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(54) Title: UNI-DIRECTIONAL RIGIDIFIER AND METHOD

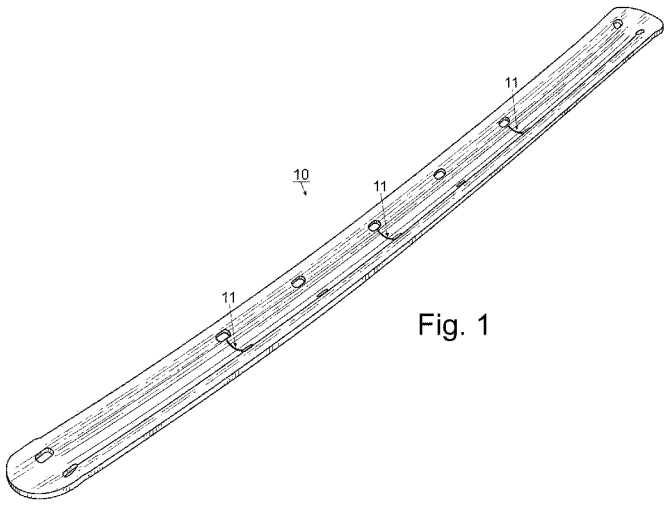


Fig. 1

(57) Abstract: A uni-directional rigidifier for a foldable mattress for use in sofa beds has an arcuate, elongated shape. Lateral slits along the rigidifier allow it to easily flex when a load is applied while in an upright position. When the rigidifier is in an inverted position, an applied load causes the slits to close and the rigidifier to stiffen. The method describes the use of the uni-directional rigidifier in a foldable sofa bed mattress.

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UNI-DIRECTIONAL RIGIDIFIER AND METHOD

FIELD OF THE INVENTION

The invention herein pertains to tension members and particularly pertains to arcuate spring members for use in sofa beds.

DESCRIPTION OF THE PRIOR ART AND OBJECTIVES OF THE INVENTION

Various types of tension members have been used in furniture seats and sofa mattresses for many years. Coil, sinuous, and flat or leaf springs have often been employed to provide comfort for the user. A foldable mattress that employs springs must carefully balance the tension so that the user is comfortable both while sitting with the mattress folded in sofa mode and while the user is in a prone position with the mattress unfolded or extended in bed mode. A sofa mattress that is either "too hard" or "too soft" brings discomfort and causes loss of sleep. Therefore to address the problem of providing the optimum tension and comfort in a sofa mattress, the present invention was conceived and one of its objectives is to provide a uni-directional rigidifier formed from an arcuate tension member which can be easily fitted and attached within a foldable mattress for a sofa bed.

It is another objective of the present invention to provide an elongated tension member for a sofa bed mattress which can lock or close to stiffen when in the bed mode and which will provide flexing when in the sofa mode.

It is still another objective of the present invention to provide a tension member which includes a series of lateral slits therealong to provide exceptional locking and stiffening ability.

It is yet another objective of the present invention to provide a tension member which is conventionally stamped and formed from coated sheet steel.

It is a further objective of the present invention to provide an elongated tension member which can be easily affixed within a sofa bed mattress for improved comfort in both the sofa and bed modes.

It is still a further objective of the present invention to provide a tension member which is relatively inexpensive to manufacture and install.

It is yet a further objective of the present invention to provide an elongated tension member having a U-shaped cross-section with lateral slits therein capable of flexing in a single direction.

Various other objectives and advantages of the present invention will become apparent to those skilled in the art as a more detailed description is set forth below.

SUMMARY OF THE INVENTION

The aforesaid and other objectives are realized by providing uni-directional rigidifiers formed from arcuate tension members which extend longitudinally and have a U-shaped cross-section. In the upright position as a load is applied such as with an

individual sitting on the folded mattress in the sofa mode, the tension members flex and the lateral slits open for seating comfort. When the mattress is unfolded in the usual bed mode the tension members are inverted and when a load is applied such as when an individual lays on the unfolded mattress, the lateral slits therealong close and therefore stiffen to prevent further flexing. Thus the tension members provide the best support and comfort for both sofa seating and bed modes.

