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(54) **PRESSURE REDISTRIBUTION MATTRESS**

(57) There is described a pressure redistribution mattress (1) comprising an inner support structure (100) housing a pressure redistribution assembly (200) including a plurality of air cells (210) connected by means of a pressure redistribution system (250). The air cells (210)

are spaced apart from one another to form gaps (210a) between the air cells (210) and the gaps (210a) are filled with supporting spacers (115) formed of an open-structured, non-foam supportive material allowing circulation of air and moisture.

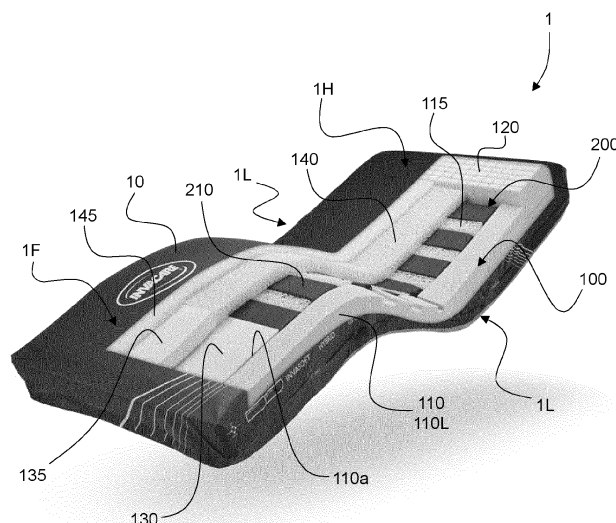


Fig. 1A

EP 4 066 690 A1

Description

TECHNICAL FIELD

[0001] The present invention generally relates to a pressure redistribution mattress comprising an inner support structure housing a pressure redistribution assembly including a plurality of air cells connected by means of a pressure redistribution system.

BACKGROUND OF THE INVENTION

[0002] Such pressure redistribution mattresses are known as such in the art, for instance from International (PCT) Publication No. WO 00/62648 A1 and U.S. Patent No. US 6,269,505 B1. Such mattresses conventionally make use of a pressure redistribution assembly including a plurality of juxtaposed air cells arranged e.g. in a longitudinal and/or transversal configuration, i.e. with each air cell extending along a length or a width of the mattress. The juxtaposition of air cells is however detrimental in that it negatively affects circulation of air and moisture in the mattress, the air cell assembly acting in effect as a barrier against such air and moisture circulation. This inherently leads to issues in terms of accumulation of heat and humidity, which becomes problematic from a microclimate perspective as such accumulation may lead to the occurrence of pressure ulcers if not appropriately managed. This is also problematic from a hygienic perspective as such accumulation of heat and moisture favours the development of bacteria and may lead to contamination of the mattress' inner support structure, which inevitably requires regular cleaning operations, if not replacement of mattress components that are irreversibly damaged.

[0003] Other known mattresses make use of an inner support structure consisting of one or more foam elements, made e.g. of polyurethane. Such foam elements may exhibit a structured upper surface as for instance disclosed in U.S. Patent No. US 5,671,492 A. Other more elaborated mattresses make use of foam elements with a castellated upper surface designed to improve comfort for the patient and ensure some level of pressure redistribution. The main disadvantage of polyurethane foam however resides in its relatively poor ability to allow circulation of air and humidity.

[0004] The aforementioned known solutions are not therefore fully satisfactory, and there accordingly remains a need for an improved solution.

SUMMARY OF THE INVENTION

[0005] A general aim of the invention is to provide an improved pressure redistribution mattress.

[0006] More specifically, an aim of the present invention is to provide such a solution that ensures efficient pressure redistribution as well as improved microclimate management.

[0007] Another aim of the invention is to provide such a solution that achieves superior performance in terms of temperature and humidity management.

[0008] A further aim of the invention is to provide such a solution that provides optimal conform for the patient.

[0009] Yet another aim of the invention is to provide such a solution which remains reasonably simple and cost-efficient to produce.

[0010] Still another aim of the invention is to provide such a solution which facilitates cleaning and maintenance operations.

[0011] These aims are achieved thanks to the solutions defined in the claims.

[0012] In accordance with the invention, there is provided a pressure redistribution mattress according to claim 1, namely such a mattress comprising an inner support structure housing a pressure redistribution assembly including a plurality of air cells connected by means of a pressure redistribution system. According to the invention, the air cells are spaced apart from one another to form gaps between the air cells, and the gaps are filled with supporting spacers formed of an open-structured, non-foam supportive material allowing circulation of air and moisture.

[0013] By way of preference, the inner support structure comprises a flexible supporting frame member with a longitudinal space configured and dimensioned to receive the pressure redistribution assembly and supporting spacers. In this context, the flexible supporting frame member preferably includes a pair of longitudinal sidewalls encasing the pressure redistribution assembly and supporting spacers, a central portion of each longitudinal sidewall being provided with at least one transversal aperture that ensures circulation of air and moisture between the longitudinal space and lateral sides of the mattress. Each transversal aperture may advantageously consist of a transversal cut-out formed in an upper side of each longitudinal sidewall.

[0014] The aforementioned flexible supporting frame member may be made of a foam material, such as a polyurethane foam.

[0015] In accordance with an embodiment of the invention, the inner support structure comprises a supporting layer overlying the pressure redistribution assembly and supporting spacers. The supporting layer may likewise be made of an open-structured, non-foam supportive material allowing circulation of air and moisture. By way of preference, the supporting layer extends in the mattress apart from a head section and a foot section of the mattress. The supporting layer may especially extend, in the width direction, all the way between the lateral sides of the mattress.

[0016] The open-structured, non-foam supportive material may in particular advantageously consist of a three-dimensional elastic arrangement of polymer filaments, especially filaments made of a thermoplastic elastomer (TPE).

[0017] In accordance with another embodiment, the in-

ner support structure comprises a heel zone supporting element provided in a foot section of the mattress. By way of preference, the heel zone supporting element includes an upper supporting element made of spacer fabrics.

[0018] In accordance with a further embodiment, the inner support structure comprises a soft top layer provided in a top portion of the inner support structure, which soft top layer preferably extends over the entire top portion of the inner support structure apart from a head section of the mattress.

[0019] In accordance with yet another embodiment, the inner support structure further comprises a head zone supporting element provided in a head section of the mattress. By way of preference, the head zone supporting element is made of a foam material, such as a polyurethane foam, and includes a castellated upper surface.

[0020] By way of preference, the air cells are transverse air cells extending in a width direction of the mattress and the supporting spacers are transverse supporting spacers filling the gaps between the transverse air cells.

[0021] Furthermore, the mattress may additionally comprise a removable cover housing the inner support structure, which removable cover is preferably made of an air-permeable, multi-directional stretch fabric reducing shear and friction, such as a polyurethane coated nylon fabric.

