

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

INTEX RECREATION CORP.
Petitioner

v.

BESTWAY INFLATABLES & MATERIALS CORP.
Patent Owner

U.S. Patent No. 10,687,633
Filing Date: Sept. 29, 2016
Issue Date: June 23, 2020
Title: Inflatable Bed

Case IPR2023-00488

**PETITION FOR *INTER PARTES* REVIEW
UNDER 35 U.S.C. §§ 311–319 AND 37 C.F.R. § 42.100 *ET SEQ.***

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I. INTRODUCTION

Intex Recreation Corp. (“Petitioner”) respectfully requests *inter partes* review (“IPR”) of claims 3-15 and 17 (the “Challenged Claims”) of U.S. Patent No. 10,687,633 (“the ’633 Patent”) (Ex. 1001).

II. MANDATORY NOTICES (37 C.F.R. § 42.8)

A. Real Party-in-Interest

Petitioner is the real party-in-interest for this petition, as are the following entities: Intex Development Company Ltd., Intex Industries (Xiamen) Co., Ltd., and Intex Marketing Ltd.

B. Related Matters

The ’633 Patent is presently asserted by Patent Owner against Petitioner in *Bestway (USA), Inc. et al. v. Intex Recreation Corp. et al.*, No. 2:22-cv-00406 (C.D. Cal.) (the “District Court Litigation”), filed January 19, 2022 and served on Petitioner on April 28, 2022. The District Court Litigation was stayed on January 18, 2023, pending Petitioner’s IPRs. (Ex. 1057.)

On June 22, 2020, Patent Owner filed U.S. Patent Appl. No. 16/907,893 (the “Continuation Application”), which is a continuation of the ’633 Patent and remains pending.¹

¹ The prior art and arguments presented in this Petition have not been disclosed to nor considered by the Examiner in the Continuation Application.

As explained in Petitioner's Notice of Ranking and Explanation filed herewith, Petitioner is concurrently filing an IPR petition challenging the Challenged Claims based on different grounds, as well as two IPR petitions challenging other claims of the '633 Patent.

Petitioner is not aware of any other judicial or administrative matter that would affect, or be affected by, a decision in this proceeding.

C. Counsel and Service Information

Pursuant to 37 C.F.R. §§ 42.8(b)(3) and 42.10(a), Petitioner hereby identifies its lead and backup counsel as follows:

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Please address all correspondence to the lead counsel at the address shown above. Petitioner also consents to electronic service to all of the email addresses shown above. Pursuant to 37 C.F.R. § 42.10(b), a Power of Attorney accompanies this Petition.

III. PAYMENT OF FEES (37 C.F.R. § 42.103)

Petitioner requests review of 14 claims. Petitioner authorizes the Commissioner to charge the \$19,000 request fee, \$22,500 post-institution fee, and any additional required fees to Deposit Account No. 02-0390.

IV. GROUNDS FOR STANDING (37 C.F.R. § 42.104(A))

Petitioner certifies that the '633 Patent is available for IPR and that Petitioner is not barred or estopped from challenging the '633 Patent claims on the Grounds identified in this Petition.

V. PRECISE RELIEF REQUESTED AND GROUNDS RAISED

Petitioner respectfully requests cancellation of the Challenged Claims based on the following Grounds:

Ground	Claims	Statutory Basis	Reference(s)
1.	3-11, 17	§103	JPU-1-1974-034811 (“Aoki”) (Ex. 1004, 1005)
2.	3-14, 17	§103	Aoki in view of U.S. Patent No. 8,562,773 (“Lin ’773”) (Ex. 1009)
3.	12	§103	Aoki in view of U.S. Patent No. 7,089,618 (“Metzger”) (Ex. 1010)

4.	15	§103	Aoki in view of Lin '773 and U.S. Patent Publication No. 2015/0335164 (“Liu”) (Ex. 1015)
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The '633 Patent issued on June 23, 2020 from U.S. Patent Application No. 15/280,513 (“the '513 Application”), filed on September 29, 2016. (Ex. 1001, Title Page, (21), (22), (45).) The '513 Application claims the benefit of Chinese Patent Application Nos. CN 201610020533 and CN 201620031074U, both of which were filed on January 13, 2016. (*Id.*, Title Page, (30).) Petitioner assumes January 13, 2016 as the priority date (“Priority Date”) for the purposes of this Petition.

Aoki issued on June 28, 1972 (Ex. 1005, Title Page); Lin '773 issued on October 22, 2013 (Ex. 1009, Title Page, (45)); Metzger issued on August 15, 2006 (Ex. 1010, Title Page, (45)); and Liu was published on November 26, 2015 (Ex. 1015, Title Page, (43)). Therefore, all four references are prior art under 35 U.S.C. §102(a)(1) and (2).

VI. THE '633 PATENT

A. Overview

The '633 Patent is directed to “inflatable beds or inflatable mattresses, and more specifically, to an inflatable bed, the structure of which is configured to limit the outward bulging or deformation of a side wall.” (Ex. 1001, 1:12-15.) The '633 Patent recognizes that inflatable beds, typically comprising “a top sheet, a bottom

sheet, and a side wall coupled to the top sheet and the bottom sheet to form an inflatable air chamber,” were known in the art. (*Id.*, 1:27-32.) The ’633 Patent further recognizes that internal tensioning structures “coupled to the top sheet and the bottom sheet” and “disposed in the air chamber” were also used “so as to form a shape having a certain height and a substantially flat upper surface for people to lie on.” (*Id.*, 1:32-36.)

The ’633 Patent notes that particularly for “larger height” inflatable beds (i.e., those higher up off the floor), the side walls “are susceptible to bulge and deform, affecting the appearance of the inflatable beds” and “result[ing] in the decay of air pressure in the air chamber, such that the inflatable beds and inflatable mattresses are softened, reducing the comfort of the inflatable beds.” (*Id.*, 1:37-46.) In addition, the ’633 Patent notes that prior art “large height” inflatable beds also had “a defect in its stability,” such that “[w]hen a user lies on or seats near the edge of the inflatable beds,” they are “susceptible to roll over.” (*Id.*, 1:60-65.) The ’633 Patent further notes that attempts to solve these problems by arranging a middle sheet between the top sheet and the bottom sheet have been unsuccessful, and moreover required additional materials and more complicated manufacturing processes. (*Id.*, 1:47-59.)

Accordingly, the ’633 Patent identifies “[t]he technical problem to be solved by the present invention” as “overcom[ing] the defects of easy occurrence of

bulging and deformation of the side walls of the inflatable beds and inflatable mattresses, poor stability of the inflatable beds and inflatable mattresses, and susceptibility of roll-over in the prior art.” (Ex. 1001, 2:7-12.)