The method of use described herein further demonstrates the benefits and advantages of the arcuate tension member. The tension member is formed with a plurality of lateral slits which allow flexing when pressure is applied to the tension member, such as while in the sofa mode. A sofa mattress can be fitted with a suitable number of tension members, such as by attachment to the spring assembly, or otherwise contained within the sofa bed mattress. Unfolding the mattress for use in the bed mode presents the tension members in an inverted configuration whereupon applying a load (pressure) to the mattress causes the slits to close, stiffening the mattress for the user.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows the elongated, arcuate tension member of the invention in an upright, relaxed perspective view;

Fig. 2 pictures the tension member as seen in Fig. 1 in a right side elevational view depicting the elongated arc, the left side elevational view being a mirror image thereof;

Fig. 3 depicts a right end view of the tension member as shown in Fig. 2, the left end view being a mirror image thereof;

Fig. 4 demonstrates a top view of the tension member as shown in Fig. 2;

Fig. 5 illustrates a bottom view of the tension member as shown in Fig. 4;

Fig. 6 features a cross-sectional view of the tension member generally as along lines 6-6 of Fig. 4;

Fig. 7 shows in schematic fashion the flexing of the tension member as shown in Fig. 2 when a load is applied;

Fig. 8 illustrates the tension member in an inverted posture with the slits closed due to the applied load;

Fig. 9 depicts a schematic side elevational view of a typical foldable mattress of a sofa bed in the sofa mode with tension members positioned within the mattress; and

Fig. 10 demonstrates the foldable mattress of Fig. 9 in an extended or unfolded posture in the bed mode with the inverted tension members shown therein.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT AND OPERATION OF THE INVENTION

For a better understanding of the invention and its operation, turning now to the drawings, Fig. 1 illustrates a perspective view of a preferred uni-directional rigidifiers presented as elongated tension members 10 having a plurality of lateral slits 11 spaced therealong. In the side view as shown in Fig. 2, slits 11 are only slightly open when tension member 10 is in its relaxed, arcuate configuration. Openings 12 allow for screws, bolts, wires,

springs, zip ties or other fasteners to be used to affix tension member 10 to the spring assembly inside mattress 21, cushion or the like as shown schematically in Figs. 9 and 10. Tension member 10 includes opposing lips 13, 13' which are relatively flat and act as top edges along the sides of U-groove 14 as seen in Figs. 3 and 6. In Fig. 5 which portrays the bottom view of tension member 10, open slits 11 are easily seen though tension member 10 is not under pressure such as by the weight of a user. As seen in Figs. 4 and 5, slits 11 include apertures 11a on each end which are in communication therewith and provide pressure relief to tension member 10 as slits 11 close and open during use to prevent damage such as bending, creasing, stress fractures or the like to the surrounding edges.

Preferred tension member 10 has a U-shaped cross-section as seen along lines 6-6 of Fig. 4 and is formed such as by a conventional stamping process from usual metal such as a thin coated steel. Tension member 10 is formed from twenty (20) gauge (0.8 mm thick) coated steel although other thicknesses and materials such as plastics, aluminum or composite materials if suitable may be employed. Tension member 10 was created to provide comfort to the user while extending the life of a mattress and as such must be formed from a durable material which will sustain its shape during repeated use over an extended time period. The preferred length of tension member 10 is preferably twenty-two inches (55.88 cm) with a width of one and a half inches (3.81 cm) although other lengths and widths may be used, depending on the particular application and specifications desired.