[0022] Further advantageous embodiments of the invention are discussed below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] Other features and advantages of the present invention will appear more clearly from reading the following detailed description of embodiments of the invention which are presented solely by way of non-restrictive examples and illustrated by the attached drawings in which:

Figure 1 is a perspective view of a pressure redistribution mattress in accordance with an embodiment of the invention;

Figure 1A is a perspective view of the pressure redistribution mattress of Figure 1 with portions thereof removed to reveal the inner support structure of the mattress;

Figure 1B is a perspective view of the pressure redistribution mattress of Figure 1A shown from a different viewing angle;

Figure 1C is a perspective view of the inner support structure of the pressure redistribution mattress of Figure 1B with a mattress cover entirely removed;

Figure 2 is a schematic perspective view of a pressure redistribution assembly forming a constituent of the pressure redistribution mattress of Figures 1 and 1A-C;

Figure 2A is a schematic top view of the pressure

redistribution assembly of Figure 2;

Figure 3 is a photographic illustration of part of the inner support structure of the pressure redistribution mattress of Figures 1 and 1A-C with upper layers removed for the sake of illustration;

Figure 3A is an enlarged view of the photographic illustration of Figure 3 showing a central portion of the inner support structure;

Figure 4 is a photographic illustration of a side view of the central portion of the inner support structure with the upper layers; and

Figure 5 is a photographic illustration of an enlarged portion of an open-structured, non-foam supportive material used as a constituent of parts of the inner support structure in accordance with a preferred embodiment of the invention.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[0024] The present invention will be described in relation to various illustrative embodiments. It shall be understood that the scope of the invention encompasses all combinations and sub-combinations of the features of the embodiments disclosed herein.

[0025] As described herein, when two or more parts or components are described as being connected, secured or coupled to one another, they can be so connected, secured or coupled directly to each other or through one or more intermediary parts.

[0026] More specifically, the invention will be described in relation to various embodiments of a pressure redistribution mattress, as depicted in Figures 1 to 5.

[0027] Referring to the illustrations of Figures 1 and 1A-C, there is shown a pressure redistribution mattress, designated globally by reference numeral 1, in accordance with an embodiment of the invention. Mattress 1 includes a removable cover 10 housing an inner support structure 100, not visible in Figure 1, but partly visible in Figures 1A and 1B, and shown entirely in Figure 1C. Figures 1A-1C show the inner support structure 100 and removable cover 10 with selected portions thereof removed for the purpose of illustration and explanation. Reference signs 1H, 1F and 1L in Figures 1 and 1A-C respectively designate a head section, a foot section and lateral sides of the mattress 1.

[0028] The removable cover 10 is preferably made of an air-permeable, multi-directional stretch fabric reducing shear and friction, such as a polyurethane coated nylon fabric. Other cover materials could be contemplated.

[0029] The inner support structure 100 houses a pressure redistribution assembly 200 including a plurality of (here eight) air cells 210, here arranged in a transversal manner, that are connected by means of a pressure redistribution system. Only part of the pressure redistribution assembly 200 is visible in Figures 1A-C. The pressure redistribution assembly 200 is schematically shown

in isolation in Figures 2 and 2A where the pressure redistribution system is designated by reference numeral 250.

[0030] The structure of each air cell 210 is known as such in the art, for instance from the disclosure of U.S. Patent No. US 5,634,224 A, which is incorporated herein by reference in its entirety. It suffices to understand that each air cell 210 in essence consists of a cushioning device comprising a load-bearing envelope that includes an intake port and a pressure release port allowing air to respectively enter or exit the load-bearing envelope as a function of load applied thereon. This load-bearing envelope contains a resilient inner member (made e.g. of a polyurethane foam) that has the ability to deform under load and regain its original form in the absence of load, thus allowing air to exit or be drawn into the load-bearing envelope.

[0031] In the example illustrated in Figures 2 and 2A, each air cell 210 includes a T-connector 210A acting as the intake and pressure release ports, which T-connector 210A is connected to tubing elements 250A of the pressure redistribution system 250, thus allowing automatic pressure redistribution amongst the air cells 210 depending on the load applied thereon. Reference signs 250B and 250C in Figures 2 and 2A respectively designate intake valves and air filters provided at both ends of the pressure redistribution system 250 to allow air to be drawn into the system from the environment. Reference sign 250D in Figure 2 designates a pressure release valve of the pressure redistribution system 250 designed to allow excess pressure to be released into the environment.

[0032] One will appreciate that the pressure redistribution assembly 200 shown in Figures 1, 1A-C, 2 and 2A is in effect a non-powered assembly and that pressure redistribution amongst the air cells therefore occurs solely depending on the load applied on the top surface of the mattress 1. In other embodiments, one could contemplate using a powered assembly, in which case the pressure redistribution system 250 would typically be connected to an air pump and may be modified to allow air to be selectively introduced into or drawn out of selected air cells 210. In other words, the configuration of the relevant pressure redistribution system may in effect differ from the illustrated configuration and is not as such critical to the implementation of the present invention.

[0033] A key aspect of the mattress in accordance with the present invention resides in the fact that the air cells 210 are spaced apart from one another to form (here transversal) gaps 210a between the air cells 210, as is visible e.g. in Figures 1A-C, 2 and 2A (see also Figures 3 and 3A which show the inner support structure 100 with upper layers 135, 140, 145 removed for the sake of illustration). This provides room for air and moisture to circulate between the air cells 210, which vastly improves microclimate management.

[0034] Another key aspect of the mattress according to the invention resides in the fact that the gaps 210a are

filled with supporting spacers 115 (as shown in Figures 1A-C, 3 and 3A) that are formed of an open-structured, non-foam supportive material allowing circulation of air and moisture. It should therefore be understood that conventional foam material, such as polyurethane foam, is not used in respect of the aforementioned supporting spacers 115, as such conventional material would impair proper circulation of air and moisture, and actually has a tendency to trap humidity, which is not desired.

[0035] Thanks to the invention, optimal circulation of air and moisture is ensured between the air cells 210, without compromising support and comfort for the patient or interfering with the operation of the pressure redistribution assembly 200.

[0036] Referring again to the embodiment shown in Figures 1A-C, the inner support structure 100 comprises a flexible supporting frame member 110 with a longitudinal space 110a configured and dimensioned to receive the pressure redistribution assembly 200 and supporting spacers 115. More specifically, the flexible supporting frame member 110 includes a pair of longitudinal sidewalls 110L encasing the pressure redistribution assembly 200 and supporting spacers 115, which longitudinal sidewalls 110L provide adequate structural integrity and reinforcement of the lateral sides 1L of the mattress 1.

[0037] As shown in Figures 1A-C (and Figures 3, 3A and 4), a central portion of each longitudinal sidewall 110L is advantageously provided with at least one transversal aperture 110b that ensures circulation of air and moisture between the longitudinal space 110a and the lateral sides 1L of the mattress 1. In the illustrated example, three such transversal apertures 110b are provided, namely as transversal cut-outs 110b formed in an upper side of each longitudinal sidewall 110L.

[0038] The flexible supporting frame member 110 may be made of a foam material, such as a polyurethane foam. While use of a foam material is contemplated, microclimate management is not compromised as air and moisture are allowed to circulate between the longitudinal space 110a and the lateral sides 1L of the mattress 1 through the transversal cut-outs 110b. As a matter of fact, the provision of the cut-outs 110b allows improved air and moisture circulation owing to the resulting Venturi effect created by the cut-outs 110b.

[0039] Figures 1A-C also show that the inner support structure 100 preferably further comprises a supporting layer 140 overlying the pressure redistribution assembly 200 and the supporting spacers 115. Such supporting layer 140 is also visible in the photographic illustration of Figure 4. In the illustrated embodiment, the supporting layer 140 is likewise made of an open-structured, non-foam supportive material allowing circulation of air and moisture.

[0040] The supporting layer 140 advantageously extends in the mattress 1 apart from the head section 1H and the foot section 1F of the mattress 1, and preferably extends, in the width direction, all the way between the lateral sides 1L of the mattress 1. Accordingly, air and

moisture are also allowed to circulate via the supporting layer 140, which favours extraction of heat and humidity, thus further improving microclimate management.

