each other have a minimum distance between them, which ensures optimum and effective working sur-

face in impact, and stability of each airbag separately or in configuration, since they operate with the same functionality in the constructions - both separately and jointly.

**[0019]** At the same time, the introduction of the special constructive element of the "skirt" makes possible the simplified replacement of the wearing parts and also makes the construction easy to maintain, convenient for assembly and disassembly, compact for transportation purposes, and generally, cost effective for its owner. The used intermediate element of the "skirt" ensures also a large contact surface of joining between the "skirt" and the main chamber and increases this surface by 25-30% compared to the same shock absorbing chamber joined directly (without a skirt) to the main chamber, thus ensuring the proper distribution of the strength in the joining point of the shock absorbing chamber to the main chamber.

**[0020]** The accurate selection of the elements, their dimensions and material provide a maximum protection from wearing of the inflatable airbag construction and warrant its efficacy and safety during use.

**[0021]** The specially selected diameter of the air opening of the "skirt" between both chambers (the main and the shock absorbing) predetermines the optimum performance of the shock absorbing chambers during impacts from different angles and as a result, the shock absorbing chamber constructed this way guarantees the damping strength.

**[0022]** The strengthening elements in the main chamber keep its form during operation and let the air to pass through their openings with the relevant speed.

**[0023]** The protective cover used is easily fastened to the main chamber and can be easily replaced if damaged or worn out; it protects completely the inflatable shock absorbing chamber (projections) and ensures them the appropriate strength, flexibility and high resistance to tearing and mechanical perforation as well as a rapid and easy access in case of replacement of the shock absorbing chambers under it.

**[0024]** The inflatable airbag according to the present invention can be used in the construction of facilities for indoor and outdoor sports, entertainment and training activities, including water and any air sports, for security measures during accidents, including rescue and fire-fighting activities etc.

**[0025]** It is intended for assembly in the area of falling, landing and jumping and can include more than one module, other modules being easily joined in parallel or sequentially to form various configurations of the joined airbags depending on the requirements, the terrain and the intended use.

**[0026]** The modules are compact, easy for safe storage when kept uninflated. The functional mechanisms of the airbag systems have been designed so as to provide the highest possible safety during landing, and when used for sports and games, they ensure safe and optimum enjoyable experience with the inflatable facility.

## EXPLANATION OF THE FIGURES

[0027]

- Fig. 1. presents a three-dimensional view of the inflatable airbag;
- Fig.2. presents a three-dimensional view of the inflatable airbag and protective cover with side skirts;
- Fig.2.a presents a close view of openings for flexible elastic connections;
- Fig.3. presents a three-dimensional view of the inflatable airbag and protective cover with the side parts;
- Fig.4 a. presents a view of a cylindrical shock absorbing inflatable chamber connected to a "skirt" and their A-A section with flexible connection of the "skirt" to the main chamber;
- Fig.4 b. presents a view of the connecting "skirt" base with a flexible connection between the skirt and the main chamber and with the point of joining between the shock absorbing cylindrical chamber to the skirt;
- Fig.4c. presents a view of the connecting "skirt" base with a fixed connection between the skirt and the main chamber and with the point of joining between the shock absorbing cylindrical chamber to the skirt.
- Fig.5. presents a spatial section of the main chamber and ribs with openings of the inflatable airbag;
- Fig.6.a. presents a view of the cuboid shock absorbing inflatable chamber connected with a "skirt" and their B-B section with a flexible connection of the "skirt" to the main chamber;
- Fig.6.b. presents a view of the connecting "skirt" base with a flexible connection between the skirt and the main chamber and with the point of joining between the shock absorbing cuboid chamber to the skirt;
- Fig.6.c. presents a view of the connecting "skirt" base with a fixed connection between the skirt and the main chamber and with the point of joining between the shock absorbing cuboid chamber to the skirt;
- Fig.7 presents a three-dimensional view of the inflatable airbag and a protective cover with strips;
- Fig.7.a presents a close view of strips with openings for flexible elastic connections.

## EXAMPLES OF INVENTION

### EXAMPLE 1

[0028] In one described embodiment, of the invention according to fig. 1-5 and fig.7, the inflatable airbag 1 is equipped with: one rectangular main inflatable air cham-

ber 2 with many sectors distributed in its inner space and connected with upper 2.1 and lower 2.4 base by means of ribs 2.3 with openings 2.8, the height of which 2.5 is equal to the height of the side parts of the main chamber 2; where on the side parts of the main chamber 2 there are positioned at least one opening for air inlet 2.6 and at least one opening for air outlet 2.6 and at least one air pressure control valve 2.7.

[0029] To the main air chamber 2 perpendicularly, on the side of the impact, there are fixed many removable cylindrical shock absorbing chambers 3 with diameter of 50cm, and each shock absorbing chamber 3 is joined by a fixed connection at the joining point 3.5 on the face part of the connecting square "skirt" base 3.3 with an air opening in its center 3.1 with a diameter of 13 cm which ensures the two-way air passage. Each shock absorbing chamber 3 together with its "skirt" 3.3. is attached by a flexible connection 3.4 fixed in advance to the back of the "skirt" 3.3 by sewing, self-adhesive band or zip in a place 3.6 to the surface of the main chamber 2, with a distance of 2.5 cm between the shock absorbing chambers 3.