A plurality of tension members 10 can be positioned for example in a foldable mattress of a sofa bed such as sofa bed 20. For example, see co-pending application Serial No. 13/470,458 and

Serial No. 13/470,478, the entire disclosures of each are hereby incorporated by reference in their respective entireties. As shown in Figs. 9 and 10, sofa bed 20 includes a standard foldable mattress 21 having at least lower or first section 22 and folded or second section 23. As seen in Fig. 9 in the sofa mode, tension members 10 are in an upright position in folded or second section 23 which is shown folded atop lower or first section 22 which includes tension members 10 in an inverted position. Second section 23 in Fig. 9 is shown directly below seat cushion 24. In Fig. 9, if sofa bed 20 is used for seating and seat cushion 24 above mattress 21 is sat upon, upright tension member 10 in second section 23 will flex and slits 11 as shown in Fig. 7 will open allowing some give (flexing) in mattress 21 providing comfort to the user. Tension members 10 in lower or first mattress section 22 will stiffen due to the closure of slits 11 therealong (see Fig. 8) as a load is applied, such as by sitting thereon to prevent further downward movement.

In Fig. 10, sofa bed 20 is shown with seat cushions 24 removed and foldable mattress 21 in its extended posture for use as a bed. Tension members 10 in first section 22 and second section 23 are positioned proximate the bottom of mattress 21 and are both inverted as shown larger in Fig. 8. Thus, when a load is applied to first section 22 or second section 23 such as a person laying thereon, tension members 10 stiffen due to slits 11 closing as seen in Fig. 8 thus stopping the flexion of tension members 10 to provide a firm support.

As would be understood the upper portion of mattress 21 as is conventional allows for some deformation when a user lays thereon. However over time and extended, repeated use, the mattress and spring assembly (not shown) begin to flatten or sag and can provide

an unstable, uncomfortable mattress for the user. By positioning tension members 10 within sofa mattress 21, an additional stiffening structure is provided to assist in supporting the spring assembly/mattress and will prevent sagging and "bottoming out" of the mattress as often occurs over time after repeated use. Tension members 10 provide support not only for the user but also for the mattress itself to maintain its posture and ultimately extend its "shelf life".

In the method of use, one or more uni-directional rigidifiers shown as tension members 10 are formed such as by usual stamping from coated steel and installed in a suitable, conventional foldable mattress such as mattress 21 for use such as in sofa bed 20 as illustrated in Figs. 9 and 10. Foldable mattress 21 is positioned as normal in sofa bed 20 with usual removable back and seat cushions. As seat cushions 24 are loaded or pressure is applied such as by an individual (not shown) sitting thereon, tension member 10 in second (upper) mattress section 23 flexes (with slits 11 opening) to provide comfort to the user. Lower or first mattress section 22 having tension member 10 inverted will only slightly flex causing slits 11 to close preventing further flexing. Next, when using sofa bed 20 as a bed, seat cushions 24 are removed and second section 23 which is hingedly joined to first section 22 is unfolded or extended as seen in Fig. 10 whereby tension members 10 in both first section 22 and second section 23 are inverted. Here, as a person lays upon mattress 21, the upper portion would deform downwardly as is conventional however tension members 10 in both first section 22 and second section 23 would stiffen as a load or pressure is applied causing lateral slits 11 to close, thus effectively locking tension members 10 and preventing further flexing or downward deformation of mattress 21. Such placement allows for a firmer mattress providing comfort to

the user while also preventing sagging of the mattress. Although not shown as would be understood a plurality of tension members 10 are evenly spaced in an asymmetrical and parallel relation approximately five inches (12.7 cm) apart along the width of mattress 21 for a total of six (6) tension members 10 in both first and second sections 22, 23 respectively to provide additional stiffening support to mattress 21.

The illustrations and examples provided herein are for explanatory purposes and are not intended to limit the scope of the appended claims.

I claim:

1. A uni-directional rigidifier formed from a flexible tension member, said tension member defining an arcuate elongated shape, said tension member further defining a lateral slit, said lateral slit closing upon flexing said tension member in one direction and opening said lateral slit upon flexing said tension member in an opposite direction.

2. The tension member of claim 1 further defining a U-shaped cross-section.

3. The tension member of claim 1 wherein said tension member defines an additional lateral slit.

4. The tension member of claim 1 further comprising a flat lip, said lip extending longitudinally therealong.

5. The tension member of claim 1 formed from twenty gauge steel.

6. The tension member of claim 1 wherein said tension member defines an opening, said opening for affixing said tension member to a foldable sofa mattress.