[0041] By way of preference, the open-structured, non-foam supportive material used as a constituent of the aforementioned supporting spacers 115 and supporting layer 140 consists of a three-dimensional elastic arrangement of polymer filaments, especially filaments made of a thermoplastic elastomer (TPE), as shown in the photographic illustration of Figure 5. Such a material is commercially available on the market, including e.g. from company Enkev B.V. (www.enkev.com) under the product designation Labyrinth® 100 (Labyrinth® being a registered trademark of Enkev B.V.). This material may be produced by extruding molten polymer and shaping/molding the resulting monofilaments into desired three-dimensional structures of fused monofilaments.

[0042] The aforementioned supporting spacers 115 and supporting layer 140 could in effect form a single integral supporting structure. The use of individual elements may however be advantageous in terms of modularity and the ability to replace only selected elements in case of need.

[0043] In the foot section 1F of mattress 1, a dedicated heel zone supporting element 130/135 is preferably provided. In the illustrated embodiment, this heel zone supporting element 130/135 includes a bottom supporting element 130 housed within the longitudinal space 110a of the flexible frame member 110 and, more importantly, an upper supporting element 135 that is made of spacer fabrics. Spacer fabrics are known as such in the art and basically consist of two textile sheets joined and separated by distance fibres (such as polyester fibres) to offer high absorption capacities, which is particularly useful to transfer weight away from the vulnerable heel area. Spacer fabrics are commercially available on the market, e.g. from company Essedea GmbH & Co. KG (www.essedea.de) under the product designation 3DEA® (3DEA® being a registered trademark of Heinz-Willy Essers).

[0044] While a distinct bottom supporting element 130 is shown in Figures 1A-C and 3, one will appreciate that this bottom supporting element 130 could form an integral part of the flexible frame member 110 if desired. As is visible in Figure 1C and 3, the flexible frame member 110 and bottom supporting element 130 may advantageously exhibit a sloped configuration, reducing in thickness towards the end of the mattress 1, to create a sloped heel zone 1F with a slight angle of the order of e.g. 5 degrees.

[0045] In the head section 1H of mattress 1, a dedicated head zone supporting element 120 is likewise preferably provided. In the illustrated embodiment, this head zone supporting element 120 is made of a foam material (such as polyurethane foam) and is partly housed within the longitudinal space 110a of the flexible frame member 110. This supporting element 120 advantageously includes a castellated upper surface 120A that provides extra comfort and a certain level of additional pressure

redistribution for the patient's head.

[0046] As a further refinement, also depicted in Figures 1A-C and 4, the inner support structure 100 additionally comprises a soft top layer 145 provided in a top portion of the inner support structure 100. Preferably, as shown in Figures 1A-C, this soft top layer 145 extends over the entire top portion of the inner support structure 110 apart from the head section 1H of the mattress 1. In other words, in the depicted embodiment, the soft top layer 145 overlies the supporting layer 140 and the upper supporting element 135 provided in the heel zone. The soft top layer 145 is mainly meant to act as a soft, responsive top layer designed to envelop the patient for maximum comfort. This soft top layer 145 may in particular consist of non-woven polyester fibres.

[0047] Various modifications and/or improvements may be made to the above-described embodiments without departing from the scope of the invention as defined by the annexed claims.

[0048] For instance, while the pressure redistribution mattress depicted in the appended drawings is designed to allow non-powered pressure redistribution, without the need for a power unit, one could nevertheless contemplate applying the same principle to a powered pressure redistribution mattress, if desired.

[0049] Additionally, while the pressure redistribution mattress depicted in the appended drawings includes eight air cells arranged in a transversal manner, the pressure redistribution mattress could include any number of air cells arranged in a longitudinal and/or transversal manner.

[0050] Furthermore, the provision of a heel zone supporting element and a head zone supporting element, as described above is not essential, although preferred as it brings further benefits to the patient. The same is basically true with respect to the provision of the supporting layer and soft top layer which may potentially be replaced by any other adequate layer or layers. The provision of the relevant supporting layer and soft top layer nevertheless remains a favoured and preferred solution that brings further benefits in terms of microclimate management and comfort for the patient.

LIST OF REFERENCE NUMERALS AND SIGNS USED THEREIN

[0051]

1	pressure redistribution mattress
1H	head section of mattress 1
1F	foot section of mattress 1
1L	lateral sides of the mattress 1
10	(removable) cover
100	inner support structure
110	flexible supporting frame member (foam structure)
110a	longitudinal space of flexible supporting frame member 110

110b transversal apertures ensuring circulation of air and moisture / transversal cut-outs formed in upper side of longitudinal sidewalls 110L

110L longitudinal sidewalls of flexible supporting frame member 110

115 supporting spacer elements (open-structured, non-foam supportive material)

120 head zone supporting element (castellated foam element)

120A castellated upper surface of head zone supporting element 120

130 heel zone bottom supporting element (foam element)

135 heel zone upper supporting element (spacer fabrics)

140 supporting layer (open-structured, non-foam supportive material)

145 soft top layer

200 pressure redistribution assembly

210 (transverse) air cells

210A T-connector of air cell 210

210a (transversal) gaps between air cells 210

250 pressure redistribution system

250A tubing elements

250B intake valves

250C air filter

250D pressure-release valve

Claims

1. A pressure redistribution mattress (1) comprising an inner support structure (100) housing a pressure redistribution assembly (200) including a plurality of air cells (210) connected by means of a pressure redistribution system (250),
characterized in that the air cells (210) are spaced apart from one another to form gaps (210a) between the air cells (210),
and in that the gaps (210a) are filled with supporting spacers (115) formed of an open-structured, non-foam supportive material allowing circulation of air and moisture.
2. The pressure redistribution mattress (1) according to claim 1, wherein the inner support structure (100) comprises a flexible supporting frame member (110) with a longitudinal space (110a) configured and dimensioned to receive the pressure redistribution assembly (200) and supporting spacers (115).
3. The pressure redistribution mattress (1) according to claim 2, wherein the flexible supporting frame member (110) includes a pair of longitudinal sidewalls (110L) encasing the pressure redistribution assembly (200) and supporting spacers (115), and wherein a central portion of each longitudinal sidewall (110L) is provided with at least one trans-

versal aperture (110b) that ensures circulation of air and moisture between the longitudinal space (110a) and lateral sides (1L) of the mattress (1).

4. The pressure redistribution mattress (1) according to claim 3, wherein each transversal aperture (110b) consists of a transversal cut-out formed in an upper side of each longitudinal sidewall (110L).
5. The pressure redistribution mattress (1) according to any one of claims 2 to 4, wherein the flexible supporting frame member (110) is made of a foam material, such as a polyurethane foam.
6. The pressure redistribution mattress (1) according to any one of the preceding claims, wherein the inner support structure (100) comprises a supporting layer (140) overlying the pressure redistribution assembly (200) and supporting spacers (115),
and wherein the supporting layer (140) is likewise preferably made of an open-structured, non-foam supportive material allowing circulation of air and moisture.
7. The pressure redistribution mattress (1) according to claim 6, wherein the supporting layer (140) extends in the mattress (1) apart from a head section (1H) and a foot section (1F) of the mattress (1), and wherein the supporting layer (140) preferably extends, in the width direction, all the way between the lateral sides (1L) of the mattress (1).
8. The pressure redistribution mattress (1) according to any one of the preceding claims, wherein the open-structured, non-foam supportive material consists of a three-dimensional elastic arrangement of polymer filaments, especially filaments made of a thermoplastic elastomer (TPE).
9. The pressure redistribution mattress (1) according to any one of the preceding claims, wherein the inner support structure (100) comprises a heel zone supporting element (130/135) provided in a foot section (1F) of the mattress (1).
10. The pressure redistribution mattress (1) according to claim 9, wherein the heel zone supporting element (130/135) includes an upper supporting element (135) made of spacer fabrics.
11. The pressure redistribution mattress (1) according to any one of the preceding claims, wherein the inner support structure (100) comprises a soft top layer (145) provided in a top portion of the inner support structure (100),
and wherein the soft top layer (145) preferably extends over the entire top portion of the inner support structure (100) apart from a head section (1H) of the

mattress (1).