[0030] On the upper side 3.2 of the shock absorbing chambers 3, there is positioned also a protective rectangular cover 4 (fig.3), which is removably connected by a self-adhesive strip, hook-and-loop or a zip 4.1 with its side parts 5, the angle connections of which 5.1 are rectangular and fastened to the side parts 5 by a double Velcro strip (crocodile mouth type) 5.2. On the side parts 5 there are located also air-permeable zones 5.3, made of net. The main air chamber 2 is connected to the protective cover 4 by an elastic connection (not shown on the figures), which passes simultaneously through openings 6.4 on strips 6.3, fastened in advance in the upper end, under side parts 5 and through openings 2.9, which are located on strips 2.2 and fixed in advance by a seam to the external edge on the upper and lower side of each side part 2.5 of the main chamber 2.

[0031] The inflatable airbag is suitable for indoor and outdoor sports, entertainment and training purposes, games and rescue activities and makes possible the joining of one or more airbags in configurations suitable for the terrain and the intended use.

The height (h) of the shock absorbing chamber (3) is 91.5% of the height (H) of the main chamber (2).

Suitable for a maximum jump of - up to 5 m;  
Required area - 7mx7m;  
Recovery time - 15sec.

### Example 2

[0032] In another embodiment the inflatable airbag 1 is made the same way as in Fig.1-5 and 7, with the difference that the shock absorbing chambers 3 are cuboid according to Fig.6 with size 1m×1m ×1m, each shock absorbing chamber 3 being connected in joining point 3.5 to its square "skirt" 3.3, which is fixed by connection

3.7 by means of sewing or gluing to the surface of the main chamber 2, where the air openings 3.1 have a diameter of 16cm at a distance of 12cm between the shock absorbing chambers 3.

[0033] The protective rectangular cover 4 is fixed (rigidly) by means of sewing or gluing to the side "skirts" 6, and the angle connections 6.1 with trapezoid form are fixed to the side skirts 6 by means of sewing, gluing or welding 6.2. The main air chamber 2 is joined to the protective cover 4 by an elastic connection which passes simultaneously through openings 6.4 located on strips 6.3 in the upper end, on the side of skirts 6 and through openings 2.9 located on strips 2.2 fixed in advance by a seam to the external edge of the upper and lower side of each side part 2.5 of the main chamber 2.

[0034] The height (h) of the shock absorbing chamber (3) is 90.9% of the height (H) of the main chamber (2).

Suitable for a maximum jump of - up to 10 m;  
Required area - 10m×10m;  
Recovery time - 15sec.

### Example 3

[0035] Represents the same embodiment of the inflatable air chamber 1 as in Example 1 with the difference that the distance between the shock absorbing chambers (3) is 1,2 cm, the diameter of the air openings 3.1 is 22 cm and the height (h) of the shock absorbing chamber (3) is 72% of the height (H) of the main chamber (2).

[0036] **Principle of operation and use** of this invention:

Initially, the user supplies air to the first main chamber 2 of the inflatable airbag 1 through air supply inlet 2.6 until the main chamber 2 fills its volume.

[0037] At the same time the shock absorbing chambers 3 of inflatable airbag 1 are also inflated, valve 2.7 being used for air pressure regulation to the required working value.

[0038] The protective cover 4 is placed on the upper free end 3.2 of the shock absorbing chambers 3, where the protective cover 4 being connected in advance to its side parts 5 and/or side skirts 6 together with their angle connections 5.1 and 6.1, respectively, either flexibly - by a self-adhesive strip, hook-and-loop or zip, or fixedly - by a seam, gluing or welding. The side parts 5 and/or side skirts 6 are joined to the main chamber 2 by flexible connections which pass through strips 6.3 with openings 6.4 positioned on the side parts 5 or the side skirts 6 of the protective cover 4 as well as through openings 2.9 positioned on an identical strip 2.2 fastened to each upper or lower edge of the main chamber 2. The inflatable airbag can be connected by modular connection to (n) other similar modules by elastic connections through openings 2.9. When the falling body falls on the surface of the airbag 1, the protective cover 4 assumes the load and transfers and distributes it to the shock absorbing chambers 3 which reduce the strength of the impact on the falling

body, and the connection of each shock absorbing chamber 3 by means of the "skirt" 3.3 increases the contact surface between both chambers (main chamber 2 and shock absorbing chamber 3) as well as improves the supporting strength and protects from damage the main chamber 2. Additional protection is ensured by the proper regulation of the pressure in the main chamber 2 by means of valve 2.7 for pressure regulation within the construction volume. The modules of the inflatable device can be easily and conveniently stored after being folded.

