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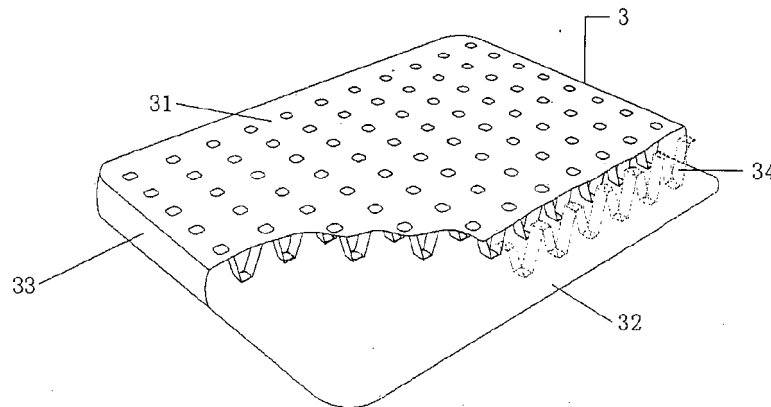
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**(54) Inflatable device with straps connected between an upper layer and lower layer thereof**

(57) An inflatable device (1) includes an upper layer (11), a lower layer (12), and at least one strap (14) alternately connected to the upper layer (11) and the lower layer (12) to form a wavelike pattern between the upper layer (11) and the lower layer (12) so as to limit deformation of both the upper layer and the lower layer. The strap (14) includes a plurality of first contact portions (14A) connected to the upper layer (11), and a plurality of sec-

ond contact portions (14B) connected to the lower layer (12). The first contact portions (14A) are offset from the second contact portions (14B) in a horizontal plane respectively defined by the upper layer (11) and the lower layer (12), such that the first contact portions (14A) are not superimposed with the second contact portions (14B) from a perspective orthogonal to the upper and lower layers (11, 12).

Fig. 5



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**Description****BACKGROUND****Technical Field**

[0001] The present application relates to an inflatable device, and in particular to an inflatable device with a strap having a wavelike pattern connected between an upper layer and lower layer thereof.

**Description of the Related Art**

[0002] With reference to Figs. 1 and 2, a conventional inflatable device 1 is shown and has an upper layer 11, a lower layer 12 and a sidewall 13 connecting a peripheral edge of the upper layer 11 to a peripheral edge of the lower layer 12 so as to form at least a space between the upper layer 11 and the lower layer 12. Inside the space between the upper layer 11 and the lower layer 12, a plurality of coils (or straps) 14 are provided to respectively and securely engage a lower face of the upper layer 11 with a top face of the lower layer 12. As a result of the provision of the coils 14, the upper layer 11 is then securely connected to the lower layer 12. It is noted that two distal and opposite contact portions 14A and 14B of each of the coils 14 are respectively and securely connected to the upper layer 11 and the lower layer 12 so as to limit movement of the upper layer 11 and the lower layer 12. It is noted that in the conventional arrangement shown in Figs. 1 and 2, contact portions 14A and 14B must be relatively large in order to securely adhere the straps to the upper and lower layers.

[0003] With reference to Fig. 3, a second conventional inflatable device 2 is shown and has an upper layer 21, a lower layer 22 and a sidewall 23 connecting a peripheral edge of the upper layer 21 to a peripheral edge of the lower layer 22 so as to form a space between the upper layer 21 and the lower layer 22. Inside the space between the upper layer 21 and the lower layer 22, multiple straps 24 are provided to respectively and securely engage a lower face of the upper layer 21 and a top face of the lower layer 22. With the provision of the straps 24, movement of the upper layer 21 as well as the lower layer 22 is limited.

[0004] From the depiction of Fig. 4, it is noted that two distal and opposite contact portions 24A and 24B of each of the straps 24 are respectively and securely connected to the upper layer 21 and the lower layer 22 of the inflatable device 2.

[0005] It is noted from the illustration in Figs. 1-4 that the contact portions 14A and 14B (or 24A and 24B) for each strap are aligned in a horizontal plane respectively defined by the upper layer and the lower layer such that they are superimposed from a perspective orthogonal to the upper and lower layers. Moreover, with reference to Figs. 1-2, each strap is independent from the other. The conventional arrangement of the straps in Figs. 1-4 may

result in the waste of material, and can create difficulties in the assembly process.

**SUMMARY**

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[0006] Embodiments of the inflatable device of the present application comprise an upper layer, a lower layer, and at least one strap alternately connected to the upper layer and the lower layer to form a wavelike pattern between the upper layer and the lower layer so as to limit deformation of both the upper layer and the lower layer. The strap comprises a plurality of first contact portions connected to the upper layer, and a plurality of second contact portions connected to the lower layer, wherein the first contact portions are offset from the second contact portions in a horizontal plane respectively defined by the upper layer and the lower layer, such that the first contact portions are not superimposed with the second contact portions from a perspective orthogonal to the upper and lower layers.