12. The pressure redistribution mattress (1) according to any one of the preceding claims, wherein the inner support structure (100) comprises a head zone supporting element (120) provided in a head section (1H) of the mattress (1). 5
13. The pressure redistribution mattress (1) according to claim 12, wherein the head zone supporting element (120) is made of a foam material, such as a polyurethane foam, and includes a castellated upper surface (120A). 10
14. The pressure redistribution mattress (1) according to any one of the preceding claims, wherein the air cells (210) are transverse air cells (210) extending in a width direction of the mattress (1) and wherein the supporting spacers (115) are transverse supporting spacers (115) filling the gaps (210a) between the air cells (210). 15 20
15. The pressure redistribution mattress (1) according to any one of the preceding claims, further comprising a removable cover (10) housing the inner support structure (100), which removable cover (10) is preferably made of an air-permeable, multi-directional stretch fabric reducing shear and friction, such as a polyurethane coated nylon fabric. 25

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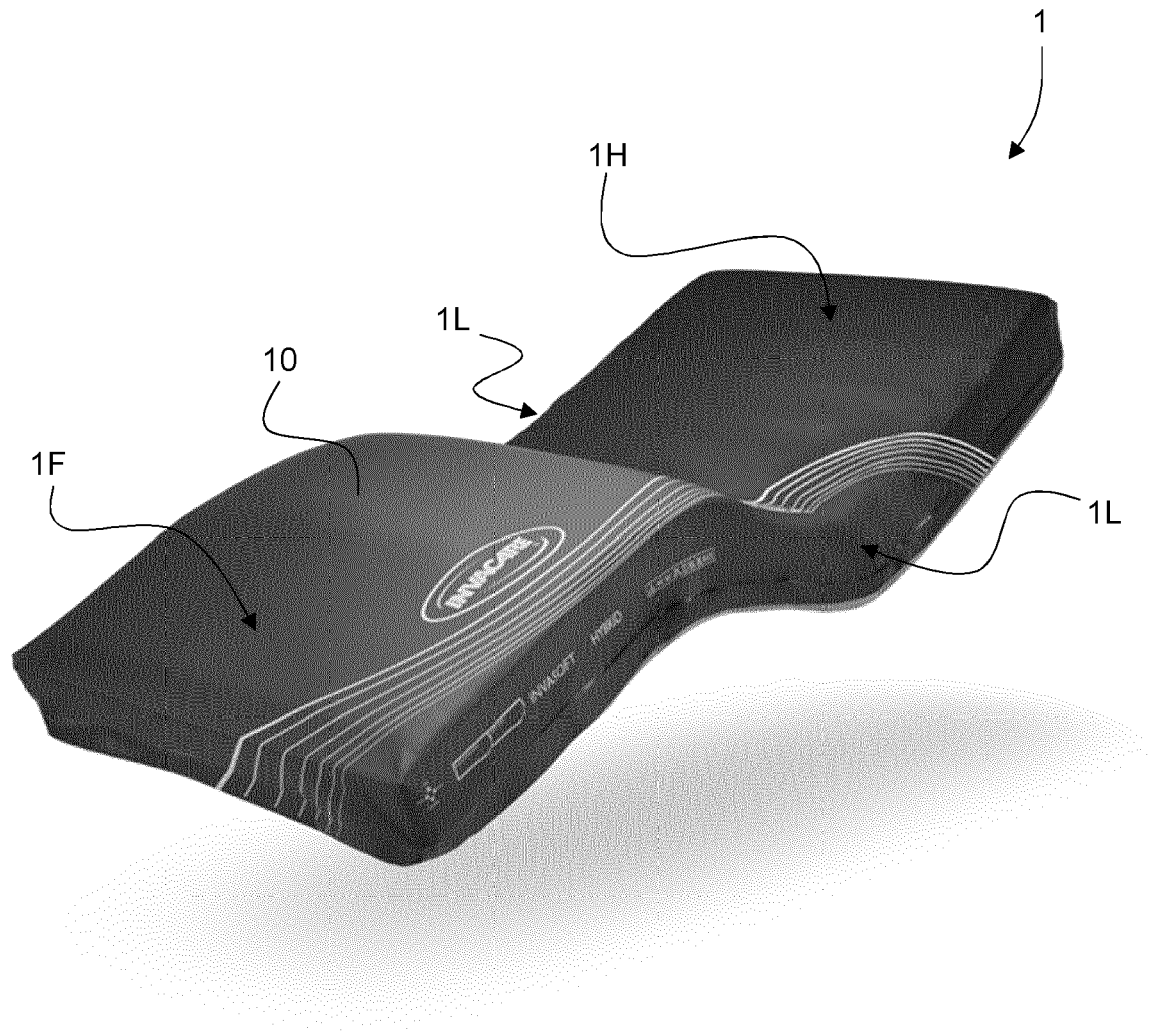