7. The tension member of claim 1 further defining a pair of opposing slit apertures, said pair of opposing slit apertures in communication with said lateral slit.

8. The tension member of claim 7 further defining a pair of opposing openings, said pair of opposing openings

positioned in opposing parallel relation to said pair of opposing slit apertures.

9. The tension member of claim 8 further comprising a pair of opposing lips, said pair of opposing lips extending longitudinally therealong.

10. A foldable mattress, said mattress comprising a first section and a second section, said second section foldable atop said first section, said second section comprising a uni-directional rigidifier formed from a flexible tension member, said tension member defining an arcuate, elongated shape and a lateral slit, said tension member defining a U-shaped cross section, said U-shape upright when said second section is folded atop said first section and said U-shape is inverted when said second section is unfolded and extended.

11. The foldable mattress of claim 10 wherein said tension member further comprises a flat lip, said flat lip extending longitudinally therealong.

12. The foldable mattress of claim 11 wherein said tension member further comprises a slit aperture, said slit aperture in communication with said lateral slit.

13. The foldable mattress of claim 11 wherein said first section comprises a flexible tension member, said first section tension member defining an arcuate, elongated shape, a lateral slit, and a U-shaped cross section, said first section U-shape inverted.

14. A method of utilizing a foldable mattress having first and second sections, the second section having a uni-directional rigidifier formed from a slitted flexible tension member comprising the steps of:
    a) extending the second section from the first section;
    b) applying pressure to the extended second section; and
    c) flexing the tension member to close the slitted tension member.

15. The method of claim 14 further comprising the step of releasing pressure from the second section and allowing the slitted tension member to open.