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**BRIEF DESCRIPTION OF THE DRAWINGS****[0007]**

Fig. 1 is a perspective view of a conventional inflatable device which is partially cross-sectioned for easy understanding of the structure of the device; Fig. 2 is a cross sectional view of the conventional inflatable device shown in Fig. 1; Fig. 3 is a perspective view of a conventional inflatable device which is partially cross-sectioned for easy understanding of the structure of the device; Fig. 4 is a cross sectional view of the conventional inflatable device shown in Fig. 3; Fig. 5 is a perspective view of the inflatable device constructed in accordance with embodiments of the application, wherein a portion of the upper layer of the inflatable device is removed for easy understanding of the device; Fig. 6 is a top plan view showing one embodiment of the arrangement of the contact portions between the straps and both the upper layer and the lower layer; Fig. 7 is a top plan view showing another embodiment of the arrangement of the contact portions between the straps and both the upper layer and the lower layer; Fig. 8 is a schematic side plan view showing the pattern of the strap between the upper layer and the lower layer of the inflatable device of an embodiment of the application; Fig. 9 is a schematic side plan view showing the pattern of the strap between the upper layer and the lower layer of the inflatable device of another embodiment of the application; Fig. 10 is a schematic side plan view showing the pattern of the strap between the upper layer and the

lower layer of the inflatable device of another embodiment of the application;

Fig. 11 is a perspective view showing the application of the alternate-contact-straps in an inflatable sofa; Fig. 12 is a schematic view showing the angular relationship of the straps with the inflatable device when the straps are disposed between the upper layer and the lower layer of the inflatable device of an embodiment of the application;

Fig. 13 is a schematic view showing the height relationship of the straps within the inflatable device when the straps are disposed between the upper layer and the lower layer of the inflatable device of an embodiment of the present application;

Fig. 14 is a schematic side plan view showing another embodiment of the inflatable device of the application;

Fig. 15 is a schematic side plan view showing another embodiment of the inflatable device of the application;

Fig. 16 is a perspective view showing an attachment of the inflatable device of a preferred embodiment of the application;

Fig. 17 is a perspective view showing that the attachment shown in Fig. 16 is connected to sides of the inflatable device of a preferred embodiment of the application;

Fig. 18 is a perspective view showing the attachment shown in Fig. 16 is located at a position other than sides of the inflatable device of a preferred embodiment of application;

Fig. 19 is a perspective view showing a foldable lamp installed on a side of the inflatable device of a preferred embodiment of the application;

Fig. 20 is a perspective view showing a foldable lamp installed on a location other than the location shown in Fig. 19; and

Fig. 21 is a schematic perspective view showing that a remote control provided with an illumination element is provided with an embodiment of the inflatable device of the application.

## **DETAILED DESCRIPTION OF THE INVENTION**

**[0008]** The following description is merely exemplary in nature and is in no way intended to limit the present teachings, applications, or uses. Those of skill in the art will recognize that the following description is merely illustrative of the principles of the invention, which may be applied in various ways to provide many different alternative embodiments.

**[0009]** With reference to Fig. 5, a preferred embodiment of an inflatable device 3 constructed in accordance with the present application has an upper layer 31, a lower layer 32, and a sidewall 33 connecting an outermost peripheral edge of the upper layer 31 to an outermost peripheral edge of the lower layer 32 so as to form at least one receiving space between the upper layer 31 and the

lower layer 32. A plurality of straps 34 are engaged inside the receiving space and connected to the upper layer 31 and the lower layer 32 respectively. Preferably, the receiving space defines an inflatable bladder or plenum that can be inflated from a deflated state to an inflated state by an inflator. The material of the upper layer, lower layer, sidewall and straps may be Polyvinyl Chloride (PVC), or any other suitable material known in the art of inflatable products.

**[0010]** As illustrated in Figs. 5 and 8-10, in preferred embodiments of the application, each strap 34 is a strip of material extending back and forth between the upper layer 31 and the lower layer 32 to form a wavelike pattern when the inflatable device is inflated. Due to the wavelike pattern of the strap 34, each strap 34 is alternately and securely connected to the upper layer 31 and the lower layer 32.

**[0011]** As illustrated in Figs. 8 and 10, in preferred embodiments of the application, each strap 34 is a single, continuous strip of material. As illustrated in Fig. 9, in other embodiments, each strap 34 comprises a plurality of individual strips connected between the upper and lower layers.

**[0012]** In Figs. 6, 7 and 8, a plurality of contact portions 34A and 34B are shown. For the purpose of illustration, in Figs. 6 and 7, each dark contact portion 34A represents the portion of each of the straps 34 contacting the upper layer 31. Each light contact portion 34B represents a projection of the portion of each of the straps 34 contacting the lower layer 32, which from the perspective of Figs. 6 and 7 would be directly below upper layer 31. When the inflatable device 3 is inflated, the contact portions 34A in the upper layer 31 and the contact portions 34B in the lower layer 32 are offset in a horizontal plane respectively defined by the upper layer 31 and the lower layer 32 such that contact portions 34A are not superimposed with the contact portions 34B from a perspective orthogonal to the upper and lower layers.

**[0013]** In embodiments of the application, the straps 34 may extend longitudinally or latitudinally relative to the dimensions of the inflatable device. Furthermore, the contact portions connected to a given layer may be aligned in the longitudinal or latitudinal directions as shown in Fig. 6, or offset in the longitudinal or latitudinal directions as shown in Fig 7. For any given strap 34, the first contact portion at a distal end of the strap may be connected to the upper layer 31 or the lower layer 32.