As illustrated in annotated Figure 6 below, the '633 Patent discloses an inflatable bed 10 that includes a top sheet 11 (in blue), a bottom sheet 12 (uncolored), at least one side wall 13 (in green), first tensioning structures 14 (in yellow), a second tensioning structure 15 (in red), a third tensioning structure 16 (in orange), and a built-in air pump 20 (in purple):

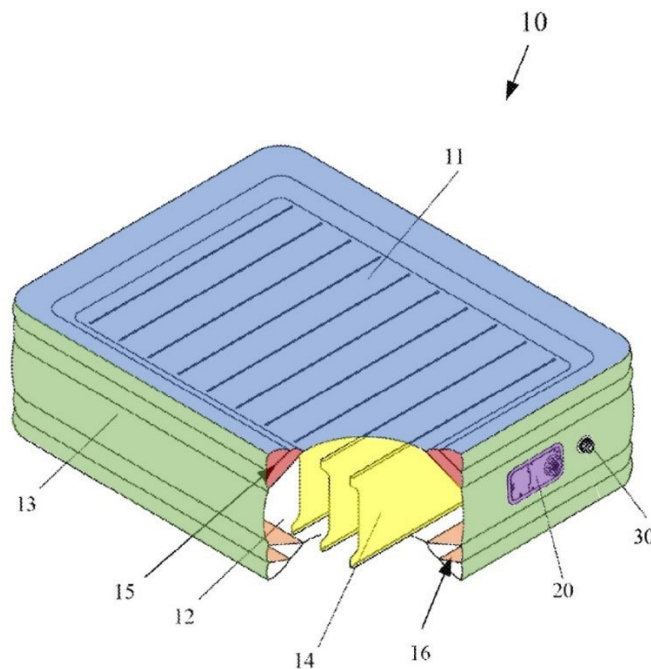


Fig. 6

(Ex. 1001, 6:18-22, 6:47-49, 8:27-31; Fig. 6.) The first tensioning structure 14 (yellow) is coupled to the top sheet 11 and bottom sheet 12 to “limit[] the respective upward and downward bulging of the top sheet 11 and the bottom sheet

12[.]” (*Id.*, 6:28-35.) The second tensioning structure 15 (red) “is configured to limit the upward and lateral bulging of the top sheet 11 and the side wall 13 after said air chamber is inflated.” (*Id.*, 6:52-55.) The third tensioning structure 16 (orange) “is configured to limit the respective downward and lateral bulging of the bottom sheet 12 and the side wall 13 after said air chamber is inflated.” (*Id.*, 6:60-63.)

B. Relevant File History

1. April 25, 2019 Restriction Requirement and Response

On April 25, 2019, the Examiner issued a Restriction Requirement. (Ex. 1003, 236-241.) On June 25, 2019, Patent Owner filed a response and elected to prosecute claims “directed to Species I as represented by Figures 5-8.” (*Id.*, 336.) Patent Owner stated that the election was “made without traverse,” and withdrew the remaining pending claims. (*Id.*)

2. Non-Patent Literature Filed by Patent Owner from European Patent Office Opposition Proceeding

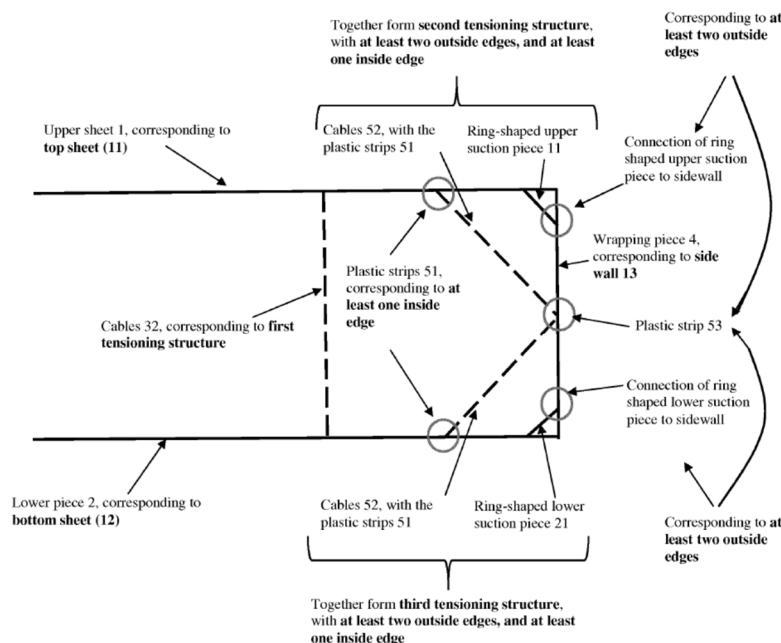
Separately from prosecution of the ’513 Application, on June 17, 2019, Petitioner filed a Notice of Opposition in the European Patent Office (“EPO”) against a related European patent assigned to Patent Owner, EP 3192401 (“the EP ’401 Patent”). (Ex. 1038, 500-519.) The EP ’401 Patent claims priority to the same Chinese applications as the ’513 Application, and generally has the same disclosure and claims as the ’513 Application. (*Id.*, 22-41.) In its Notice of

Opposition, Petitioner included, *inter alia*, a schematic explaining disclosures in one prior art reference (Chinese Patent No. CN203137719 (“Lin”) (Exs. 1006, 1007)) in support of Petitioner’s invalidity arguments. (*Id.*, 504-505.)

On August 28, 2019, Patent Owner submitted Petitioner’s Notice of Opposition as part of an Information Disclosure Statement in the prosecution file of the ’513 Application. (Ex. 1003, 341, 343.)

3. October 8, 2019 Non-Final Rejection and Response

On October 8, 2019, the Examiner issued a non-final rejection in which he rejected pending claims 1-6, 13-16, 23, 24, 32, 33, 37, and 38 as being anticipated by Lin. (*Id.*, 441, 443-447.) In support, the Examiner stated that he “agree[d] with the sectional view Figure provided in [Petitioner’s] Notice of Opposition,” reproduced below:



(*Id.*, 444.)²

The Examiner also rejected pending claims 34-36, 39, and 40—generally corresponding to issued claims 14-16, 19, and 20—as being obvious over Lin in view of the Examiner’s Official Notice regarding the knowledge and skill of a POSA. (*Id.*, 448-450.)

On January 8, 2020, Patent Owner amended claim 1 to add the following limitation:

wherein said support structure comprises a second tensioning structure and a third tensioning structure, at least two outside edges of said second tensioning structure are respectively coupled to said at least one side wall, at least one inside edge of said second tensioning structure is coupled to said top sheet; and

wherein at least two outside edges of said third tensioning structure are respectively coupled to said at least one side wall, at least one inside edge of said third tensioning structure is couple to said bottom sheet.

(*Id.*, Ex. 1003, 474-475, 484.) Patent Owner argued that the amendment to claim 1 served to overcome the rejections of the dependent claims, without amendment to those claims. (Ex. 1003, 485-486.)

² During prosecution of the Continuation Application, the Examiner again indicated that he agreed with this Figure as representing Lin’s disclosure. (Ex. 1055, 169.)

On February 20, 2020, the Examiner issued a Notice of Allowance without explanation. (*Id.*, 489-491.)

VII. LEVEL OF ORDINARY SKILL IN THE ART

A. Background and State of the Art

1. Inflatable Beds and Tensioning Structures

It was well known as of the Priority Date that inflatable beds typically comprised basic features such as a top sheet and bottom sheet connected at their outer edges to four side walls to form an air chamber inside. (*See, e.g.*, Ex. 1001, 1:27-32; Ex. 1007, [0021]; Ex. 1010, 4:4-21; Ex. 1002, ¶35.) It was also well known before the Priority Date that inflatable beds would comprise means for inflation and deflation such as air pumps and/or air valves through which air may pass into and out of the air chamber. (*See, e.g.*, Ex. 1011, 3:38-44; Ex. 1012, 1:16-27; Ex. 1013, ¶[0051]; Ex. 1002, ¶36.)

It was also long known that tensioning structures should be used in inflatable beds to join the top, bottom, and side surfaces of the bed together internally, thus preventing such surfaces from expanding away from each other and taking on a rounded or balloon shape. (*See, e.g.*, Ex. 1015, ¶[0006]; Ex. 1024, 1:50-67; Ex. 1002, ¶37.) For example, it was well known before the Priority Date that tensioning structures should be coupled to the underside of the top sheet and the topside of the bottom sheet to prevent the top sheet and bottom sheet from taking

on a rounded shape as the bed is inflated. (*See, e.g.*, Ex. 1001, 1:32-36; Ex. 1013, ¶¶[0009], [0068]-[0069]; Ex. 1014, ¶[0005]; Ex. 1015, ¶[0040]; Ex. 1025, 3:35-49; Ex. 1026, 5:39-51; Ex. 1027, ¶[0041]; Ex. 1002, ¶38.)