16. The method of claim 14 further comprising the step of folding the second section atop the first section.

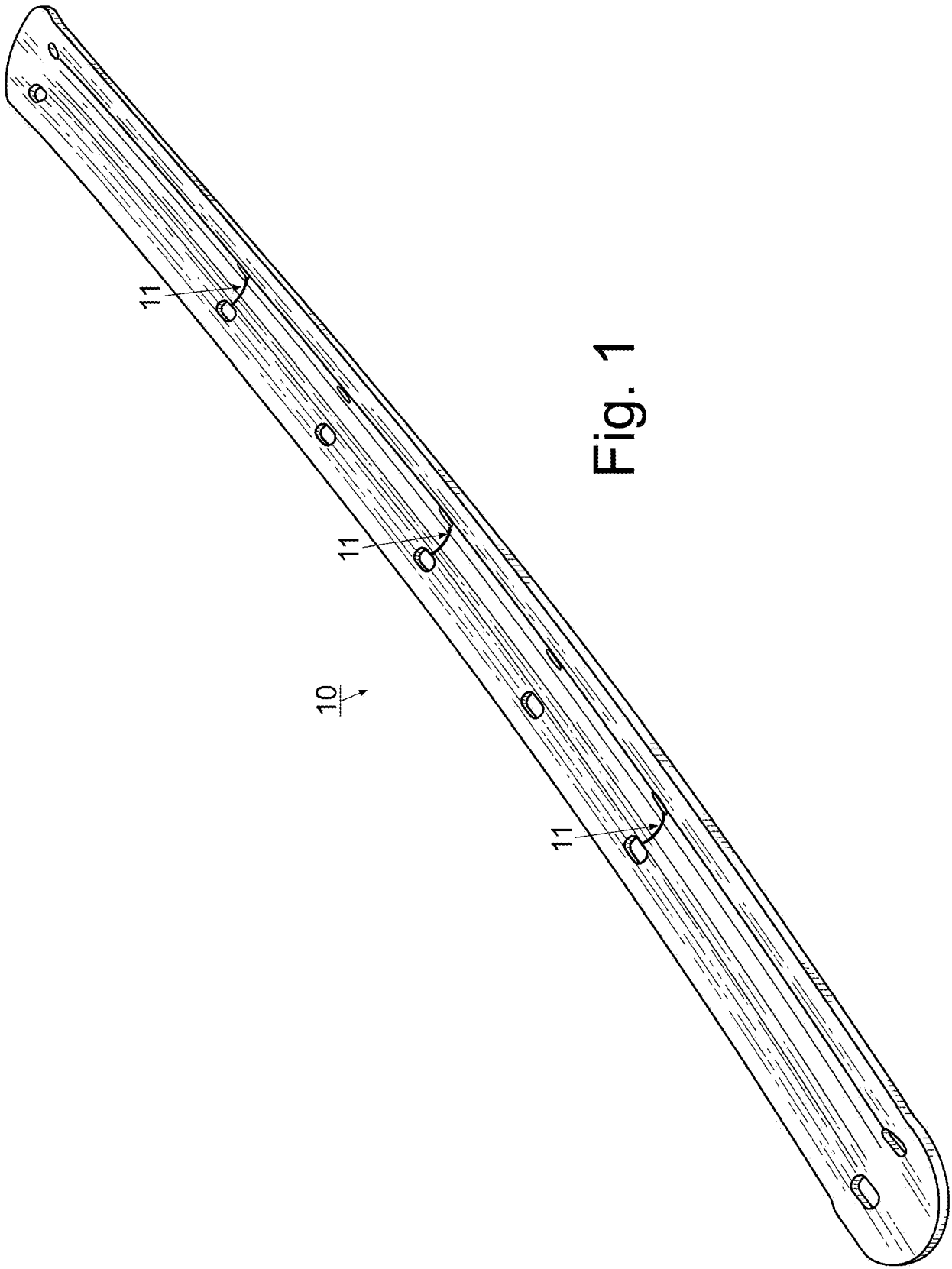


Fig. 1

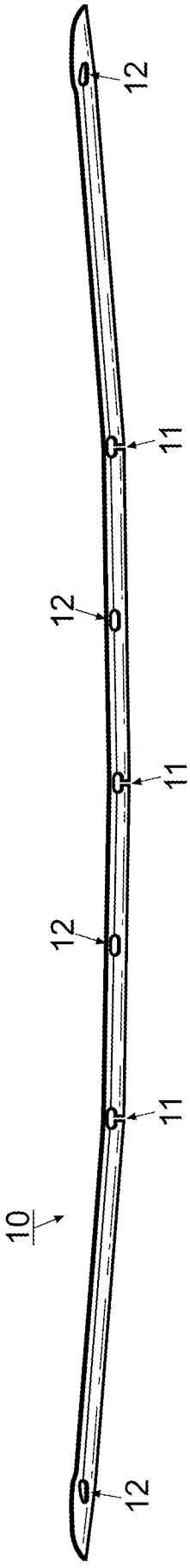