**[0014]** In embodiments of the invention, contact portions 34A and 34B are respectively connected to the upper layer 31 and lower layer 32 by welding. However, other methods known in the art may be used to adhere the contact portions of the straps to the upper and lower layers. In preferred embodiments, all of the connections of the contact portions 34A with the upper layer 31 and/or all of the connections of the contact portions 34B with the lower layer 32 may be simultaneously welded with a single press of a machine.

**[0015]** It is further noted that the inner surface of upper

layer 31 and the inner surface of lower layer 32 respectively define an area available for engagement with the contact portions 34A and contact portions 34B of straps 34. An area of the inner surface of the upper layer and/or the lower layer is defined as an available area wherever a load might be applied. In preferred embodiments, the total areas of the contact portions 34A and 34B are respectively greater than or equal to 6.3% of the available areas of the upper layer and the lower layer. Moreover, in preferred embodiments, the total areas of the contact portions 34A and 34B are respectively less than or equal to 63% of the available areas of the upper layer and the lower layer.

**[0016]** With reference to Fig. 8, in some embodiments of the application, an underside of the lower layer 32 of the inflatable device 3 may be free of any support. In other embodiments illustrated in Figs. 9 and 10, a protruding peripheral edge 35, 35' may be provided to the underside of the lower layer 32 such that after the inflatable device 3 is inflated, a suction cup is formed under the inflatable device 3. Furthermore, in order to reduce or eliminate deformation of the inflatable device 3, an auxiliary strap 36 may be provided inside the inflatable device 3 and between an inner surface of the sidewall 33 and an inner surface of the lower layer 32, as shown in Fig. 9. An auxiliary strap 37 may also be provided between an outer surface of the lower layer 32 and the protruding peripheral edge 35', as shown in Fig. 10.

**[0017]** In an embodiment of the application illustrated in Fig. 9, the upper layer, the lower layer and the sidewall 33 form a trapezoidal shape when the inflatable device 3 is inflated. The addition of the auxiliary strap 36 between the inner sidewall of the sidewall 33 and the sidewall of the lower layer 32 reduces or eliminates deformation of the trapezoidal shape. Figs. 8 and 10 illustrate embodiments of the application in which the cross-section of the inflatable device 3 is rectangular.

**[0018]** With reference to Fig. 11, in another preferred embodiment, inflatable device 3' has a first auxiliary bar 38 provided at a joint between the upper layer 31 and the sidewall 33 and a second auxiliary bar 38' provided at a joint between the sidewall 33 and the lower layer 32 to enhance the integrity of both the upper layer 31 and the lower layer 32. Furthermore, an upright second inflatable device 3'' is securely or detachably connected to the inflatable device 3' depending on the requirements and design differences.

**[0019]** With reference to Figs. 12 and 13, it is noted that because strap 34 extends alternately between the upper layer 31 and the lower layer 32, each segment 34C of the strap extending between the upper and lower layers is slanted with respect to a reference line orthogonal to the upper layer 31 and the lower layer 32 when the inflatable device is inflated. In a preferred embodiment, the angle measured between a segment of the strap forming the contact portion 34A or 34B and a segment 34C of the strap extending between the upper layer 31 and the lower layer 32 is between 91 and 167 degrees.

In one preferred embodiment, the angle is 112 degrees. However, it is understood that according to different requirements and designs, any angle larger than 90 degrees and smaller than 180 degrees may be used for the arrangement of the strap 34.

**[0020]** As shown in Fig. 13, it is noted that when the inflatable device is inflated, each strap 34 is formed into a wavelike pattern with segments extending back and forth between the upper and lower layers. As shown in the figure, the wavelike pattern has a height H measured from a peripheral edge of a given contact portion 34A in the upper layer to the face to the lower layer, or vice versa. The length of the segment 34C extending from the peripheral edge of a given contact portion 34A in the upper layer to a peripheral edge of an adjacent contact portion 34B in the lower layer (or vice versa) is Y, where H is shorter than Y. As shown in the figure, X is distance between the peripheral edge of the contact portion 34A in the upper layer projected to the peripheral edge of the adjacent contact portion 34B in the lower layer (or vice versa).

**[0021]** The arrangement of straps 34 in a wavelike pattern between upper and lower layers of inflatable device 3 increases the tensile strength of the inflatable device when a load is applied thereon. Moreover, the inventors have discovered that the wavelike pattern of the straps 34 disclosed in the present application, wherein a contact portion 34A in the upper layer 31 shares a single segment 34C of the strap 34 with an adjacent segment 34B in the lower layer 32, allows secure connection of the straps 34 to the upper and lower layers using contact portions 34A and 34B with areas smaller relative to what would be necessary in the conventional coil arrangement shown in Figs. 1 and 2. Thus, in embodiments of the application, the amount of material used in the strap can be reduced relative to the conventional arrangement shown in the Figs. 1-2. In other embodiments, the same amount of material relative to the conventional arrangement shown in the Figs. 1-2 may be used, but more contact portions can be provided, resulting in improved tensile strength of the inflatable device. For example, in embodiments of the application, a total of ninety-nine contact portions may be provided in each of the upper and lower layers with the same amount of material that would allow for only forty eight contact portions in each of the upper and lower layers using the conventional arrangement shown in Figs. 1 and 2. It is understood that in other embodiments of the application, both material savings and improved tensile strength over the conventional arrangement may be achieved by balancing the amount of material and the number of contact portions according to design requirements.