It was also well known before the Priority Date that tensioning structures should be disposed in the air chamber at an oblique, or diagonal, orientation to join the top sheet with the side walls, and to join the bottom sheet with the side walls, and thus prevent those surfaces from overly expanding away from each other as the mattress is inflated. (*See, e.g.*, Ex. 1011, 2:18-31, 3:45-4:5; Ex. 1013, ¶¶[0068]-[0069], Fig. 9; Fig. 8; Ex. 1025, 1:30-33, 2:53-67, Fig. 3; Ex. 1028, 4:63-5:21, Fig. 7; Ex. 1029, ¶¶[0039]-[0040], Figs. 8B, 8C; Ex. 1002, ¶¶39-44.)

2. Known Problems with Larger Inflatable Beds

Before the Priority Date, it was recognized in the art that “large height” or “multi-layer” inflatable beds presented a number of problems. (Ex. 1002., ¶¶45-50.) First, it was known that the larger size of such inflatable beds exacerbated the problems of ballooning or bulging of the outer surfaces. (*See, e.g.*, Ex. 1001, 1:37-41; Ex. 1005, 1; Ex. 1007, [0003]; Ex. 1010, 2:6-17; Ex. 1014, ¶¶[0008]-[0010]; Ex. 1002, ¶47.) Second, it was known that the larger height of such inflatable beds also led to instability of the bed, which could cause the bed to roll over or a user to fall off the bed. (*See* Ex. 1001, 1:60-65; Ex. 1005, 2; Ex. 1026, 1:48-52; Ex. 1030, 2:39-49; Ex. 1002, ¶48.) Third, it was recognized that attempts to solve these

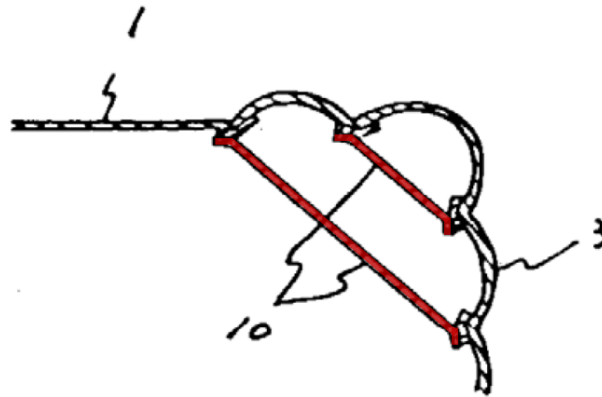
problems, such as by including a middle layer between the top and bottom sheets or providing a stabilizing tube around the periphery of the inflatable bed, presented a number of disadvantages such as increased materials and costs and unappealing aesthetics. (See Ex. 1001, 1:47-2:3; Ex. 1007, ¶¶[0003]-[0005]; Ex. 1011, 1:20-55; Ex. 1031, 1:30-35; Ex. 1002, ¶¶49-50.)

3. Use of Multiple Tensioning Structures Connecting the Top and Bottom Sheets to the Side Walls of Larger-Height Inflatable Beds

By the Priority Date, it was recognized that the above-described issues could be addressed by providing sufficient tensioning structures in the air chamber of the inflatable bed, including multiple diagonally oriented tensioning structures coupled to the top and side walls of the mattress, and the bottom and side walls of the mattress, respectively. (Ex. 1002, ¶¶51-56.)

For example, Aoki discloses providing multiple “diagonal bracing hanging sheets (10)” at each corner of the air mattress. (Ex. 1005, 2-4.) As shown in annotated Figure 4 below, Aoki discloses that “[j]ust one diagonal bracing hanging sheet (10) for each corner is insufficient, and it is desirable for two or more diagonal bracing hanging sheets (10) to be placed there”:

FIG. 4



(*Id.*, 4, Fig. 4.) Aoki teaches that use of multiple diagonal bracing hanging sheets at each corner of the inflatable bed prevents bulging of the outer surfaces, enhances stability, and prevents users from falling off the bed. (*Id.*, 4-5; Ex. 1002, ¶¶52-53.)

As another example and as shown in the annotated Figure 9 below, U.S. Patent Publication No. 2013/0145560 to Chen (Ex. 1013) discloses an air mattress comprising an air chamber with “a first peripheral strip 150a” (red) connected between the top and side walls, and “a second peripheral strip 190” (orange) connected between the bottom and side walls:

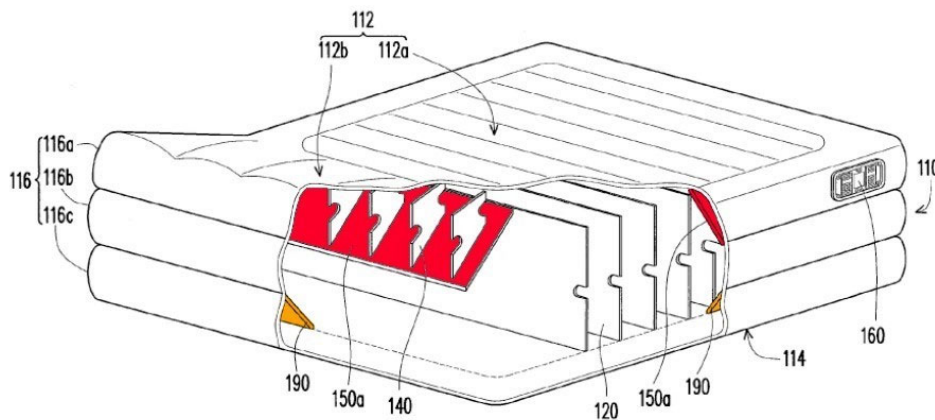


FIG. 9

(Ex. 1013, ¶¶[0068]-[0069], Fig. 9; Ex. 1002, ¶54.) Chen discloses that the “quantity of the peripheral strip with different heights connected to the side wall is not limited,” and that “when more than one peripheral strip is used to respectively surround the side wall and connected to positions of different height, then the air mattress having the side wall with more-than-three-layered structure can easily be formed.” (Ex. 1013, ¶¶[0067], [0072].)

As another example and as shown in annotated Figure 3 below, U.S. Patent Publication No. 2006/0265810 to Wu (Ex. 1014) discloses an upper pull band (12) (red) joined to the top and side walls of an inflatable mattress, and a lower pull band (12) (orange) joined to the bottom and side walls of the mattress:

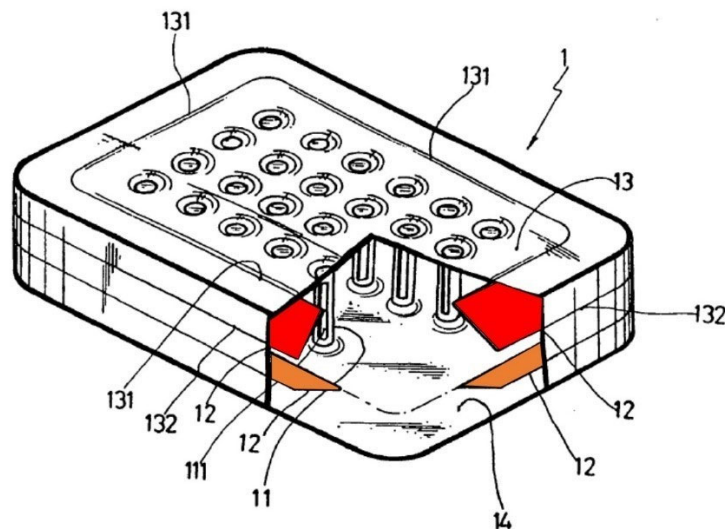
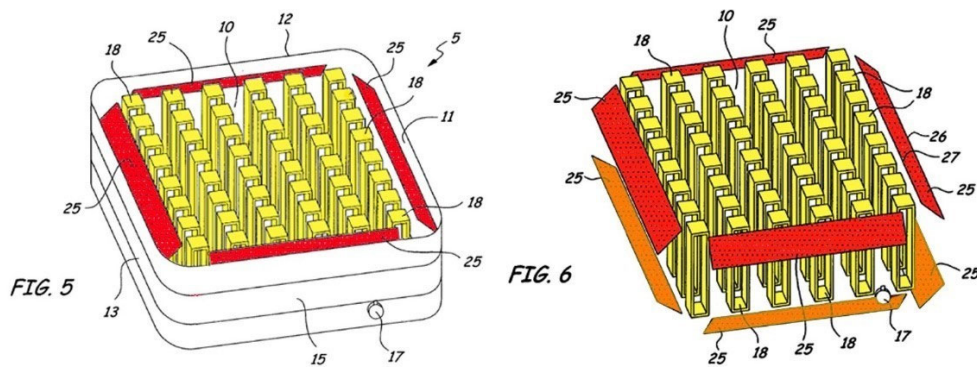


FIG.3

(Ex. 1014, ¶[0027], Fig. 3; Ex. 1002, ¶55.) Wu further discloses that using “two or more” components, including pull bands, “may also find a useful application in

other types of methods” of solving the problem of deformation of the corners of the mattress. (Ex. 1014, ¶[0028].)

As another example and as shown in annotated Figures 5 and 6 below, Metzger discloses an air mattress comprising “at least one side support beam 25” (red and orange) that “extend[s] in the lengthwise direction of at least one of the mattress side panels, or along each one of the side panels of the air mattress”:



(Ex. 1010, 5:27-30, Figs. 5, 6.) Metzger teaches that multiple side support beams could be used to accomplish this purpose. (*Id.*, 5:41-51, 6:10-14, 6:44-47, 8:59-60, 10:3-8; Ex. 1002, ¶56.)

4. Use of Lightweight Materials for Tensioning Structures

It was further known in the art before the Priority Date that it would be advantageous to make tensioning structures with lighter materials, such as plastic strips disposed on either side of a panel of mesh, threads, or fibers, to minimize costs, weight, and volume of inflatable beds. (Ex. 1002, ¶57; Ex. 1009, 1:20-22, 1:53-2:20, 6:50-7:25, 8:30-9:5, 9:52-55; Ex. 1015, ¶¶[0003], [0006]-[0010], [0034], [0061]; Ex. 1040, ¶¶[0036], [0038]-[0039], [0056].)

B. Qualifications of a POSA

A POSA as of the Priority Date would have had at least:

- A bachelor's degree in mechanical engineering, or an equivalent field; or
- An associate's degree in mechanical engineering, or an equivalent field,

and two years of practical experience in inflatable product design.

(Ex. 1002, ¶¶30-31.) More education can supplement practical experience and vice versa. (*Id.*, ¶32.)

VIII. CLAIM CONSTRUCTION

The bases for Petitioner's invalidity grounds do not turn on a specific construction of any of the Challenged Claims, as the prior art discloses and renders obvious the Challenged Claims even under the most narrow application of the ordinary and customary meaning. 37 C.F.R. § 42.100(b).

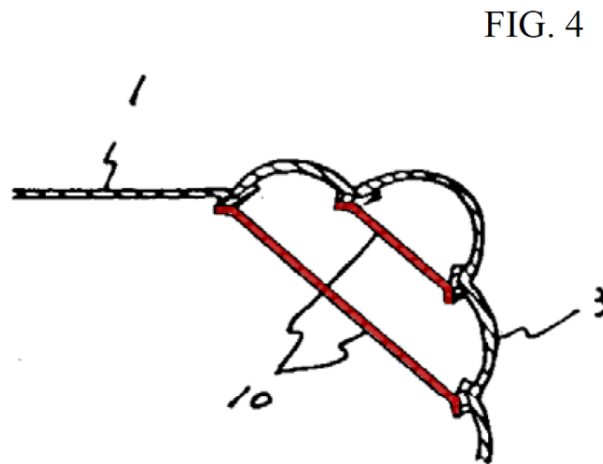
IX. SUMMARY OF THE PRIOR ART

A. Aoki

Aoki is directed to a "box-shaped air mattress." (Ex. 1005, Title Page, 1-2.) Aoki identifies a number of problems with existing air mattress designs that use "vertical hanging sheets" adhered between the top and bottom sheets. First, Aoki notes that "when air is inserted, the sides of the box-shaped air mattress become rounder on the outside than the inside." (*Id.*, 1.) As a result, "the air mattress may become unstable, making it difficult to sit on and wobble, thus increasing the

likelihood that people lying on it will fall off.” (*Id.*, 2.) Aoki notes that “[t]his tendency becomes greater the higher the sides become.” (*Id.*)

To address these problems, Aoki discloses using two or more diagonal bracing hanging sheets for each corner of the air mattress, as shown in annotated Figure 4 below:



(*Id.*, Fig. 4.) Aoki discloses that use of multiple diagonal bracing hanging sheets in this way addresses the known problems regarding larger air mattresses identified above. (*Id.*, 3-5; Ex. 1002, ¶¶85-86.)

Aoki is in the same field as the '633 Patent because Aoki relates to inflatable mattresses and the components of such mattresses. (*Id.*, 1-2.) Aoki is pertinent to the problems the '633 Patent purportedly addresses because Aoki is directed to preventing bulging, increasing stability, and improving aesthetics of larger height air mattresses. (*Id.*, 1-2, 4-5.) Aoki therefore is analogous art to the '633 Patent.

B. Lin ’773

Lin ’773 is directed to an improved internal tensioning structure for use in inflatable products such as inflatable beds. (Ex. 1009, Abstract, 1:20-2:20.) Lin ’773 recognizes that internal tensioning structures disposed in the chamber of an inflatable bed to “give shape to the bed as internal pressure increases, thereby preventing the inflatable bed from expanding evenly on all sides in the manner of a balloon,” were well-known in the art. (*Id.*, 1:38-52; *see also* 1:28-37.) However, Lin ’773 notes that conventional inflatable beds use tensioning structures “made of PVC sheets with a sufficient thickness to ensure spreading of force and concomitant reductions in stress in the product material,” which “contribute[s] to increased weight of the inflatable product” and “increases the compressed/folded volume of the deflated inflatable structure.” (*Id.*, 1:53-2:4.)

To address these problems, Lin ’773 discloses a tensioning structure that is “lightweight and occup[ies] minimal volume when the device is deflated and packed away, while also functioning as a strong and durable internal support upon inflation and use of the inflatable device.” (*Id.*, 6:50-56.)