Fig. 2

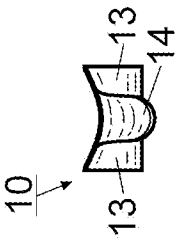


Fig. 3

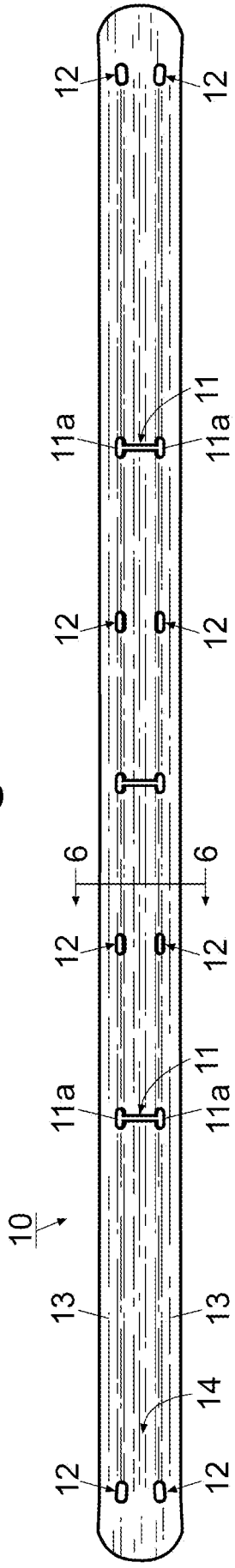


Fig. 4

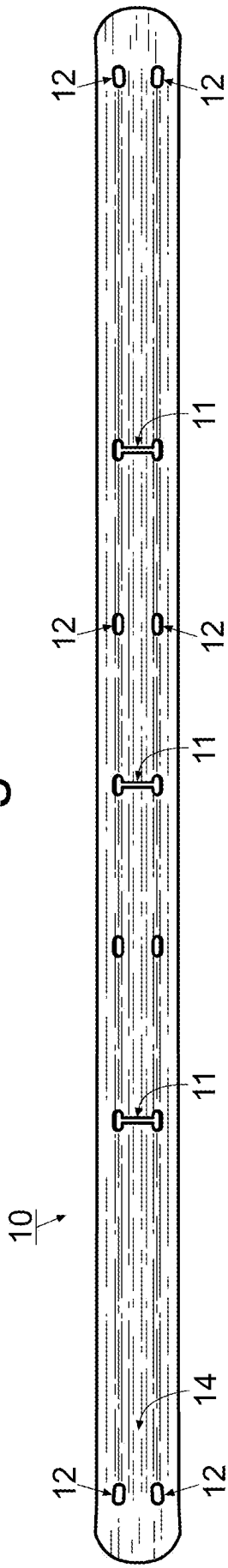


Fig. 5

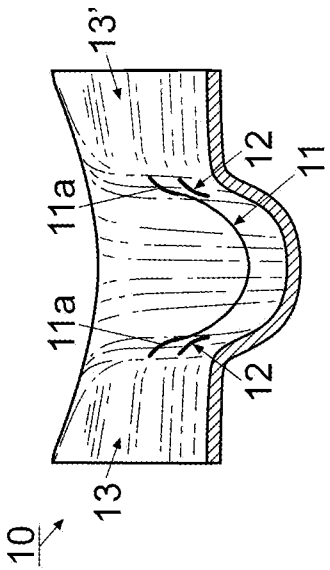