**[0022]** With reference to Figs. 14 and 15, in other embodiments, the inflatable device 4 may also be provided with a rectangular body 41 and an elongated circular headboard 42 or an elongated semielliptical headboard 42' connected to a side of the rectangular body 41. The headboard may be formed into any shape and fit into the

body 41.

**[0023]** With reference to Figs. 16, 17, 18, 19 and 20, a receptacle 5 is provided with a recess 51 for receiving therein accessories such as eyeglasses, a cup holder for a soft drink, or a USB socket 52 for connection with USB devices. The receptacle 5 may be inflatable or rigid. A single receptacle 5 may be provided at one side of the device, or a receptacle 5 may be provided at each side of the inflatable device spaced part from the headboard 42. Alternately, the receptacle 5 could also be provided in the headboard 42'. In additional embodiments, a foldable light 6 may be provided inside a receiving space 421 defined inside the headboard 42' or a receiving space 411 defined in a side layer of the rectangular body 41 for purpose of providing illumination to the user lying on the inflatable device.

**[0024]** With reference to Fig. 21, in an additional embodiment, a reading light 7 is provided to a remote control for an electrical inflator of the inflatable device. The remote control is electrically connected to a power source of the inflator, such that whenever a user is using the remote control to control the inflating/deflating process of the inflatable device, the reading light 7 is available to provide illumination if necessary.

**[0025]** It is to be noted that although the preferred embodiment of the present invention has been described, other modifications, alterations or minor change to the structure should still be within the scope defined in the claims. As those skilled in the art will readily observe that numerous modifications and alterations of the device and method may be made while retaining the teachings of the invention.

## Claims

### 1. An inflatable device comprising:

an upper layer;  
a lower layer; and  
at least one strap alternately connected to the upper layer and the lower layer to form a wave-like pattern between the upper layer and the lower layer so as to limit deformation of both the upper layer and the lower layer.

2. The inflatable device as claimed in claim 1, wherein the strap comprises a plurality of first contact portions connected to the upper layer, and a plurality of second contact portions connected to the lower layer, wherein the first contact portions are offset from the second contact portions in a horizontal plane respectively defined by the upper layer and the lower layer, such that the first contact portions are not superimposed with the second contact portions from a perspective orthogonal to the upper and lower layers.

3. The inflatable device as claimed in claim 1, compris-

ing a plurality of straps, wherein the straps are arranged longitudinally with respect to the upper layer and the lower layer or wherein the straps are arranged latitudinally with respect to the upper layer and the lower layer.

4. The inflatable device as claimed in any of claims 1 to 3, wherein the upper layer has an inner surface area, and a total contact area between the strap and the inner surface area as a percentage of the inner surface area is equal to or larger than 6.3%.

5. The inflatable device as claimed in claim 4, wherein the total contact area between the strap and the inner surface area as a percentage of the inner surface area is less than or equal to 63%.

6. The inflatable device as claimed in any of claims 1 to 5, wherein the lower layer has an inner surface area, and a total contact area between the strap and the inner surface area as a percentage of the inner surface area is equal to or larger than 6.3%.

7. The inflatable device as claimed in claim 6, wherein the total contact area between the strap and the inner surface area as a percentage of the inner surface area is less than or equal to 63%.

8. The inflatable device as claimed in any of claims 1 to 7, wherein the lower layer is provided with a protruding peripheral edge formed on an underside of the lower layer arranged to establish a suction force with a surface on which the inflatable device is disposed.

9. The inflatable device as claimed in claim 8, wherein an auxiliary strap is provided between an exterior surface of the lower layer and an inner sidewall of the protruding peripheral edge.

10. The inflatable device as claimed in any of claims 1 to 8, further comprising a sidewall wherein an auxiliary strap is provided between an inner surface of the sidewall and an inner surface of the lower layer.

11. The inflatable device as claimed in any of claims 1 to 10, wherein a first auxiliary bar is provided at a joint between the upper layer and the sidewall and a second auxiliary bar is provided at a joint between the sidewall and the lower layer to enhance integrity of both the upper layer and the lower layer.

12. The inflatable device as claimed in any of claims 1 to 11, wherein portions of the strap extending between the upper and lower layer are slanted with respect to a reference line orthogonal to the upper layer and the lower layer.

13. The inflatable device as claimed in any of claims 1 to 12, wherein the strap is a single, continuous strip of material or wherein the strap comprises a plurality of individual strips connected between the upper and lower layers. 5
14. The inflatable device as claimed in any of claims 1 to 13, wherein an angle measured between a portion of the strap forming a contact portion connected to the upper layer and a segment of the strap extending from the contact portion to the lower layer is between 91 and 167 degrees. 10
15. The inflatable device as claimed in any of claims 1 to 14, wherein an angle measured between a portion of the strap forming a contact portion connected to the lower layer and a segment of the strap extending from the contact portion to the upper layer is between 91 and 167 degrees. 15

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Fig. 1 (Prior Art)