In particular, Lin ’773 discloses a tensioning structure that “utilizes thin and flexible string- or wire-like strands which join two areas of fabric to one another.” (*Id.*, 6:57-59.) Thus, in one exemplary embodiment, Lin ’773 discloses tensioning

structures comprising a “plurality of substantially parallel strands 32” (yellow) that are captured between two weld strips 31 (red) at the top and bottom of the strands:

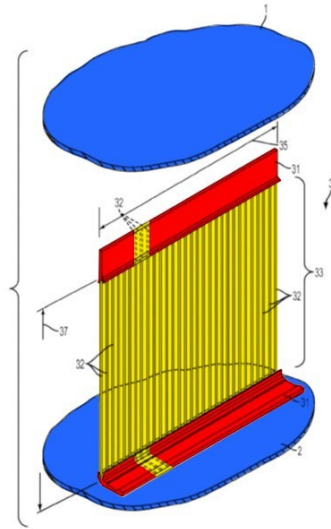


FIG. 1

(*Id.*, 7:17-22, 12:22-31, Fig. 1.) The weld strips, in turn, are welded to an “upper material 1” and “lower material 2,” such as the top and bottom sheets (blue) of an inflatable bed, as shown above and further in annotated Figure 3 below:

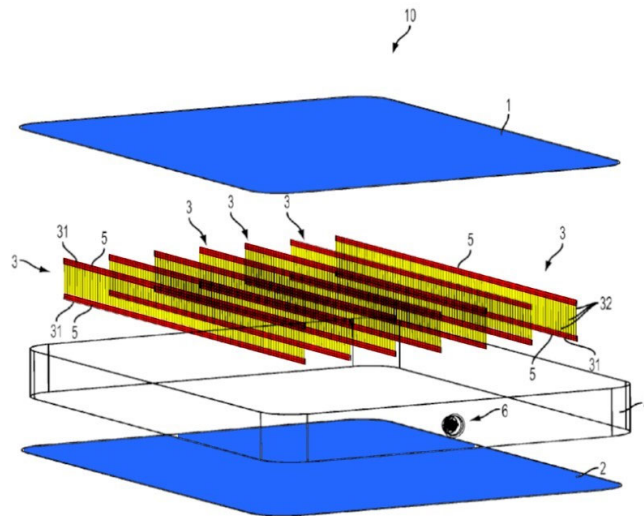


FIG. 3

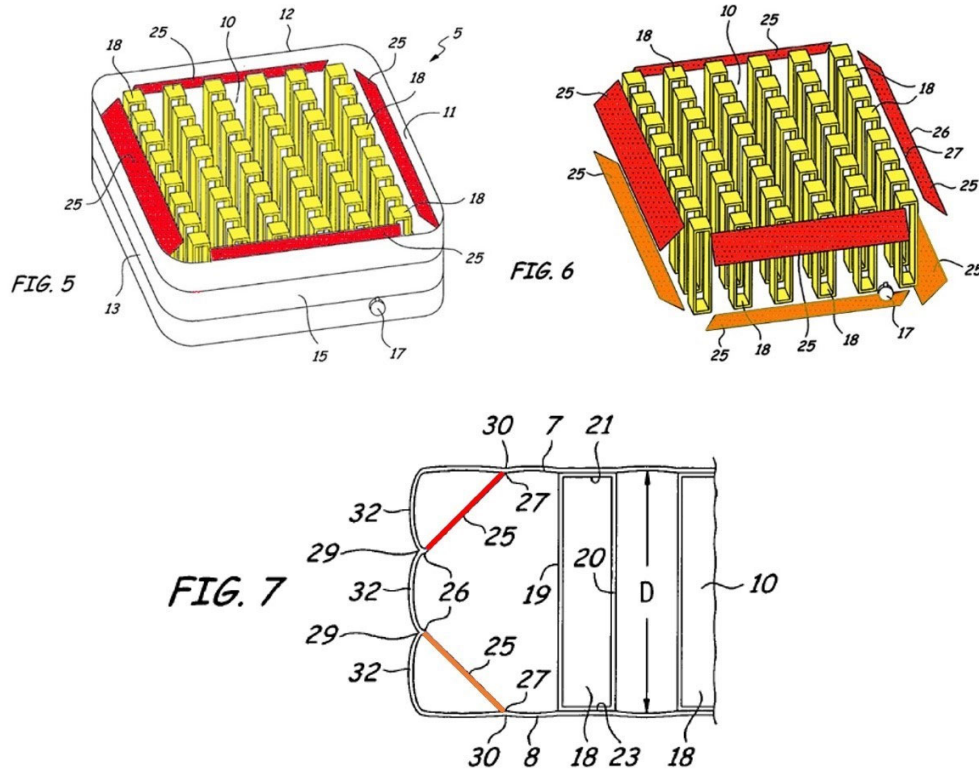
(*Id.*, 7:22-25, 7:53-66, Fig. 3.)

Lin '773 teaches that using these tensioning structures in an inflatable bed “achieves high tensile strength while promoting light weight and low packed volume of the finished inflatable product.” (*Id.*, 9:52-55; *see also id.*, 6:52-56; 10:19-20; 16:17-31.) In addition, Lin '773 teaches that the use of these tensioning structures reduces costs as compared to prior art tensioning structures. (*Id.*, 1:20-22; 8:67-9:1; 18:25-27.)

Lin '773 is in the same field as the '633 Patent because Lin '773 relates to inflatable beds and internal tensioning structures used in such beds. (*Id.*, Abstract, 1:20-22, 2:8-20, 6:50-56.) Lin '773 is pertinent to the problems the '633 Patent purportedly addresses because Lin '773 is directed to preventing the outward expansion of the outside surfaces of an inflatable bed as the bed is inflated. (*Id.*, 1:38-52, 7:16-25, 8:47-55.) Lin '773 therefore is analogous art to the '633 Patent.

C. Metzger

Like the '633 Patent, Metzger recognizes a number of problems with existing “double height” air mattresses, including “the expansion or deflection of the mattress faces during use.” (Ex. 1010, 1:60-2:17.) To address these problems, Metzger discloses “a series of spaced coils 18” (yellow) and “at least one side support beam 25” (red and orange) that “extend[s] in the lengthwise direction of at least one of the mattress side panels, or along each one of the side panels of the air mattress”:



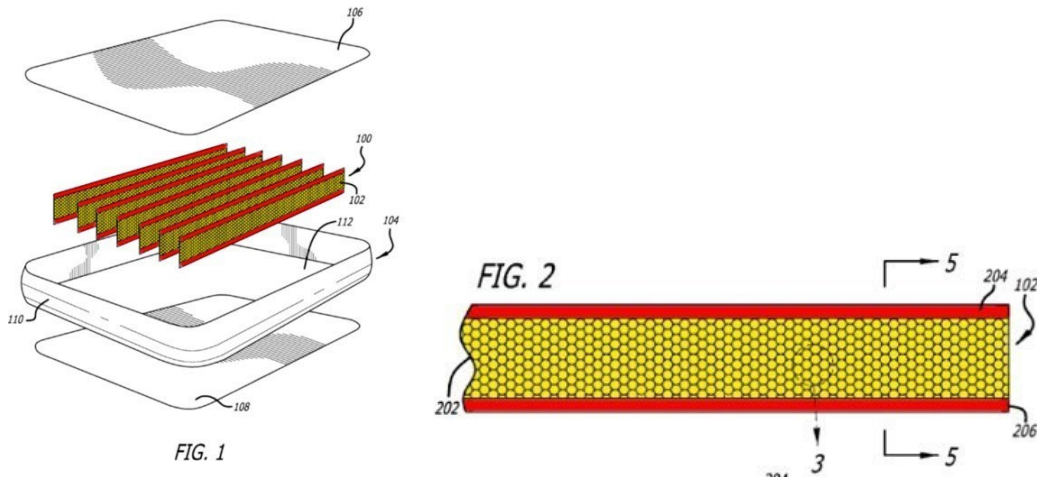
(*Id.*, 4:41-51, 5:27-30, Figs. 5-7.) The side support beams “act to limit the outward expansion of the side panel(s) of the air mattress.” (*Id.*, 5:54-59.)