### Claims

1. Inflatable airbag equipped with at least one main inflatable chamber with at least one air inlet and outlet, air pressure regulation valve and plurality perpendicularly fixed inflatable shock absorbing chambers, connected in their base to the inflatable main chamber, and with at least one protective cover, positioned above the shock absorbing air chambers, **characterized in that**, the shock absorbing chambers (3) have a height of 70-95% of the height of the main chamber (2) and are opened in their base and connected fixedly to the face side of the connecting base - "skirt" (3.3) on which is with a centrally positioned air opening (3.1) with a diameter from 10cm to 25 cm, joined by a flexible or fixed fastening between its back and the surface of the main air chamber (2), **so that** the distance between the shock absorbing chambers (3) is not less than 1cm and not more than 15 cm, **and** the protective cover (4) is fastened by **movable or fixed side parts** (5) and/or side skirts (6), connected between themselves by angle connections (5.1) and (6.1) respectively, and is fastened to the main air chamber (2) by an elastic connection.
2. Inflatable airbag according to claim 1, **characterized in that** the "skirt" (3.3) has a square, rectangular, oval or polygonal form.
3. Inflatable airbag according to claims 1 and 2, **characterized in that the movable** joining of the "skirt" (3.3) to the surface of the main chamber (2), is by a flexible connection (3.4) of a self-adhesive strip or zip, and the **fixed** connection (3.7) is by sewing, gluing or welding.
4. Inflatable airbag according to claim 1, **characterized in that** the shock absorbing chambers (3) have the form of cylinders, cubes, cones, parallelepipeds and other irregular three-dimensional forms.
5. Inflatable airbag according to claim 1, **characterized in that** inside of the main inflatable chamber (2) are arranged one or more transverse ribs (2.3) with openings (2.8) that connect the upper (2.1) and the lower base (2.4) of the main air chamber 2, and form

one or more sectors, respectively, with a height equal to the height of the side parts (2.5) of the main air chamber (2).

6. Inflatable airbag according to claim 1, **characterized in that** the angle connections of the side parts (5) and/or the side skirts (6) of the protective cover (4) have a rectangular (5.1) or a trapezoidal (6.1) form. 5
  
7. Inflatable airbag according to claim 1, **characterized in that** the elastic connection passes simultaneously through openings (6.4) with strips (6.3) positioned in the upper end, under the side parts (5) and the side skirts (6) then passes through openings (2.9), positioned on strips (2.2) fastened in advance to the external edge of the upper and the lower side of each side part (2.5) of the main chamber (2). 10  
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8. Inflatable airbag according to claim 1, **characterized in that** on the side parts (5) and the side skirts (6) of the protective cover (4), there are one or more air-permeable zones (5.3), with a possibility to cover also the whole surface of the side skirt (6). 20
  