Fig. 6

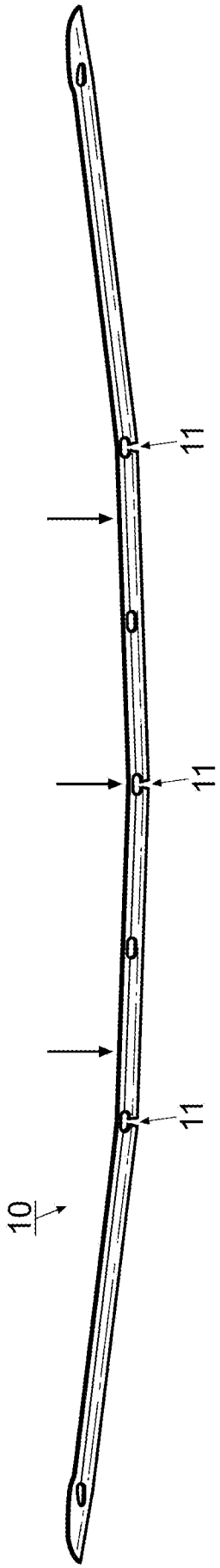


Fig. 7

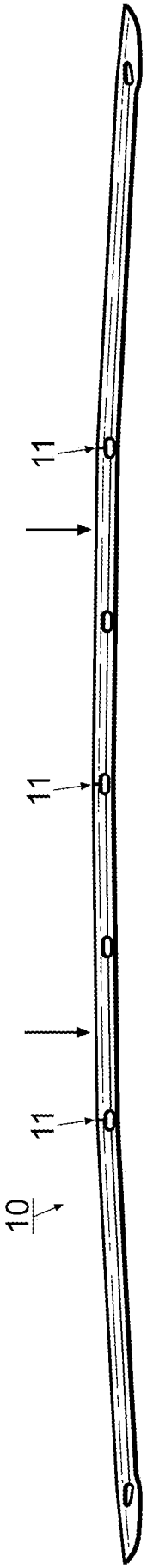


Fig. 8

Fig. 9

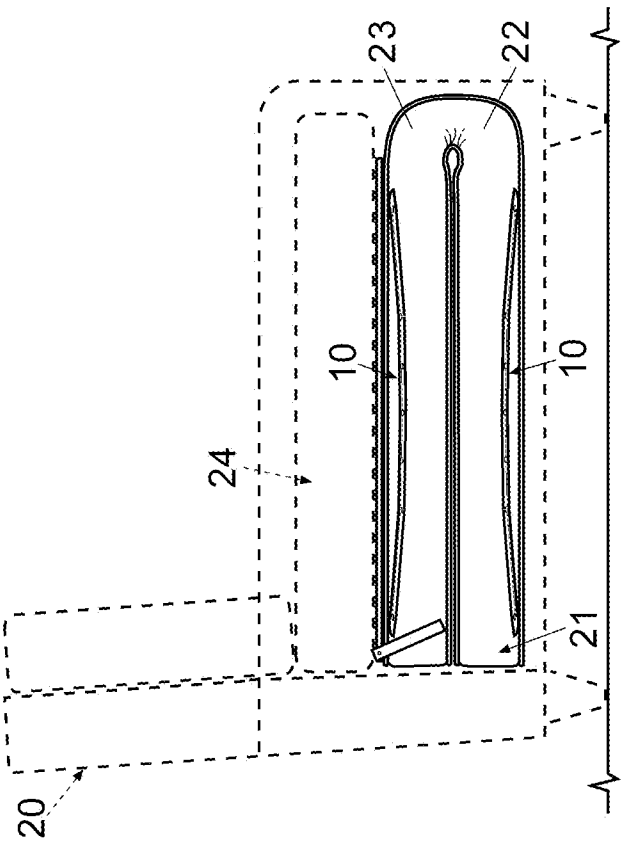
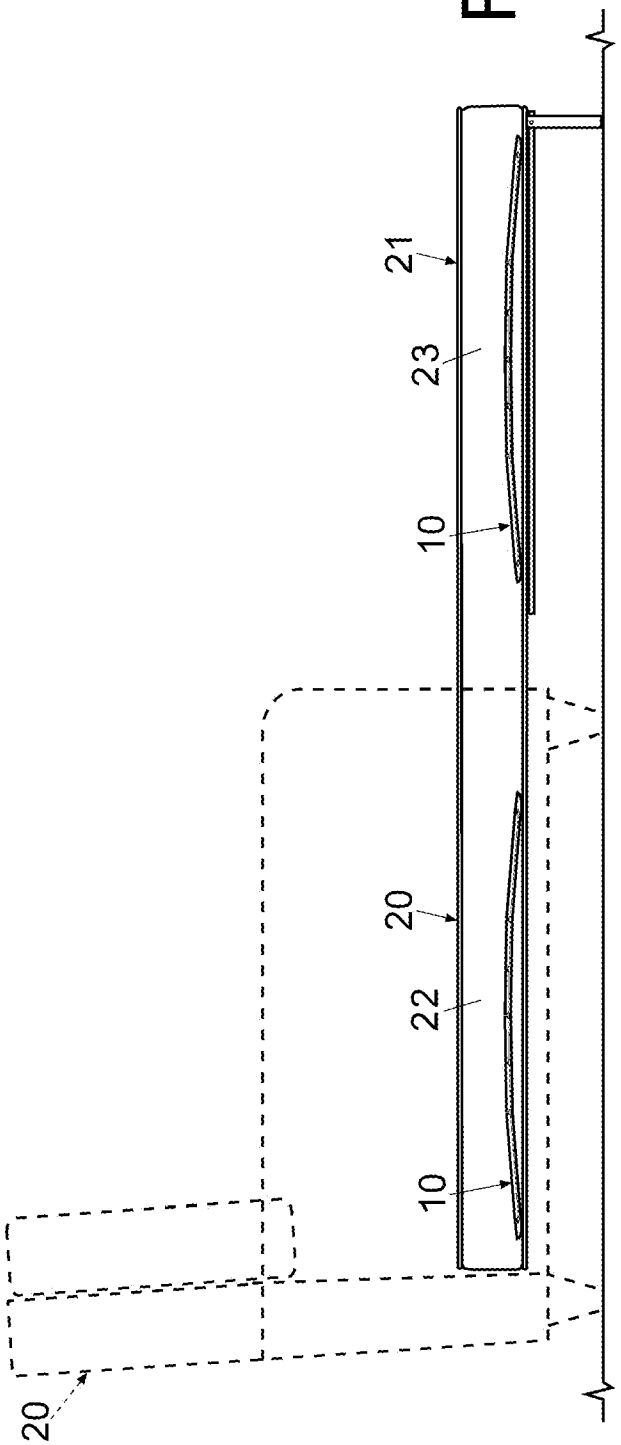