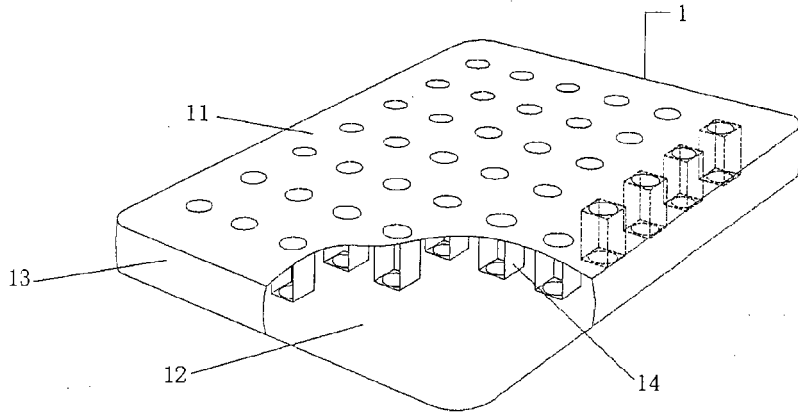


Fig. 2 (Prior Art)

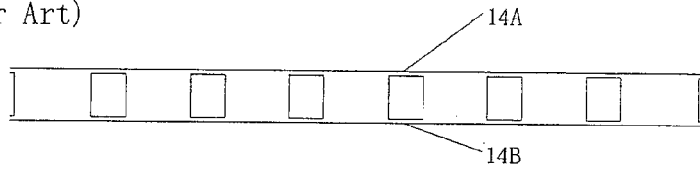


Fig. 3 (Prior Art)

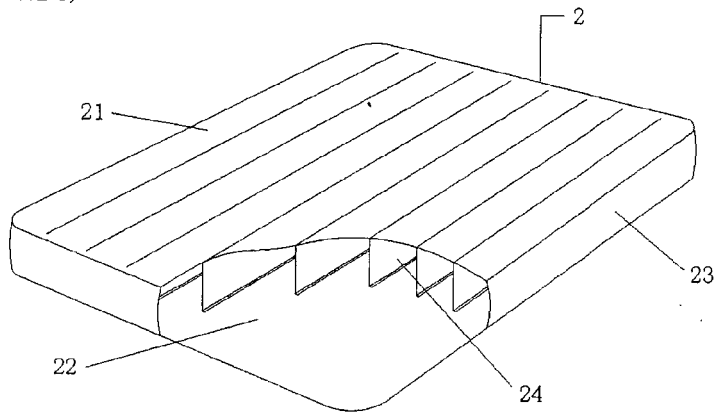
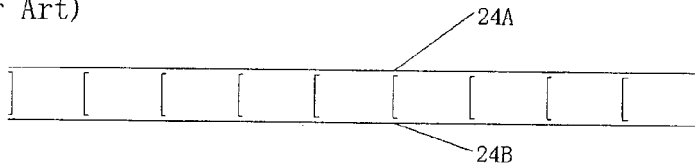


Fig. 4 (Prior Art)



P 6-1

Fig. 5

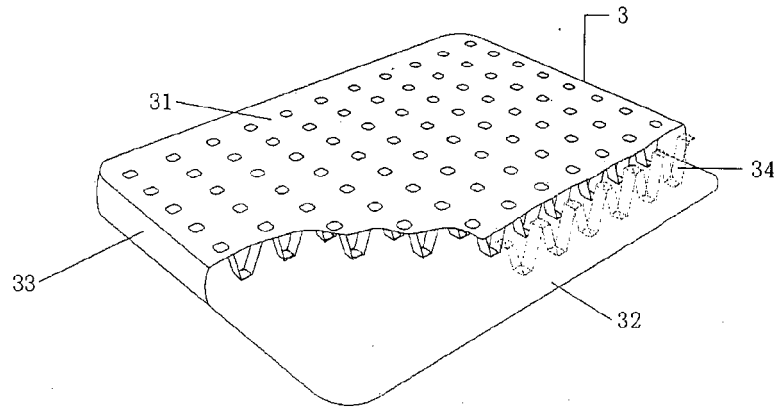


Fig. 6

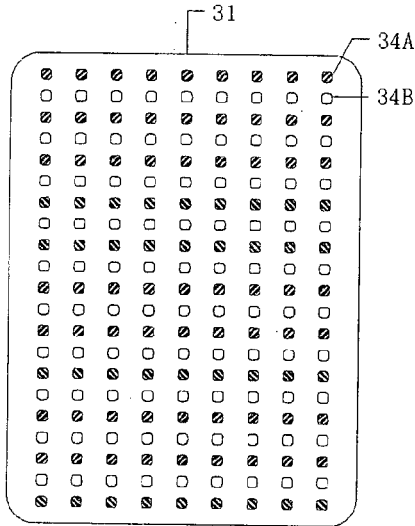


Fig. 7

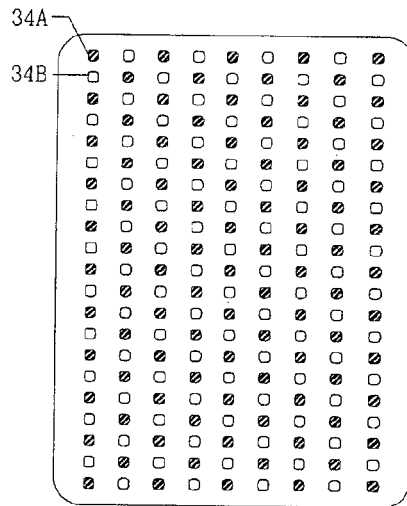
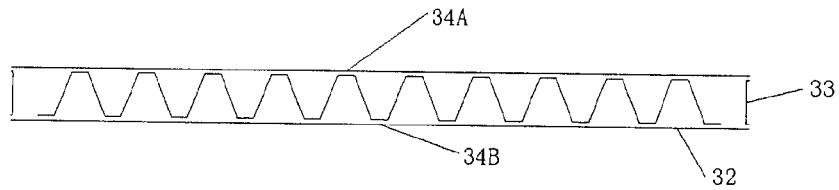