9. Inflatable airbag according to claim 1, **characterized in that** it is a module, with a possibility for parallel or sequential connection to one or more identical modules, forming various configurations of an inflatable facility intended for indoor or outdoor sports, entertainment and training purposes, rescue activities, for individual or collective use. 25  
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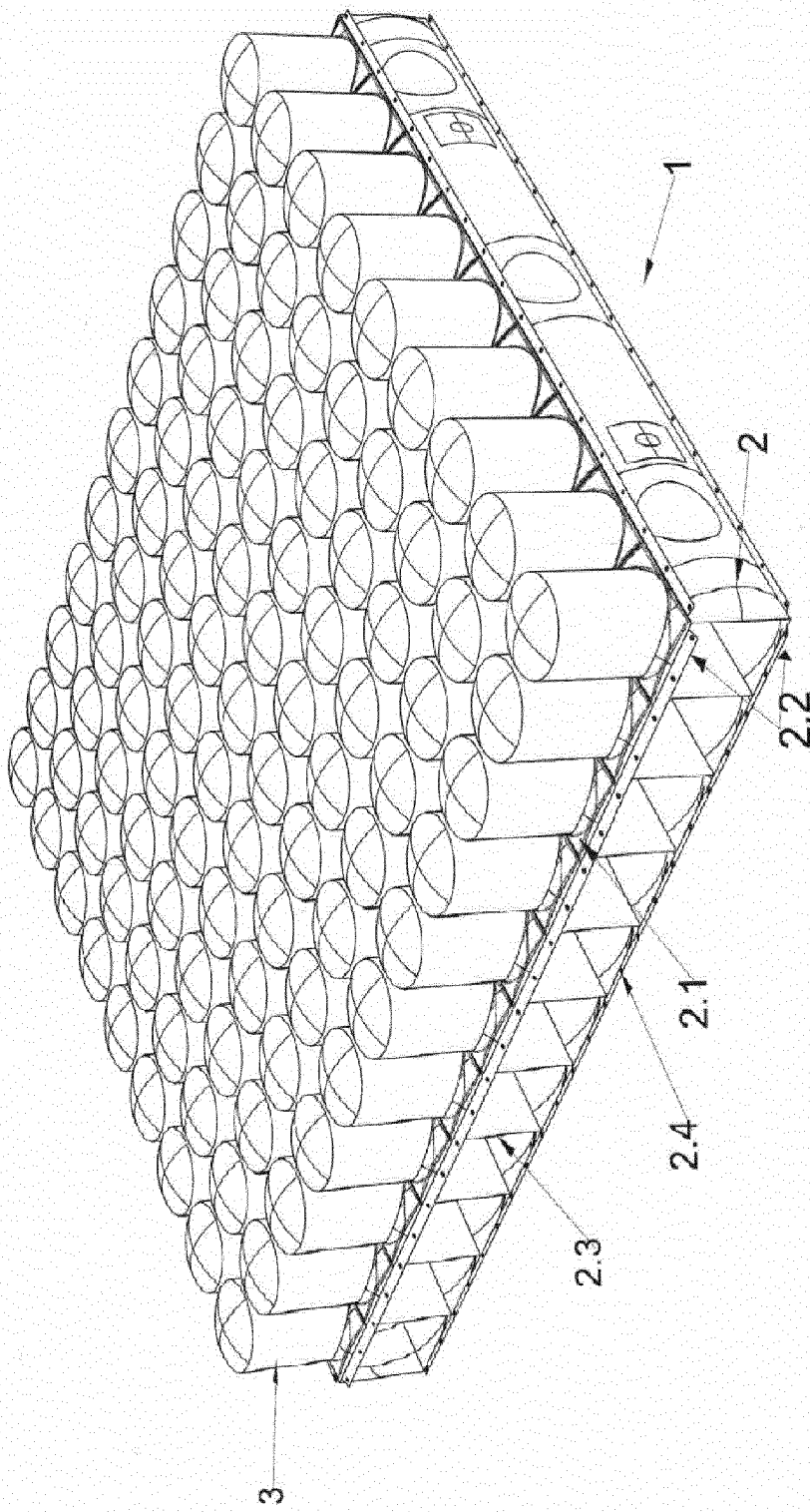
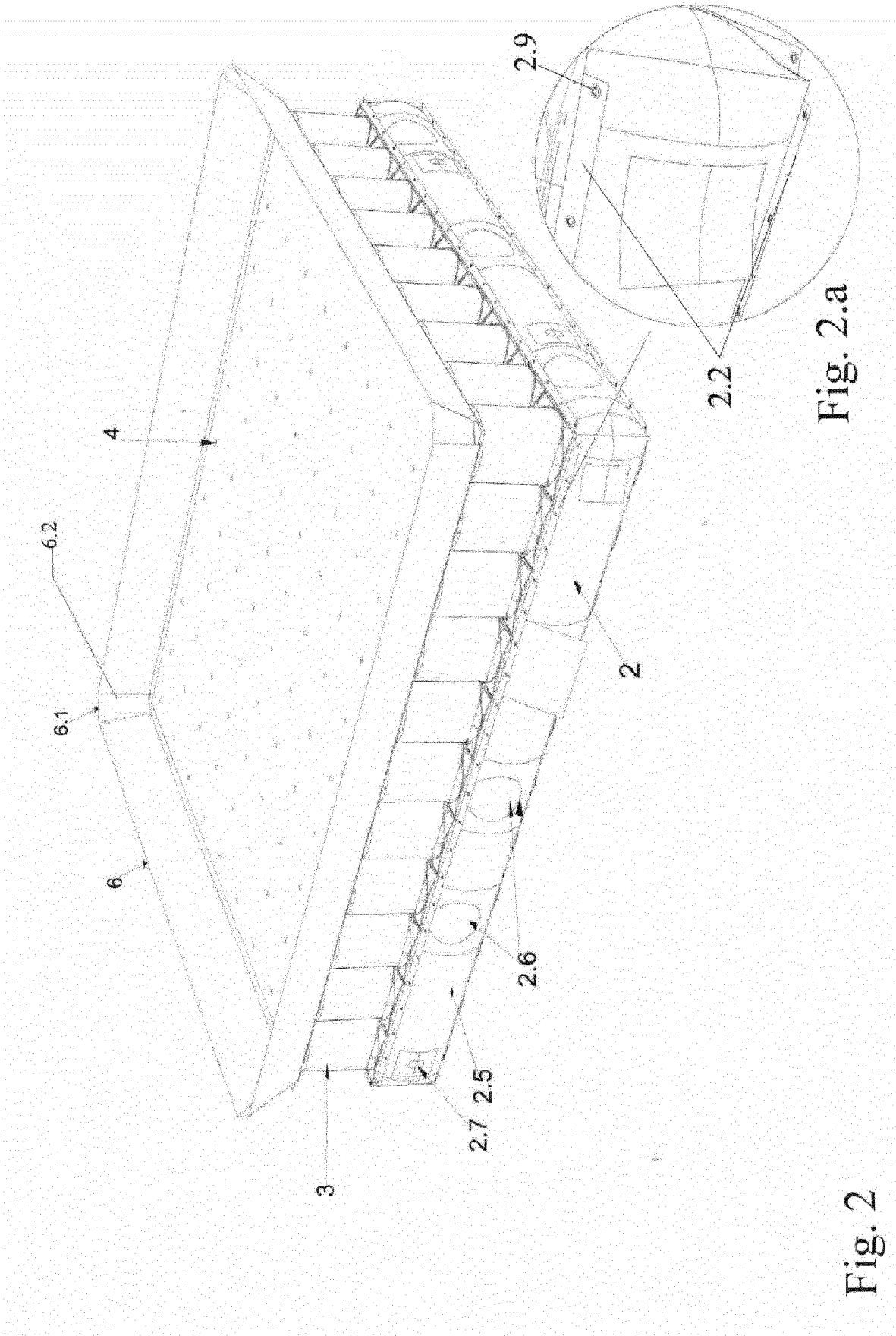
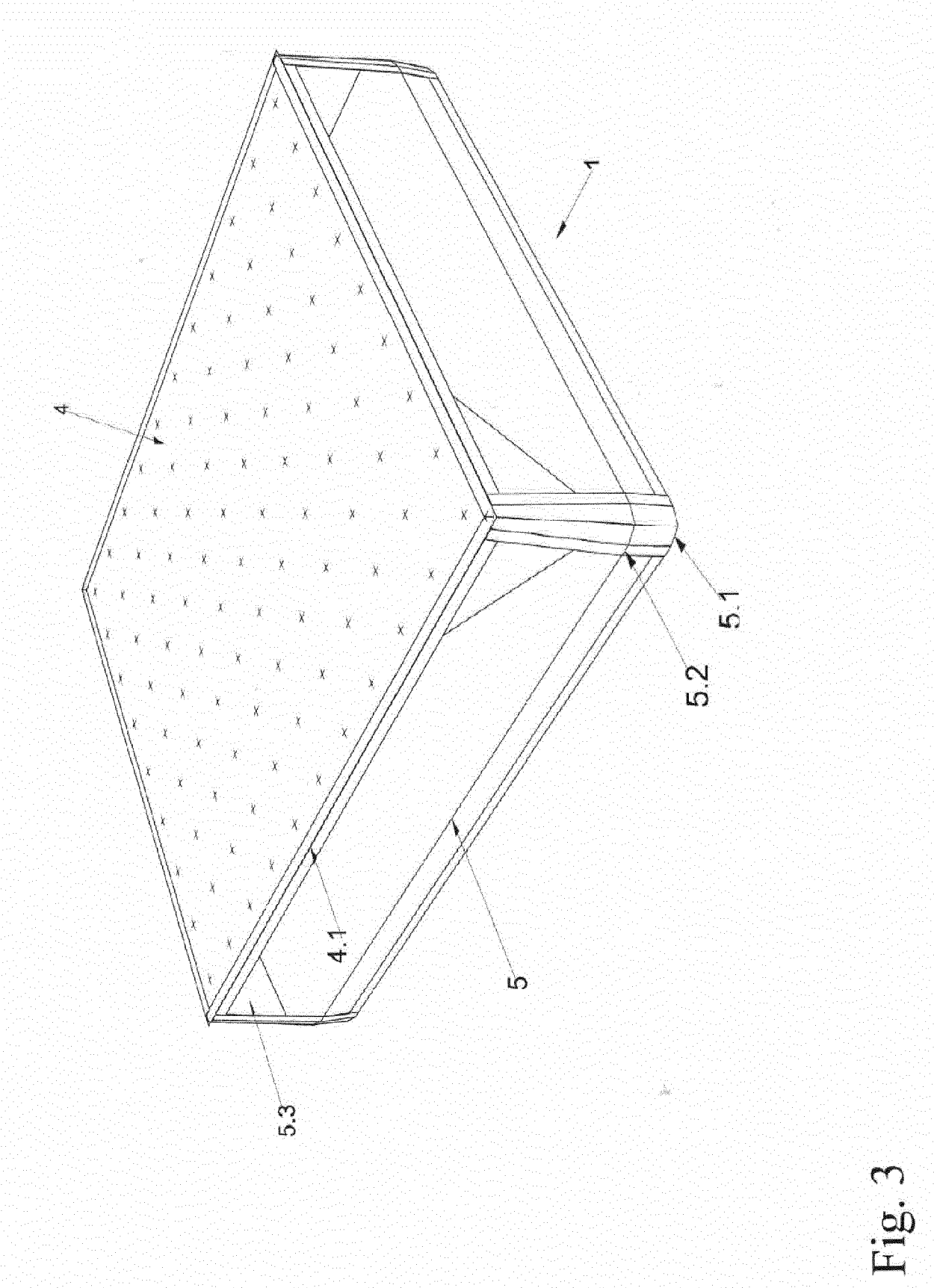
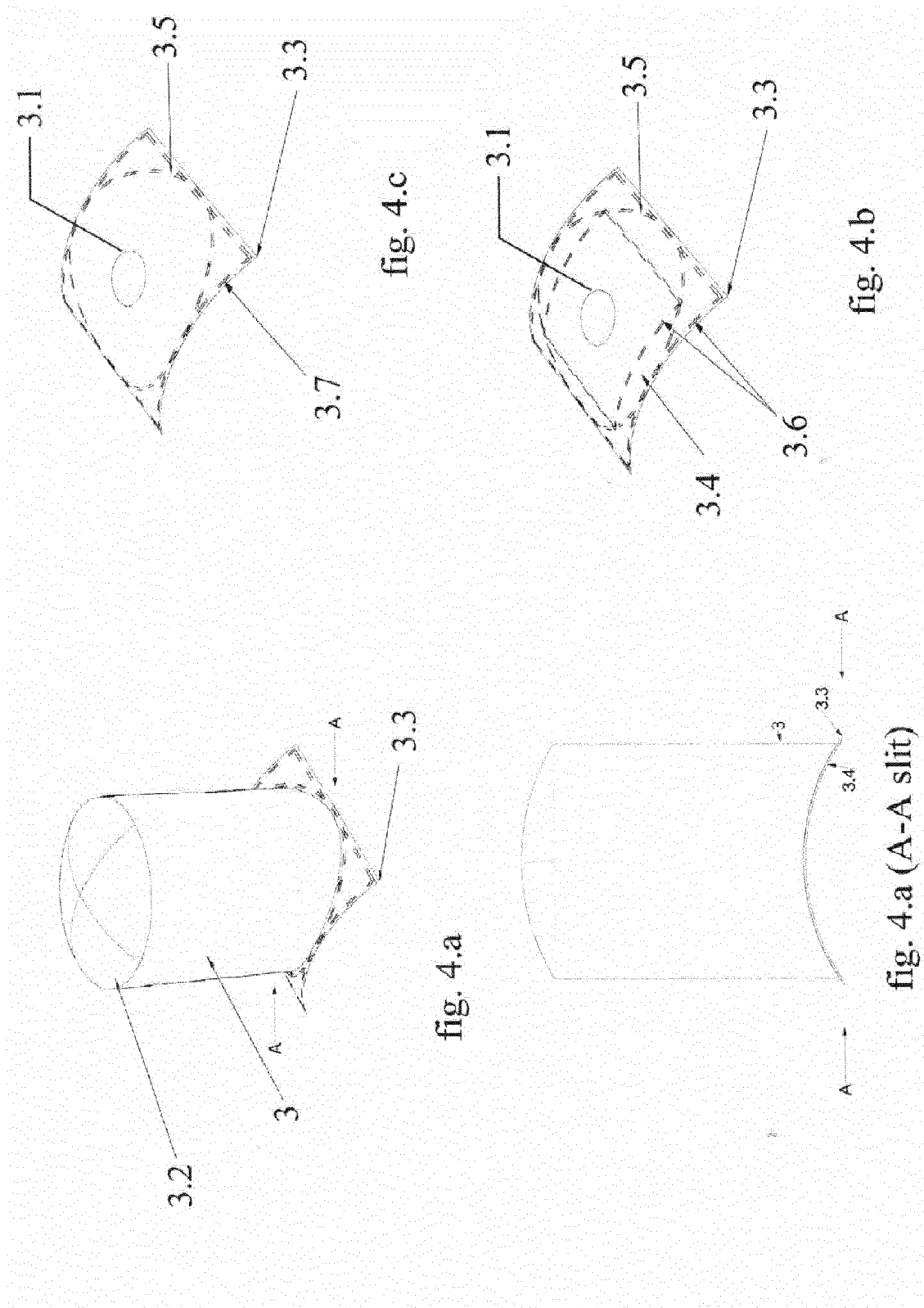