Fig. 1

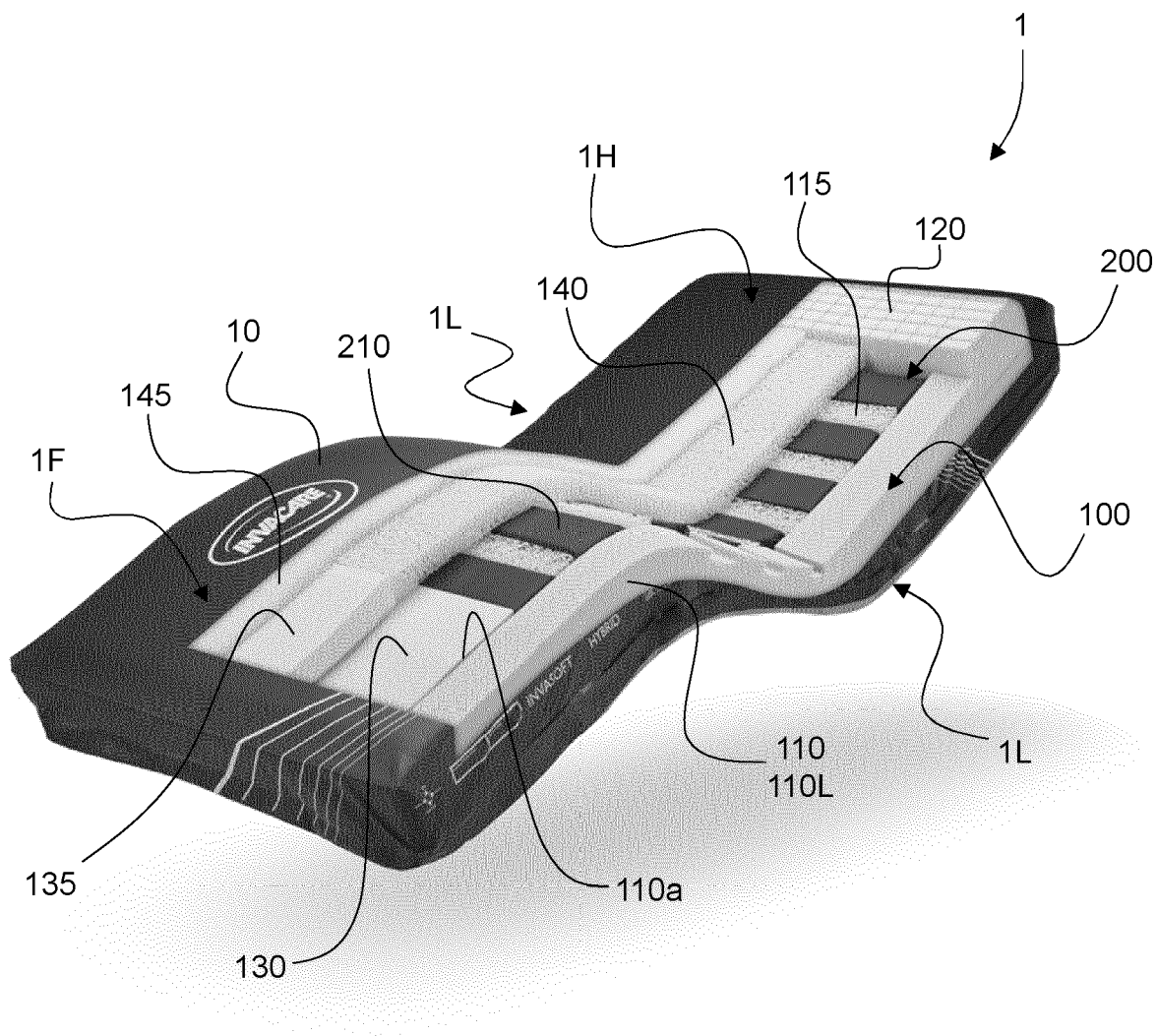


Fig. 1A

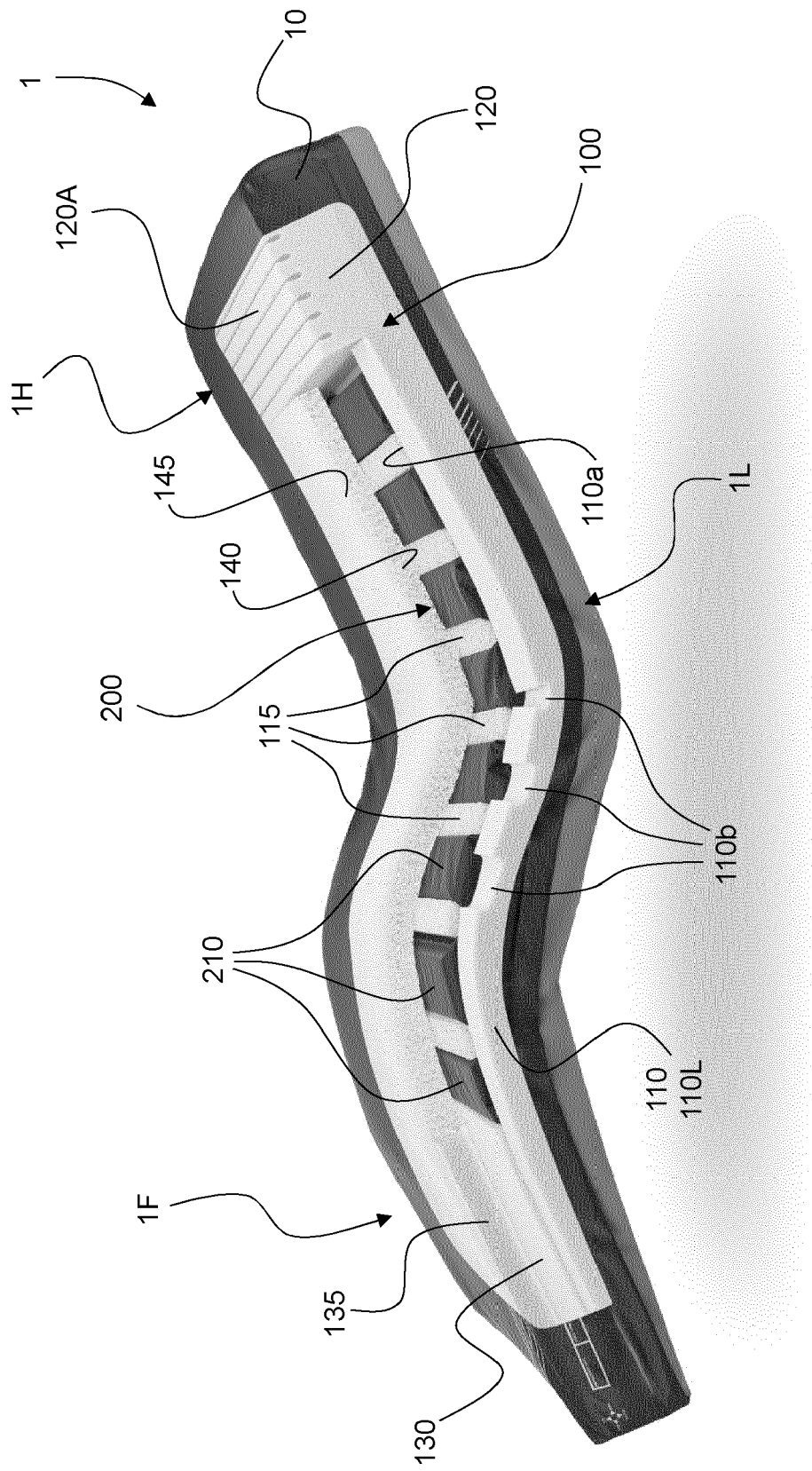


Fig. 1B

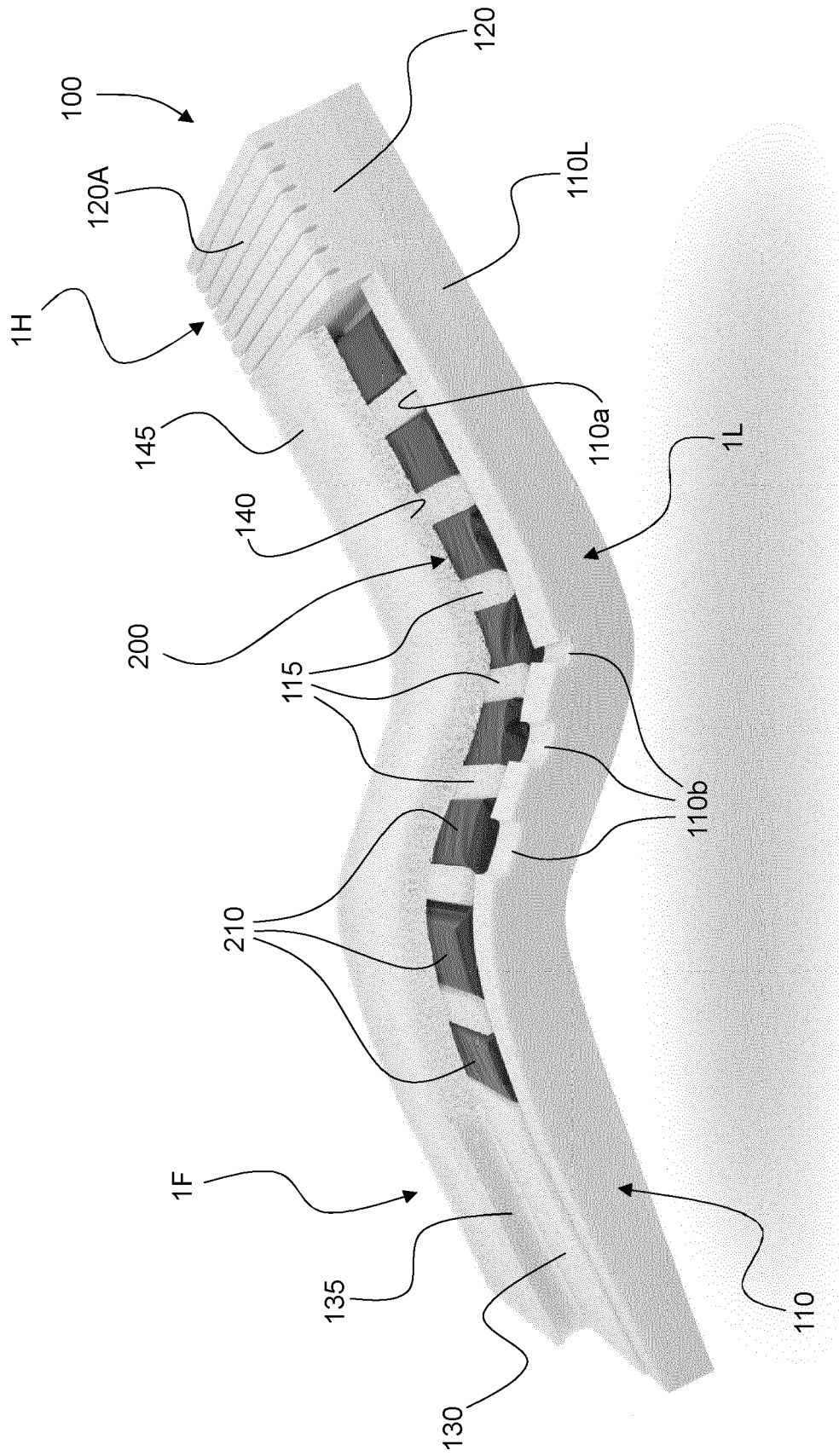


Fig. 1C

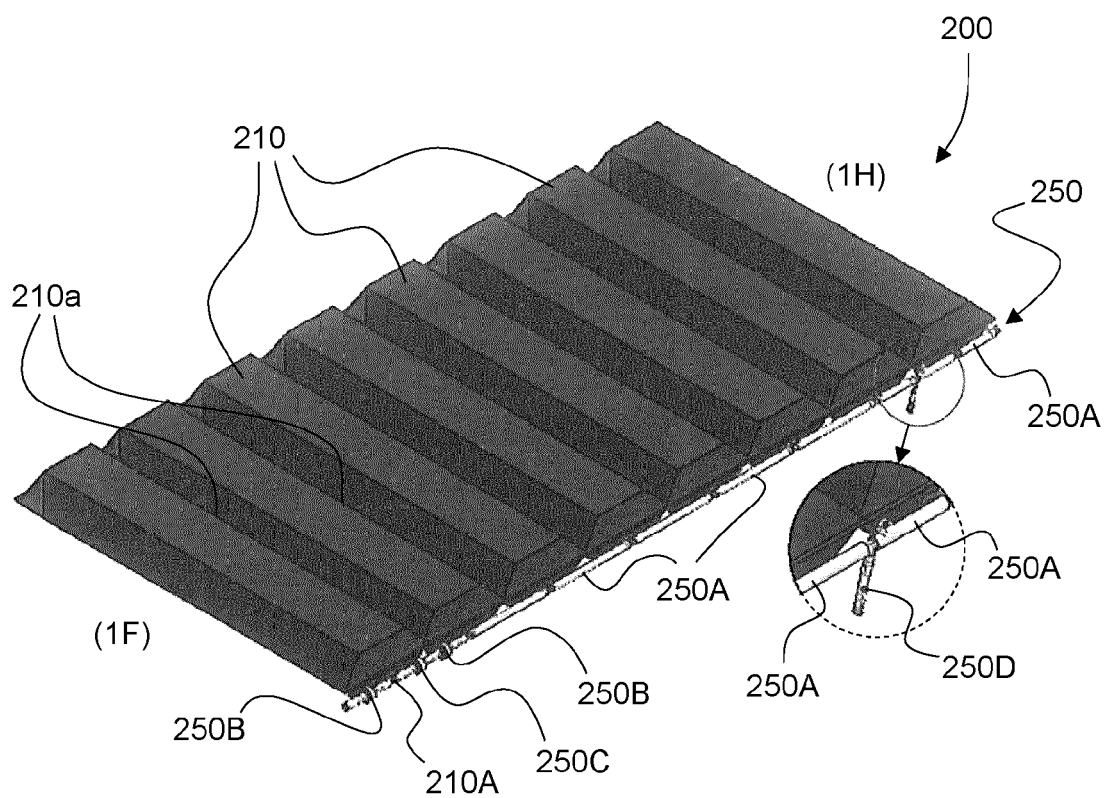


Fig. 2

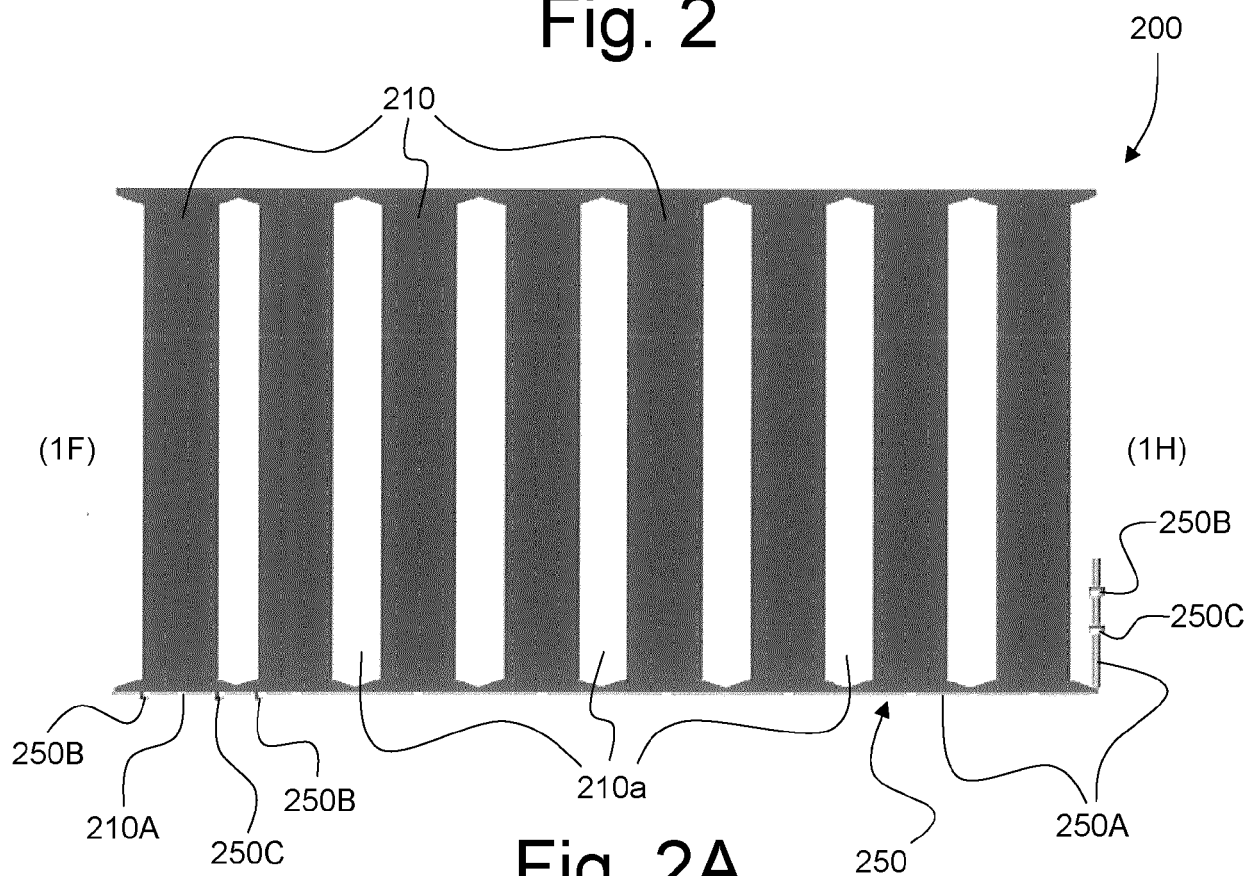


Fig. 2A