Metzger is in the same field as the '633 Patent because Metzger relates to inflatable mattresses and the components of such mattresses. (*Id.*, 1:5-8, 2:55-3:13.) Metzger is pertinent to the problems the '633 Patent purportedly addresses because Metzger is directed to preventing the outward expansion of large-height air mattresses during use, particularly the side walls of such mattresses. (*Id.*, 1:45-2:51, 5:12-59.) Metzger therefore is analogous art to the '633 Patent.

D. Liu

Liu discloses tensioning structures comprised of “open cell or mesh material” (yellow) and that are “firmly connected at their ends to adjacent fabric by

an intermediate material, such as a strip of plastic” (red), as shown in annotated Figures 1 and 2 below:



(Ex. 1015, ¶¶[0035], [0040], Figs. 1, 2.)

Liu is in the same field as the '633 Patent because Liu relates to inflatable mattresses and the components of such mattresses. (*Id.*, ¶¶[0003], [0037]-[0040].) Liu is pertinent to the problems the '633 Patent purportedly addresses because Liu is directed to preventing the outward expansion of air mattresses during use, including multiple-layer air mattresses. (*Id.*, ¶¶[0009]-[0010], [0039]-[0040], [0063].) Liu therefore is analogous art to the '633 Patent.

X. DETAILED EXPLANATION OF GROUNDS

A. Ground 1: Aoki Renders Obvious Claim 3-11 and 17 of the '633 Patent

1. Claim 3

a. *The inflatable bed according to claim 1,*

As discussed below, Aoki discloses or renders obvious all of the limitations of claim 1.

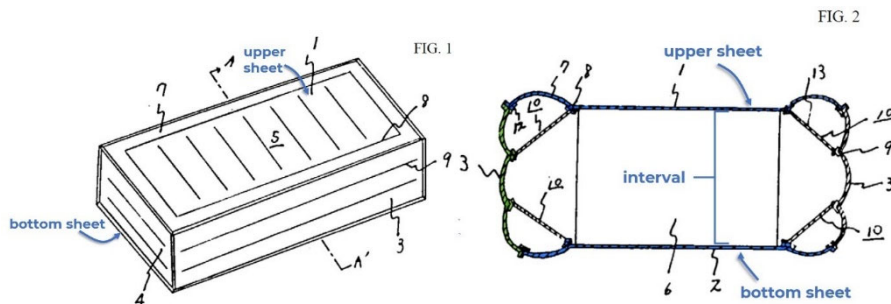
i. An inflatable bed, comprising:

To the extent the preamble is limiting, Aoki discloses this feature. (Ex. 1005, Title Page, 1-4, Fig. 1; Ex. 1002, ¶129.) For example, Aoki discloses a “box-shaped air mattress (5),” into which “air is inserted” so that it is “full of air.” (*Id.*, Ex. 1005, 1, 4.)

ii. a top sheet and a bottom sheet disposed vertically at an interval;

Aoki discloses this limitation. (Ex. 1005, 2, 3, Figs. 1, 2; Ex. 1002, ¶129.)

Aoki discloses that the box-shaped air mattress is comprised of an “upper sheet (1)” and “bottom sheet (2)” disposed vertically at an interval, as shown in the annotated Figures 1 and 2 below:

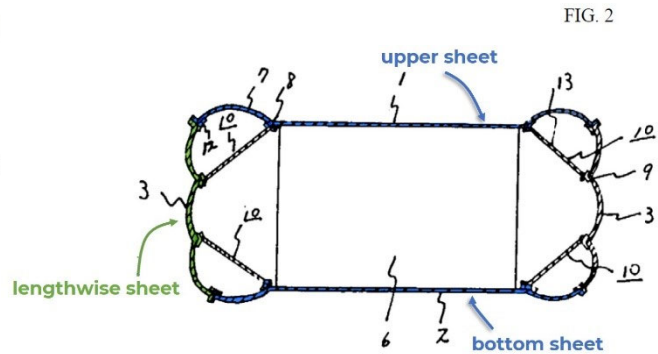
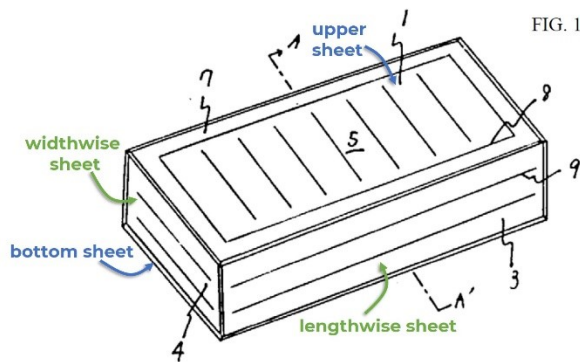


(Ex. 1005, 2, 3, Figs. 1, 2.)

- iii. at least one side wall, an upper edge of said side wall being coupled to an outer edge of said top sheet, a lower edge of said side wall being coupled to an outer edge of said bottom sheet, an air chamber formed between said top sheet, said bottom sheet and said side wall; and

Aoki discloses this limitation. (Ex. 1005, 3, 5, Figs. 1, 2; Ex. 1002, ¶129.)

Aoki discloses that the upper sheet (1) and the bottom sheet (2) are joined “at an approximate 90-degree angle” to lengthwise sheets (3) and widthwise sheets (4) (which constitute side walls) to form the air mattress, and that air pressure is maintained inside the air mattress. (Ex. 1005, 3, 5.) As shown in annotated Figures 1 and 2 below, upper edges of the lengthwise and widthwise sheets (green) are thus coupled to outer edges of the upper sheet (blue), lower edges of the lengthwise and widthwise sheets are coupled to outer edges of the bottom sheet (blue), and an air chamber is formed between the upper sheet, bottom sheet, lengthwise sheets, and widthwise sheets:



(Ex. 1005, Figs. 1, 2.)

- iv. at least one first tensioning structure disposed in said air chamber, an upper end and a lower end of said first tensioning structure being respectively coupled to said top sheet and said bottom sheet; and

Aoki discloses this limitation. (Ex. 1005, 1-2, 4-5, Figs. 1, 2; Ex. 1002,

¶130.) As shown in annotated Figures 1 and 2 below, Aoki discloses “vertical hanging sheets (6)” (yellow) that are “adhered” or sewn to the upper and bottom sheets with “sufficient adhesive power,” thereby (1) preventing the upper and bottom sheets from “swell[ing] and form[ing] an arch”; (2) “allaying concerns about [a user] falling off” the mattress; and (3) improving design aesthetics by “placing an accent on the surface of the box-shaped air mattress”:

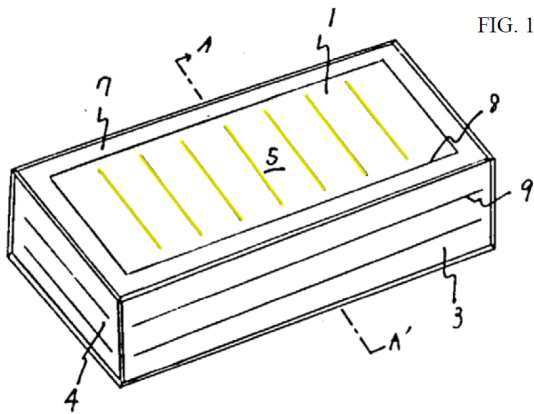


FIG. 1

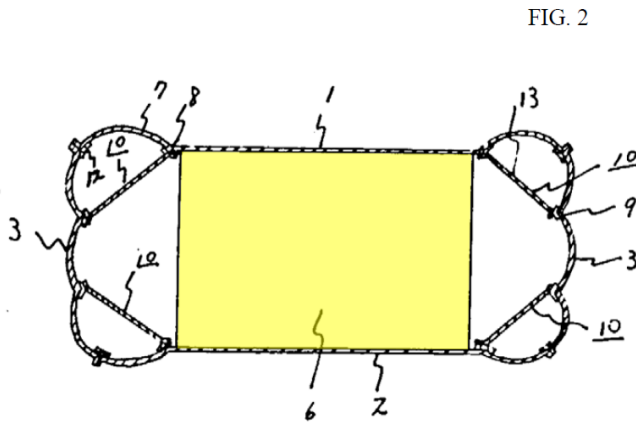
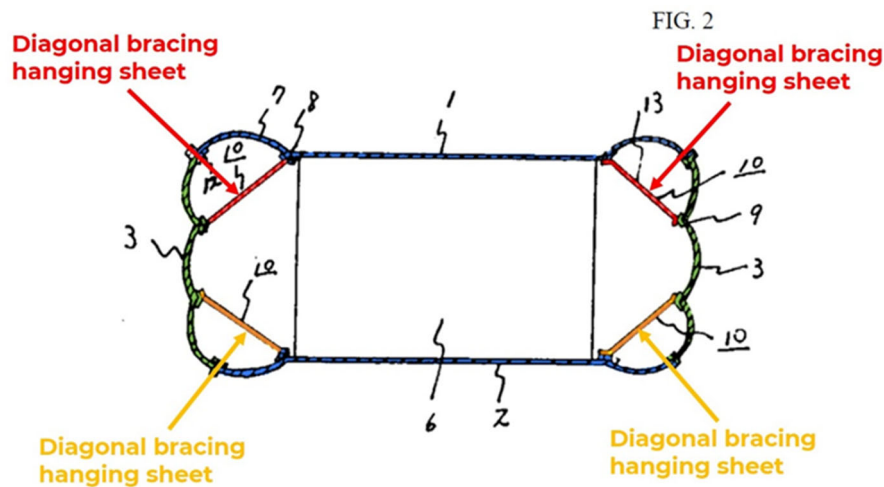


FIG. 2

(Ex. 1005., 2-5, Figs. 1, 2.)

- v. at least one support structure disposed in said air chamber, said support structure being disposed in a longitudinal direction of at least one of said side walls, at least two outside edges of said support structure being respectively coupled to the side wall adjacent, at least one inside edge of said support structure being coupled to the top sheet or bottom sheet adjacent;

Aoki discloses this limitation. (Ex. 1005, 2-5, Figs. 2-4; Ex. 1002, ¶¶131-139.) Aoki discloses a number of “diagonal bracing hanging sheets (10),” which are individually adhered between the upper sheet and side walls (lengthwise and widthwise sheets), and between the bottom sheet and side walls, respectively. (Ex. 1005, 2, 4.) This is partially reflected in annotated Figure 2 below, which is a cross-section of the air mattress showing four diagonal bracing hanging sheets disposed in a longitudinal direction of the lengthwise sheets (side walls): two (in red) adhered between the upper sheet and lengthwise sheets, and two (in orange) adhered between the bottom sheet and lengthwise sheets:



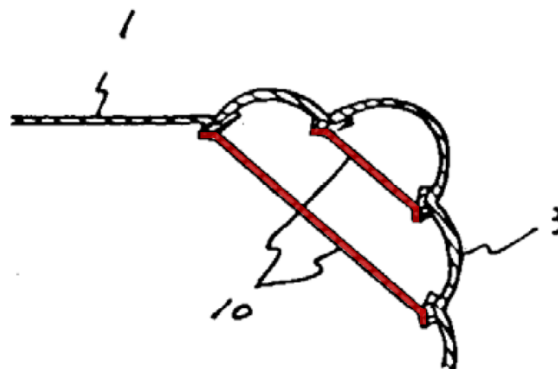
(Ex. 1005, Fig. 2.)

Aoki discloses that the diagonal bracing hanging sheets (10) have “adhesive positions (8) and (9),” and the upper sheet, bottom sheet, and lengthwise and widthwise sheets have “adhesive sites” or “adhesion sites” (11) and (11’). (*Id.*, 2, 3.) Aoki further discloses that the diagonal bracing hanging sheets (10) are

comprised of “intermediate materials” (the main portion of the diagonal bracing hanging sheets, in between the adhesive positions (8) and (9)) which are adhered or sewn to the adhesive sites (11) and (11’) of the upper, bottom, lengthwise, and widthwise sheets, respectively. (*Id.*, 3-4, Fig. 3.) In this way, the intermediate materials and the adhesion sites “will be integrated,” and the diagonal bracing hanging sheet “will have sufficient adhesive power ... so that the respective surface sheets and hanging sheets will not peel off.” (*Id.*, 4.) Thus, Aoki discloses that outside edges of the diagonal bracing hanging sheets are coupled to the outside walls adjacent, and the inside edges of the diagonal bracing hanging sheets are coupled to the top and bottom sheets, respectively. (Ex. 1002, ¶132-134.)

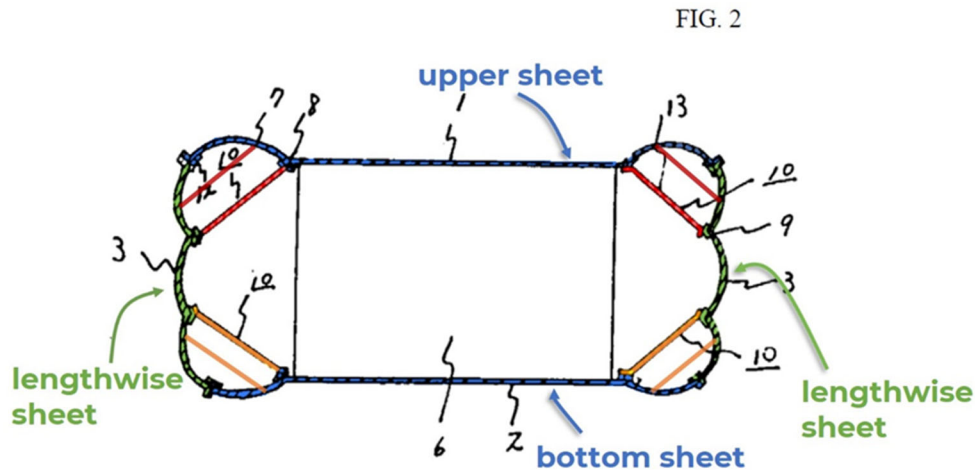
As reflected in annotated Figure 4 below, Aoki further discloses that “just one diagonal bracing hanging sheet (10) for each corner is insufficient, and it is desirable for two or more diagonal bracing hanging sheets (10) to be placed there”:

FIG. 4



(Ex. 1005, 4, Fig. 4.) Although Figure 4 only shows one example corner of the air mattress, Aoki discloses that this would be applied to “**each corner**” to maintain

an angle that is approximately 90-degrees. (*Id.*, 4-5 (emphasis added).) This results in a structure illustrated by the annotated Figure below, which generally reflects the disclosure of Figure 4 for each corner as shown in Figure 2:



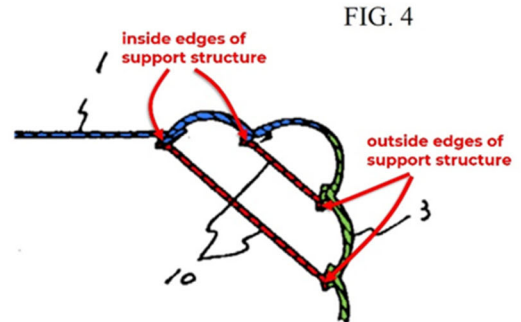
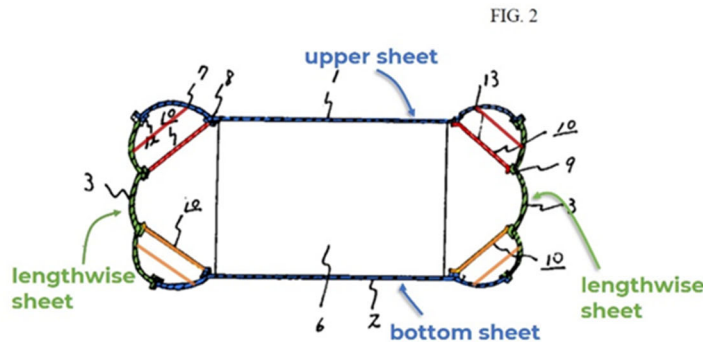
(Ex. 1002, ¶¶135-136.)