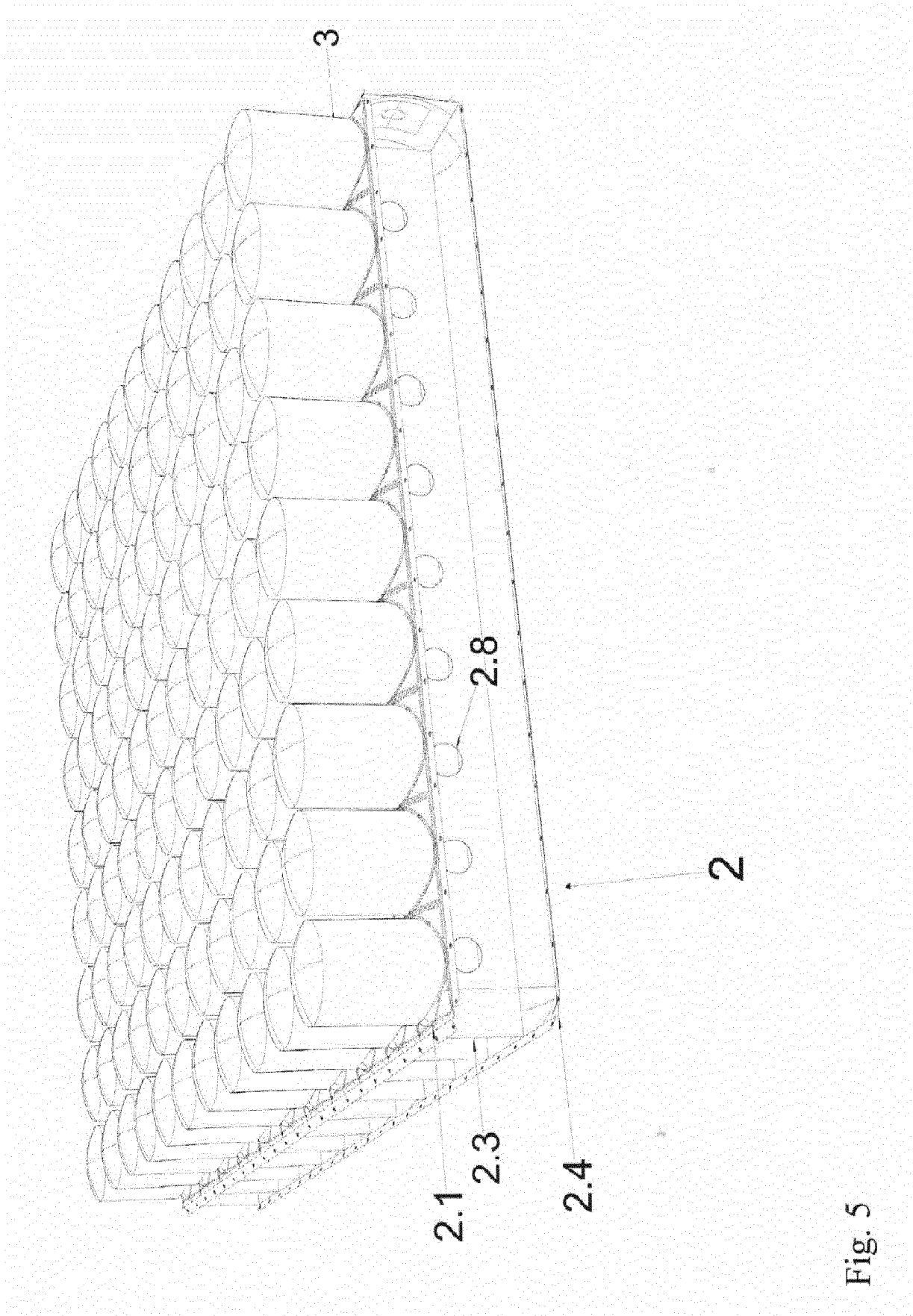
Fig. 1

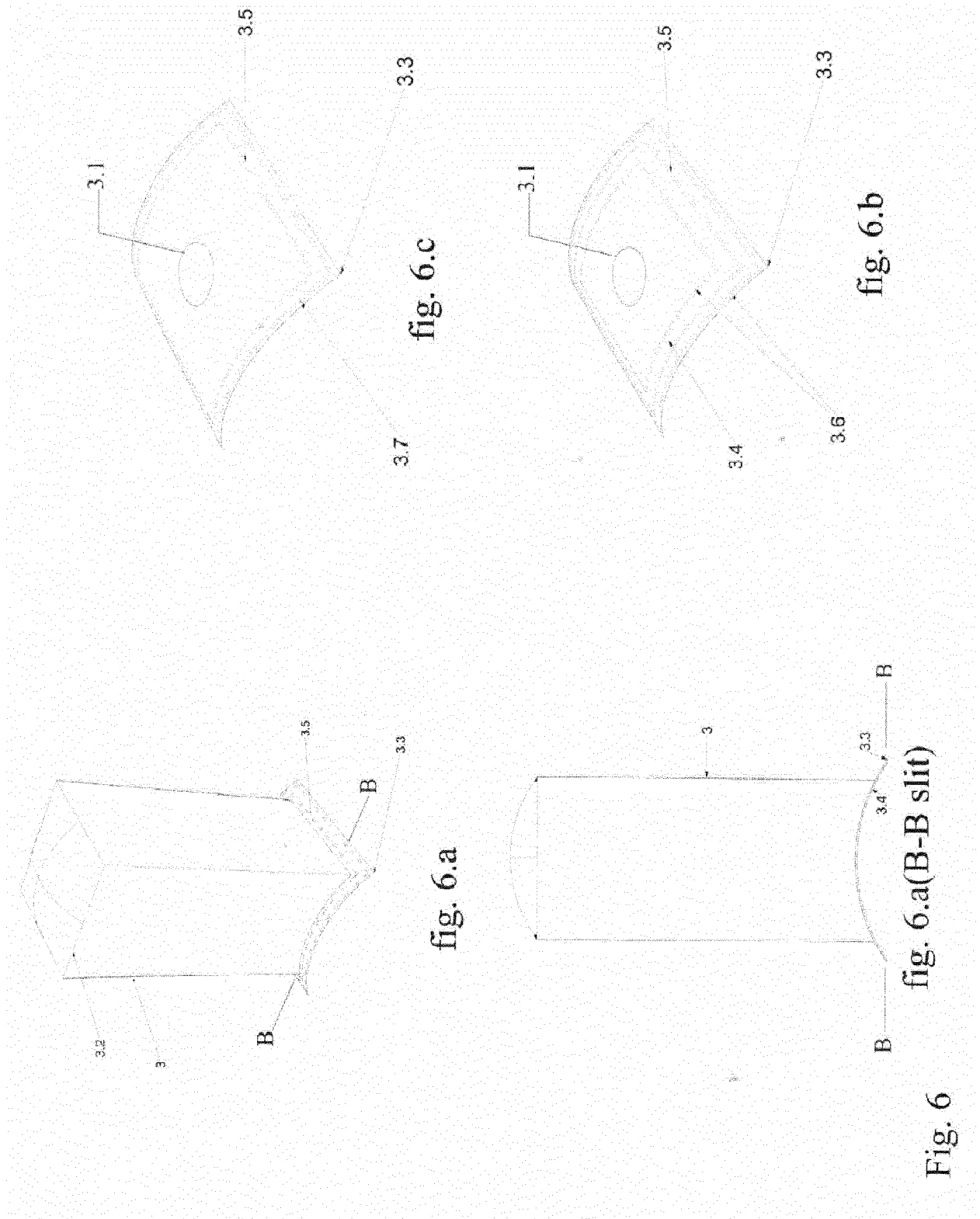












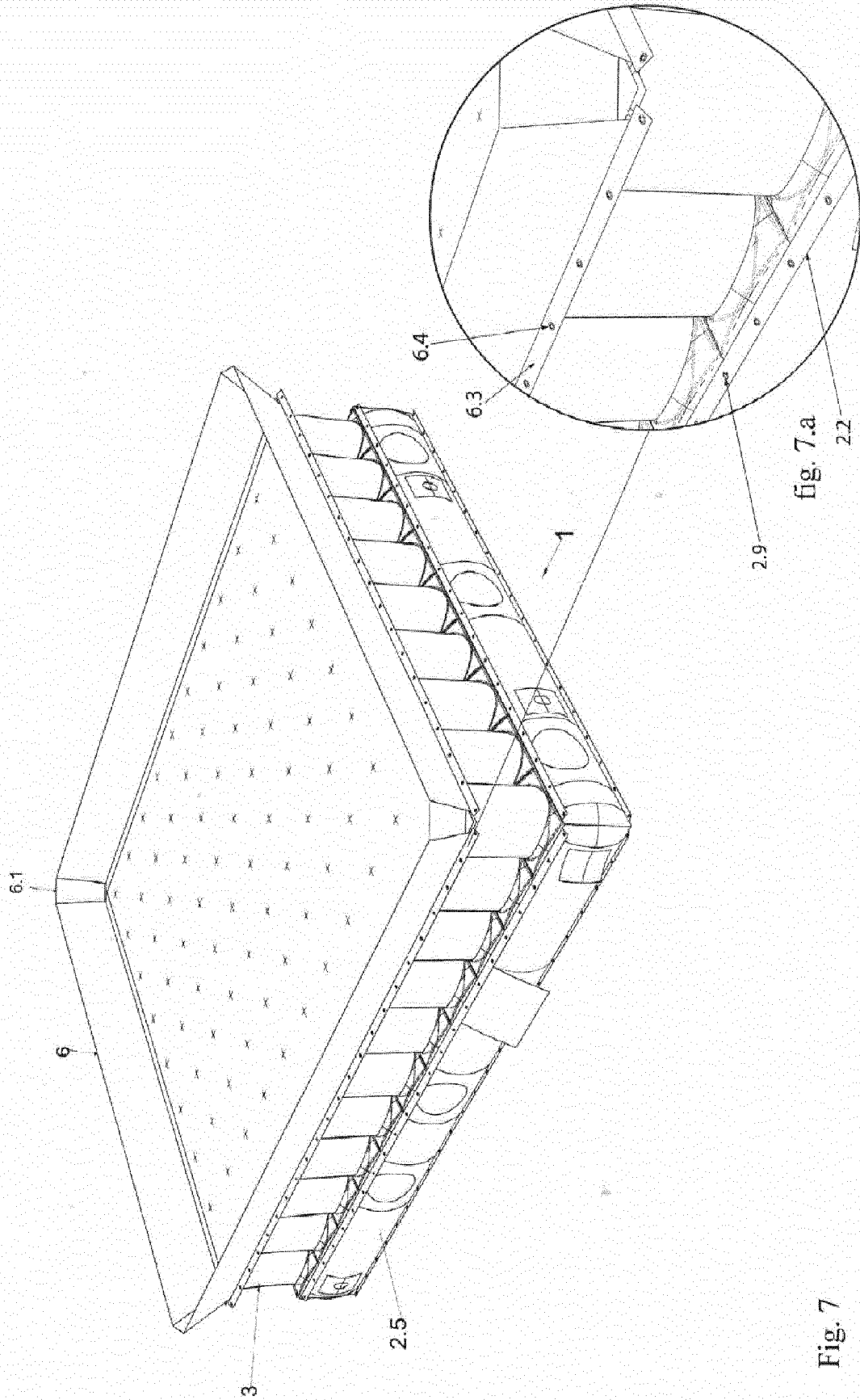


Fig. 7



## EUROPEAN SEARCH REPORT

Application Number

EP 21 02 0541

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Citation of document with indication, where appropriate, of relevant passages                                                                                            | Relevant to claim                                        | CLASSIFICATION OF THE APPLICATION (IPC)                                                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|-----------------------------------------------------------------------------------------|
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>KR 2016 0031697 A (PARK JUNG SEOK [KR])</b><br><b>23 March 2016 (2016-03-23)</b><br><b>* paragraph [0044] - paragraph [0048] *</b><br><b>* figures 5-9 *</b><br>----- | 1-9                                                      | <b>INV.</b><br><b>A63B6/02</b><br><b>A62B1/22</b>                                       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                          |                                                          | <b>TECHNICAL FIELDS SEARCHED (IPC)</b><br><br><b>A63B</b><br><b>A62C</b><br><b>A62B</b> |
| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                          |                                                          |                                                                                         |
| Place of search<br><b>Munich</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                          | Date of completion of the search<br><b>21 April 2022</b> | Examiner<br><b>Tejada Biarge, Diego</b>                                                 |
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ANNEX TO THE EUROPEAN SEARCH REPORT  
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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