Fig. 8



P 6-2



Fig. 9

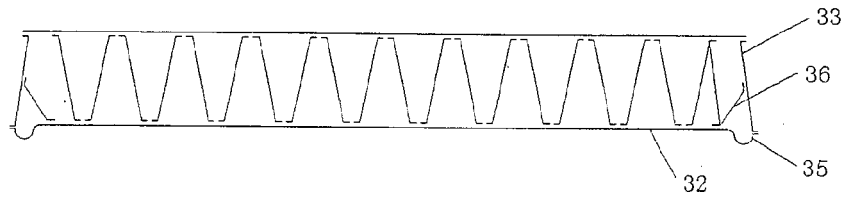


Fig. 10

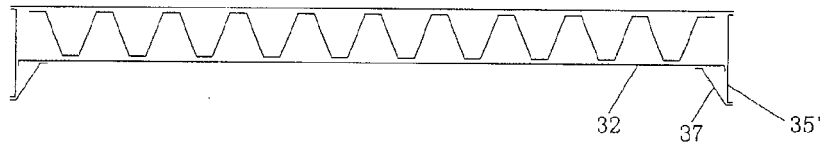


Fig. 11

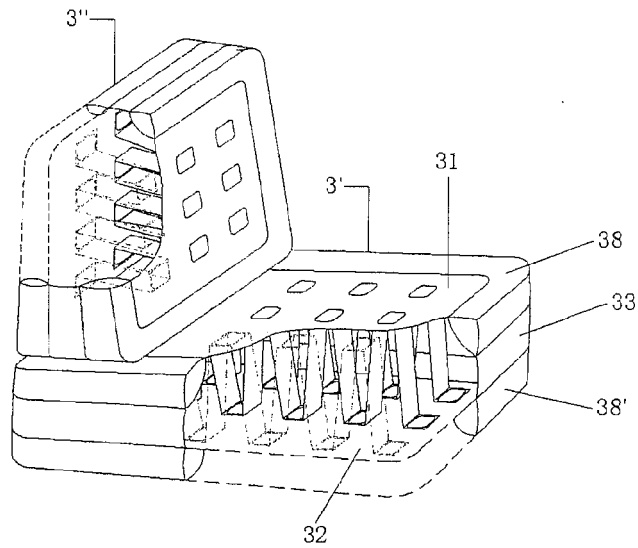


Fig. 12

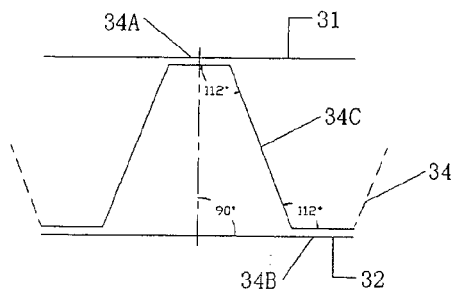
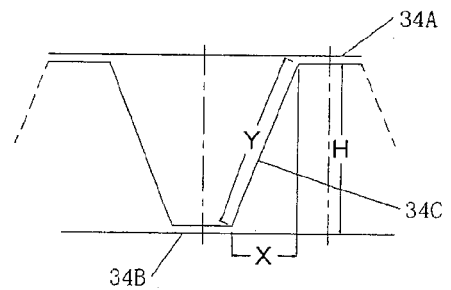