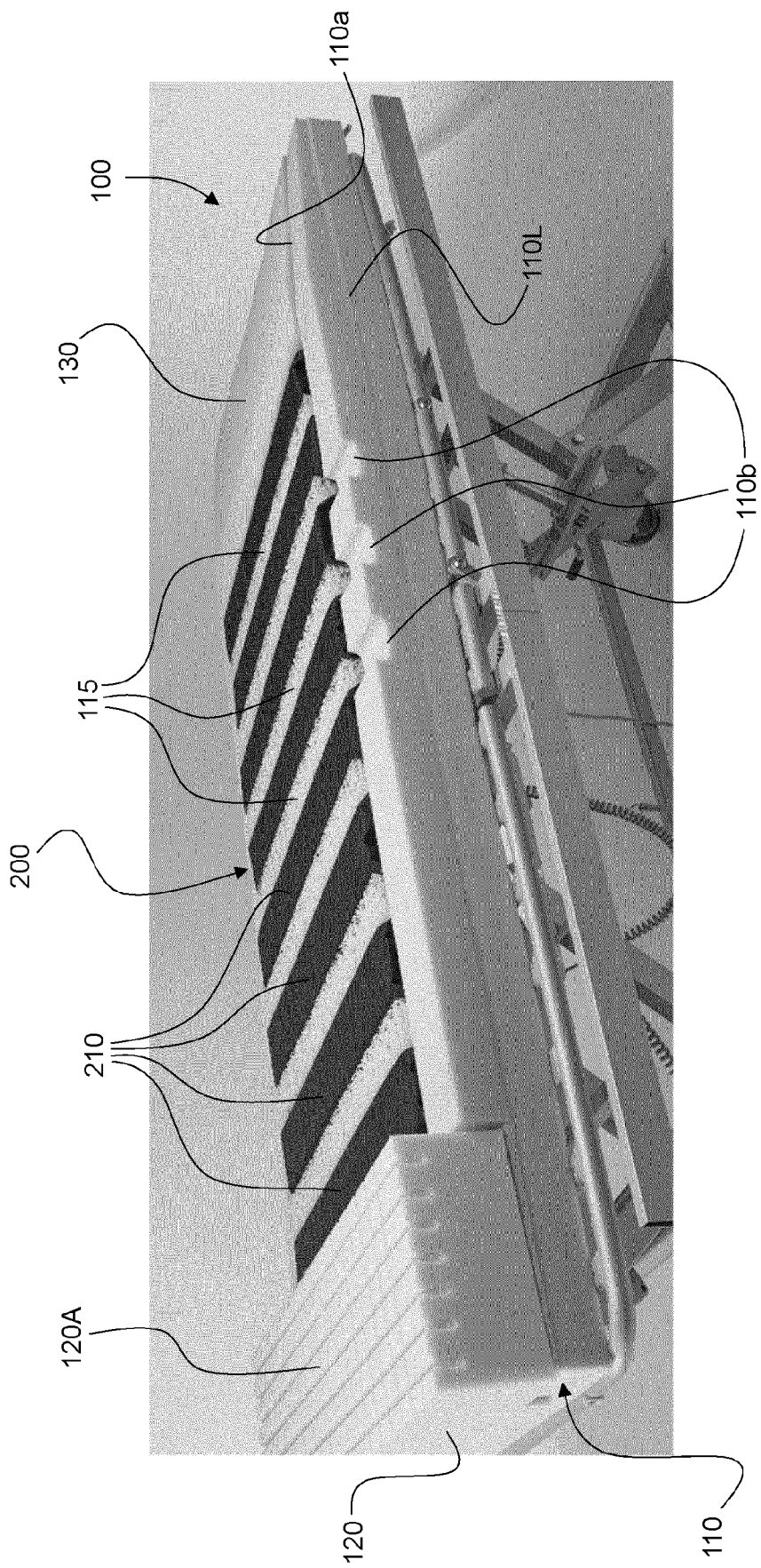


Fig. 3

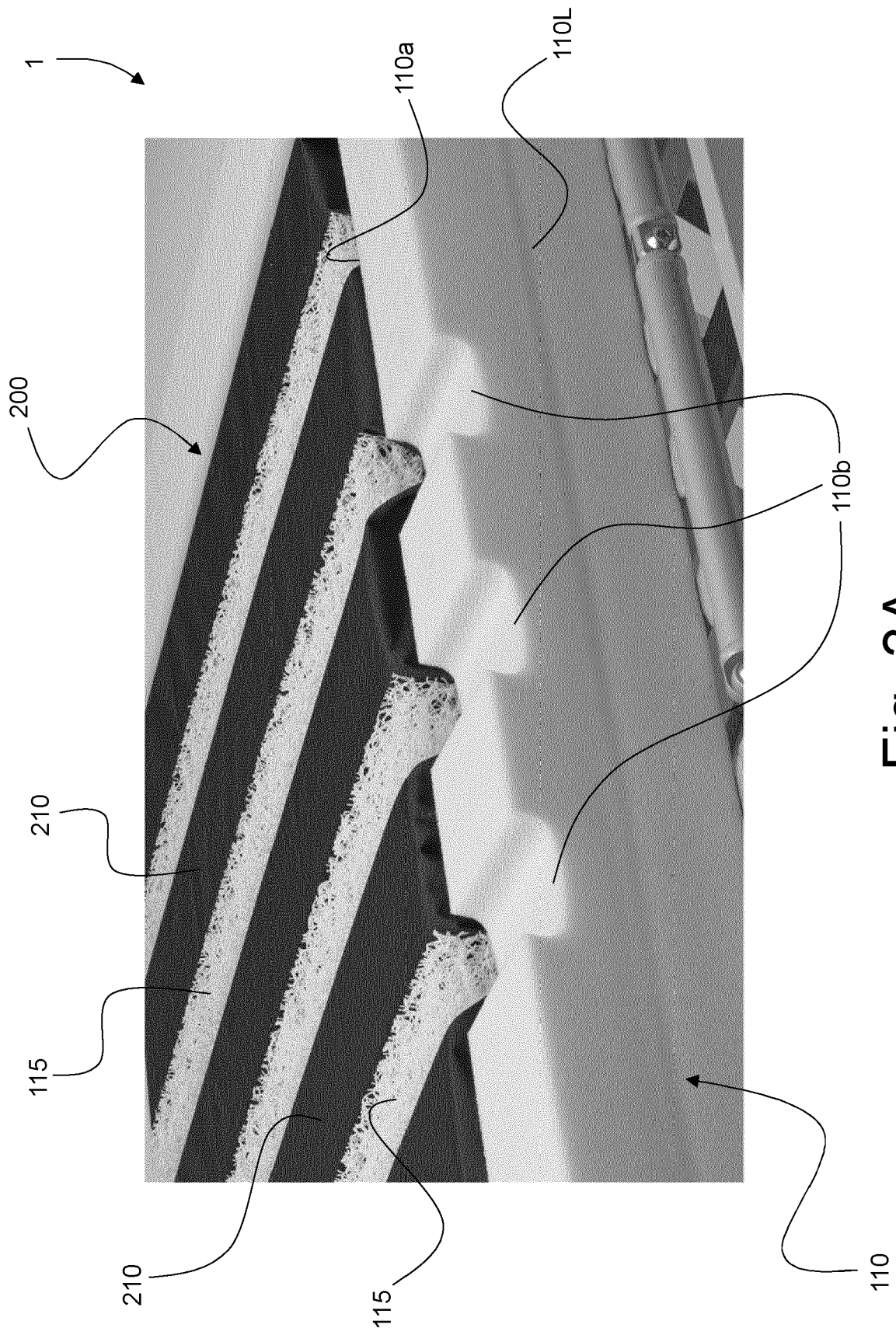


Fig. 3A

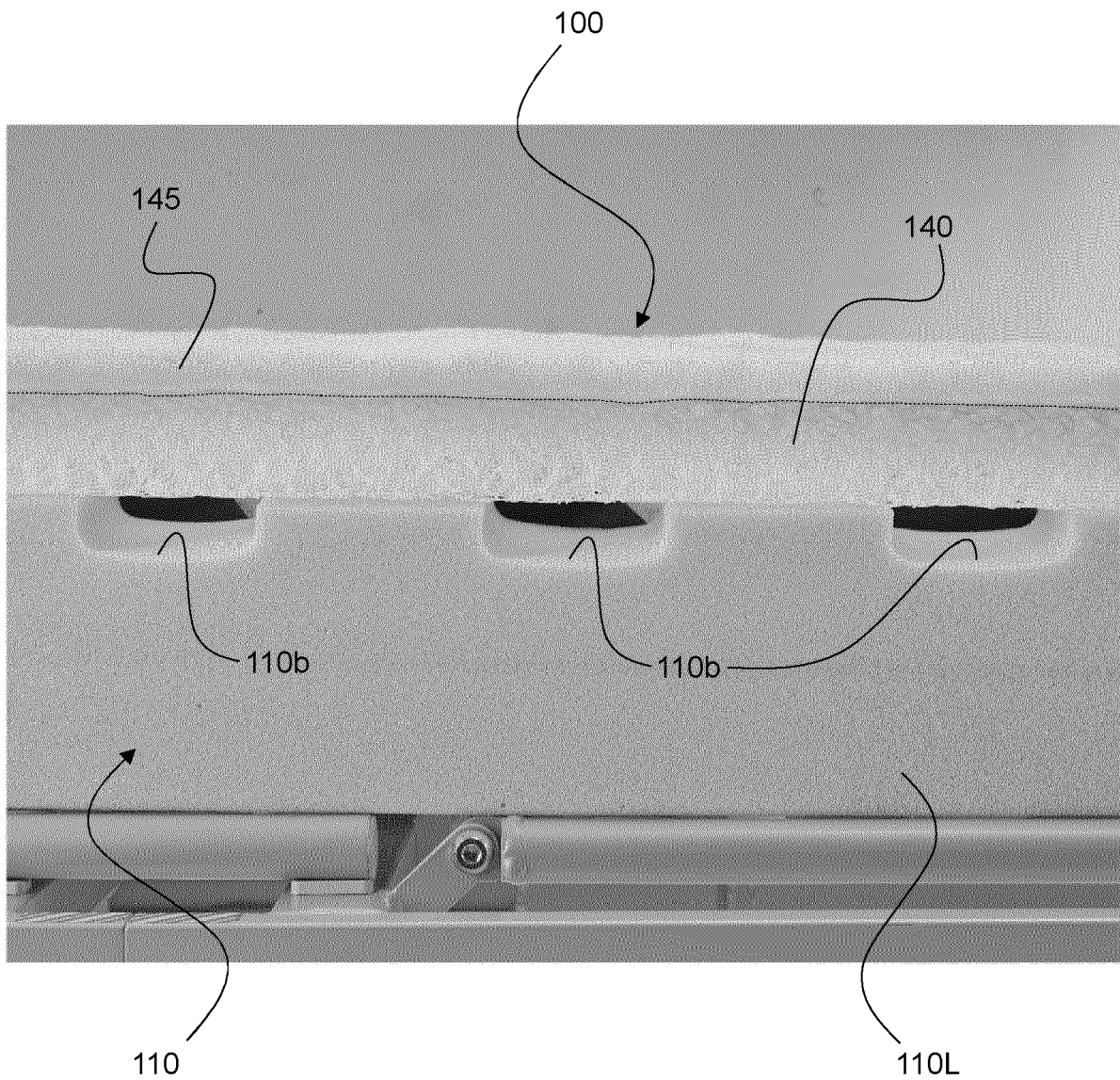


Fig. 4

115 / 140

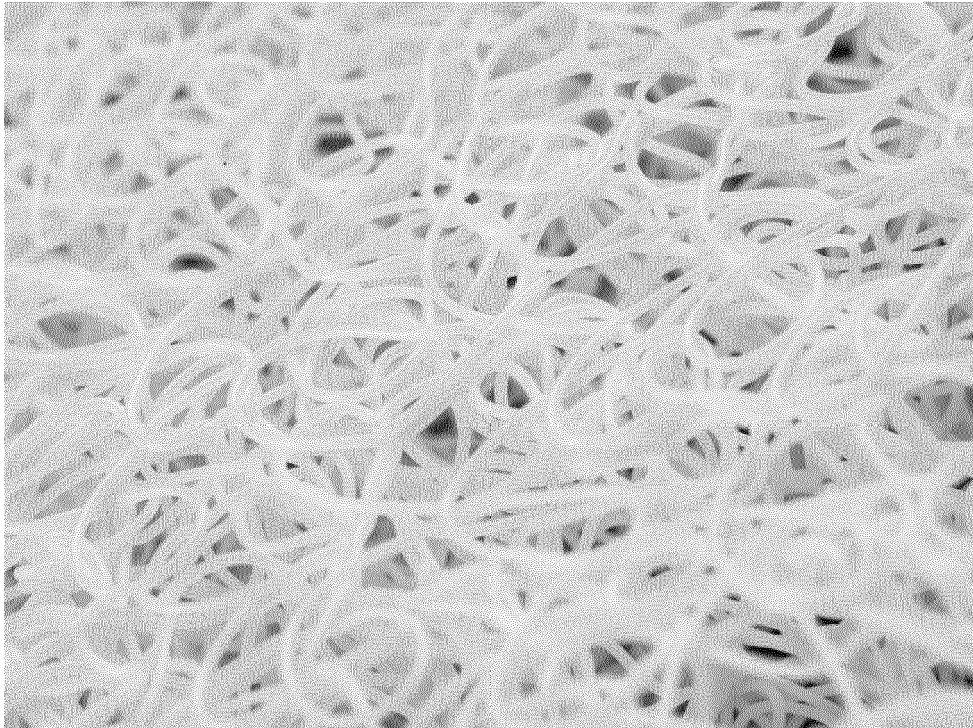


Fig. 5



EUROPEAN SEARCH REPORT

Application Number
EP 21 16 6020

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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A	US 10 631 658 B2 (DESCANSARE SLEEP LAB S L [ES]; MALZL HANS [AT]) 28 April 2020 (2020-04-28) * figures * -----	1	A47C
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 10 September 2021	Examiner Kis, Pál
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			

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 21 16 6020

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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