Fig. 10



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/035408

A. CLASSIFICATION OF SUBJECT MATTER

A47C 27/00(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A47C 27/00; A47C 17/37; A47C 17/26; A47C 17/22; A47C 27/04; A47C 17/13

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean utility models and applications for utility models
Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS(KIPO internal) & Keywords: mattress, sofa bed, rigidifier, flexible, fold, slit, opening

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2002-0178503 A1 (REEDER et al.) 05 December 2002 See paragraphs [0006], [0126]-[0135], [0229] and figures 1(a), 5-7, 26-27.	1-16
A	US 2830306 A (WAGNER et al.) 18 June 1954 See column 2, lines 31-36, column 3, lines 47-50 and figures 2-4.	1-16
A	KR 20-0289125 Y1 (BYONG OAK, CHOI) 13 September 2002 See claim 1 and figures 1-2.	1-16
A	US 5539944 A (MILLER, JOHN E.) 30 July 1996 See column 6, line 28 - column 8, line 27 and figures 1-4.	1-16
A	WO 2013-173202 A1 (AXESS DIRECT, INC.) 21 November 2013 See claims 1-10 and figures 1-5.	1-16

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
15 October 2014 (15.10.2014)	**15 October 2014 (15.10.2014)**

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Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/US2014/035408

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2002-0178503 A1	05/12/2002	AU 1998-97951 A1	03/05/1999
		AU 1999-18161 A1	28/06/1999
		AU 9795198 A	03/05/1999
		BR 9812858 A	08/08/2000
		CA 2239121 A1	05/06/1997
		CA 2239121 C	31/01/2006
		CA 2305522 A1	22/04/1999
		CA 2313793 A1	17/06/1999
		DE 69823534 D1	03/06/2004
		DE 69823534 T2	14/10/2004
		EP 0869728 A1	27/11/2002
		EP 1021108 A1	26/07/2000
		EP 1021108 B1	28/04/2004
		EP 1037545 A1	27/09/2000
		EP 1037545 B1	16/02/2005
		EP 1464258 A2	06/10/2004
		EP 1464258 A3	22/12/2004
		JP 2000-501305 A	08/02/2000
		JP 2001-519186 A	23/10/2001
		JP 2001-525206 A	11/12/2001
		JP 3985905 B2	03/10/2007
		US 2002-0124320 A1	12/09/2002
		US 2004-0133987 A1	15/07/2004
		US 5815865 A	06/10/1998
		US 6115861 A	12/09/2000
		US 6286167 B1	11/09/2001
		US 6378152 B1	30/04/2002
		US 6460209 B1	08/10/2002
		US 6687935 B2	10/02/2004
		US 6952852 B2	11/10/2005
		WO 99-18827 A1	22/04/1999
		WO 99-29213 A1	17/06/1999
US 2830306 A	18/06/1954	None	
KR 20-0289125 Y1	13/09/2002	None	
US 5539944 A	30/07/1996	AU 1996-44072 B2	01/04/1999
		EP 0793430 A1	24/09/2003
		JP 2002-514938 A	21/05/2002
		US 5524305 A	11/06/1996
		US 5539940 A	30/07/1996
		US 5540418 A	30/07/1996
		US 5642536 A	01/07/1997
		US 5655240 A	12/08/1997
		WO 96-16576 A1	06/06/1996
WO 2013-173202 A1	21/11/2013	US 8806672 B1	19/08/2014