Fig. 13



P 6-3

Fig. 14

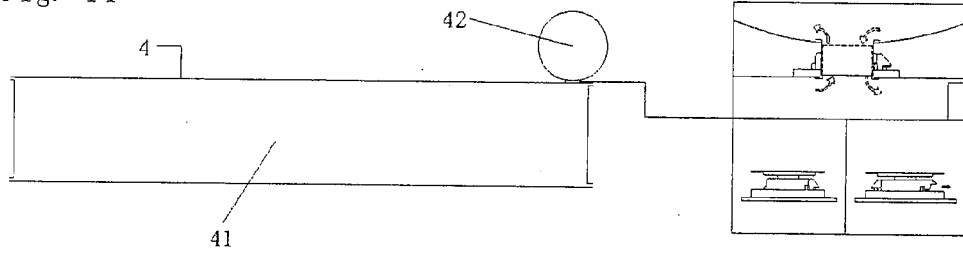


Fig. 15

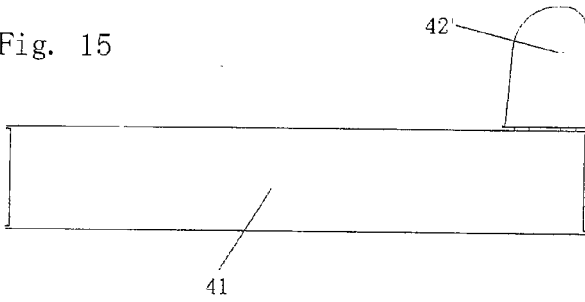


Fig. 16

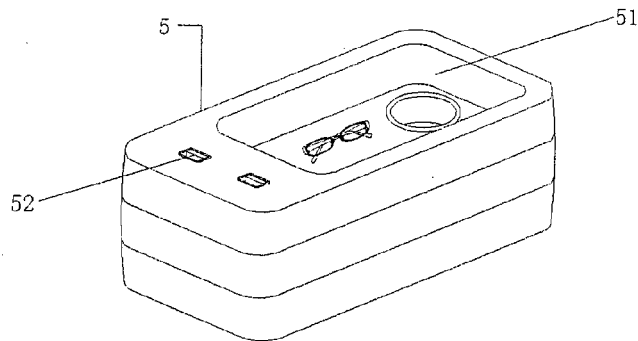
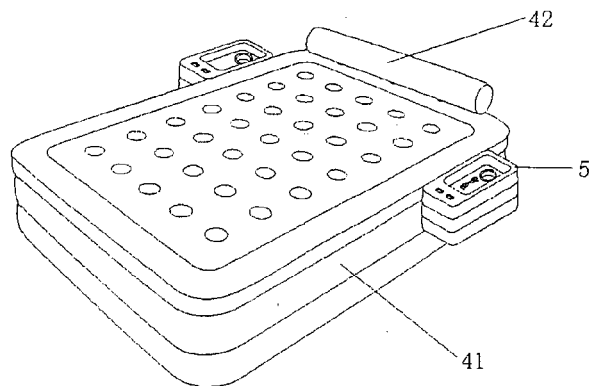


Fig. 17



P 6-4

Fig. 18

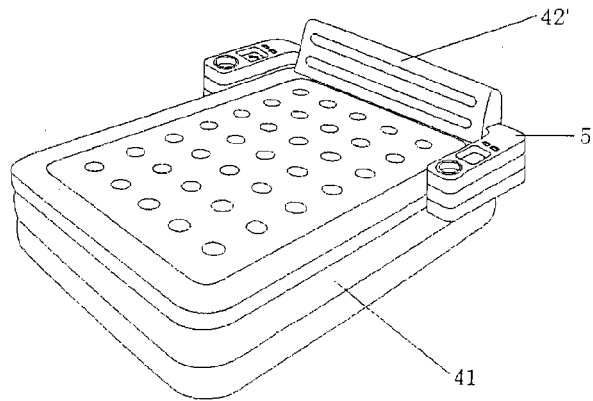
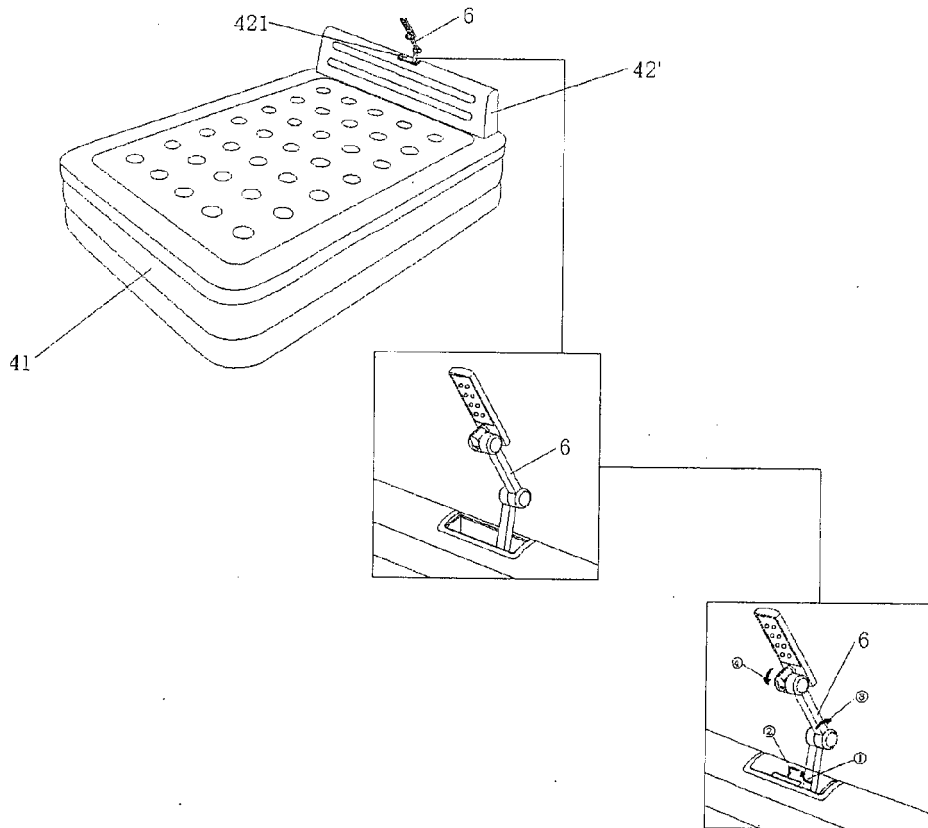


Fig. 19



P 6-5

Fig. 20

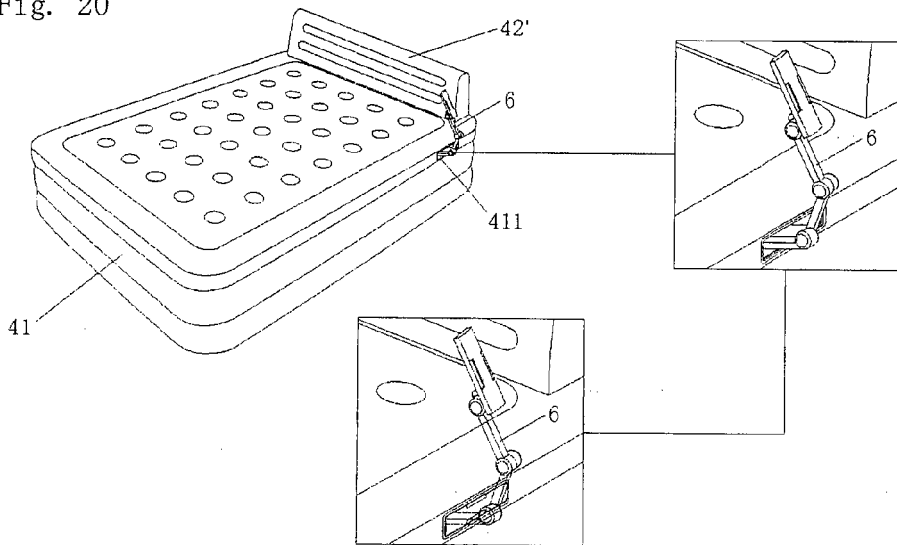
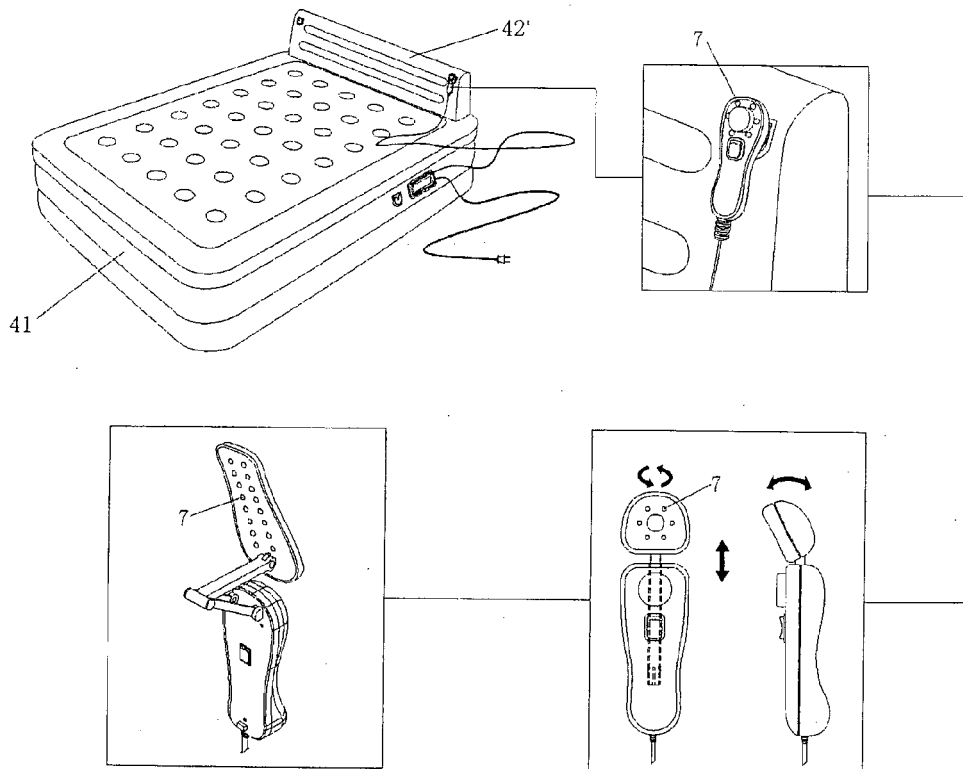


Fig. 21



P 6-6



EUROPEAN SEARCH REPORT

Application Number  
EP 14 00 0861

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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)
X	US 2011/113551 A1 (LIN) 19 May 2011 (2011-05-19) * paragraph [0019]; figures * -----	1,2,4-7, 12-15	INV. A47C27/08
X	US 2003/200610 A1 (WANG) 30 October 2003 (2003-10-30) * claim 1; figures 6,7,10 * -----	1,3,8, 10,13	
X	US 2 887 692 A (BERVEIR) 26 May 1959 (1959-05-26) * figures * -----	1-3, 12-15	
A	US 2008/000030 A1 (WANG) 3 January 2008 (2008-01-03) * figure 2D * -----	1,3,8,9, 13	
A	US 2009/165211 A1 (SONG ET AL) 2 July 2009 (2009-07-02) * paragraph [0017]; figures * -----	1,11,13	
			TECHNICAL FIELDS SEARCHED (IPC)
			A47C

The present search report has been drawn up for all claims

Place of search <b>The Hague</b>	Date of completion of the search <b>12 June 2014</b>	Examiner <b>Kis, Pál</b>
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<b>CATEGORY OF CITED DOCUMENTS</b> 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  
ON EUROPEAN PATENT APPLICATION NO.**

EP 14 00 0861

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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 The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

12-06-2014

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