Aoki discloses that use of the diagonal bracing hanging sheets thus addresses known problems regarding large height air mattresses—including bulging of the side walls, lack of stability, and aesthetics—by (a) maintaining the upper sheet, lower sheet, and side walls “at an appropriate 90-degree angle so it is possible to construct a large box-shaped air mattress”; (b) preventing the top, bottom, and side sheet surfaces from “swell[ing] and form[ing] an arch”; (c) “allaying concerns about falling off while lying on it”; and (d) improving design aesthetics by “placing an accent on the surface of the box-shaped air mattress.” (Ex. 1005, 1-2, 4-5.)

Although Aoki expressly discloses that two or more diagonal bracing hanging sheets would be applied to “each corner” of the mattress as shown in Figure 4 and as described above, to the extent Figure 4 of Aoki is considered to be a separate embodiment, it would have been obvious to a POSA to apply Figure 4’s teaching of multiple diagonal bracing hanging sheets to each corner of the inflatable bed disclosed in Figures 1 and 2. (Ex. 1002, ¶¶137-138.) A POSA would have known that in order to achieve the benefits of Aoki as described above—including maintaining each side of the inflatable bed at an approximate 90-degree angle, preventing swelling of the outer surfaces, preventing a user from falling off, and improving design aesthetics—it would be advantageous to apply multiple diagonal bracing hanging sheets to not only one corner, but to all corners of the inflatable bed. (*Id.*) Indeed, a POSA would have known that applying multiple diagonal bracing hanging sheets to just one corner would result in the inflatable bed being asymmetric and/or lopsided, which would defeat Aoki’s objectives as described above. (*Id.*, ¶138.) Thus, a POSA would have been motivated to combine Figure 4’s teaching of two or more diagonal bracing hanging sheets to the inflatable bed disclosed in Figures 1 and 2 of Aoki. (*Id.*)

As shown in annotated Figures 2 and 4 below, the diagonal bracing hanging sheets thus constitute a support structure disposed in a longitudinal direction of the side walls, with at least two outside edges of the support structure being coupled to

the side wall (lengthwise sheet) adjacent, and at least one inside edge of the support structure being coupled to the upper sheet or bottom sheet adjacent:



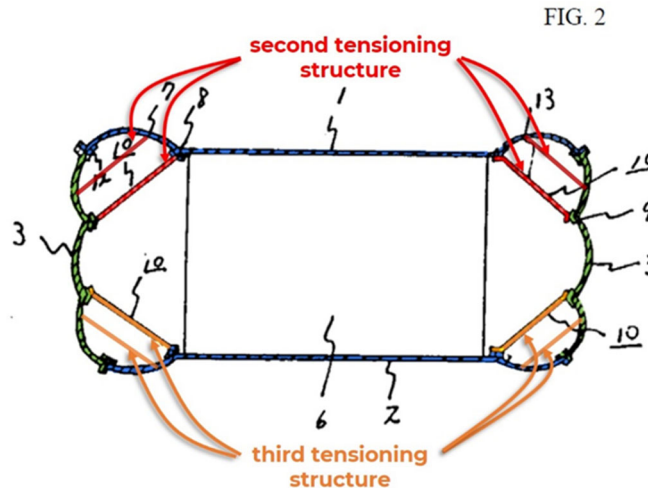
(*Id.*, Figs. 2, 4; Ex. 1002, ¶139.)

- vi. wherein said support structure comprises a second tensioning structure and a third tensioning structure, at least two outside edges of said second tensioning structure are respectively coupled to said at least one side wall, at least one inside edge of said second tensioning structure is coupled to said top sheet; and
- wherein at least two outside edges of said third tensioning structure are respectively coupled to said at least one side wall, at least one inside edge of said third tensioning structure is coupled to said bottom sheet.

Aoki discloses or suggests these limitations. (Ex. 1005, 2, 4, Figs. 2, 4; Ex. 1002, ¶¶140-142.)³ As shown in the annotated Figure below, which again reflects

³ While Petitioner believes that Aoki discloses these limitations and anticipates claims 3-11 and 17 as explained further below, Petitioner asserts this ground under

the diagonal bracing hanging sheets as shown in Figures 2 and 4, the diagonal bracing hanging sheets adhered between the upper sheet and side walls comprise a second tensioning structure, and the diagonal bracing hanging sheets adhered between the bottom sheet and side walls comprise a third tensioning structure:

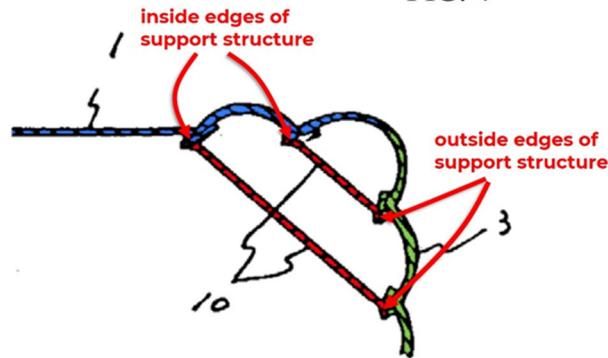


(Ex. 1002, ¶140; Ex. 1005, Figs. 2 and 4.)

With respect to the diagonal bracing hanging sheets adhered between the upper sheet and side walls (second tensioning structure), as shown below in annotated Figure 4 below, at least two outside edges are respectively coupled to at least one side wall (in this Figure, one of the lengthwise sheets), and at least one inside edge is coupled to the top (upper) sheet:

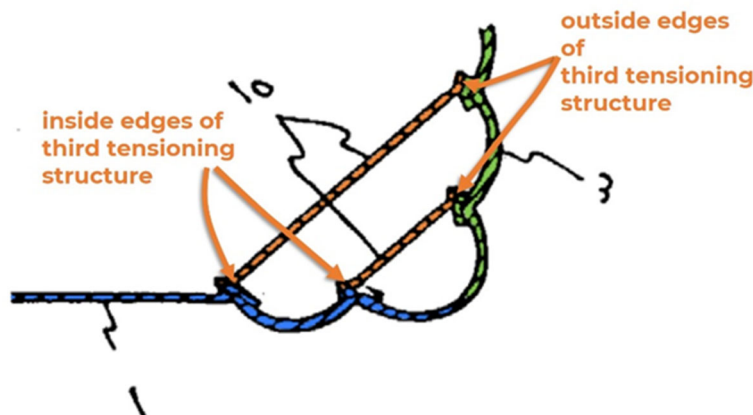
103 to address any argument that Figure 4 is a separate embodiment as described above.

FIG. 4



(Ex. 1005, Fig. 4; Ex. 1002, ¶141)

With respect to the diagonal bracing hanging sheets adhered between the bottom sheet and side walls (third tensioning structure), as shown below in the annotated Figure below (which is Figure 4 rotated 180 degrees about the X-axis to show the bottom orientation of the air mattress), at least two outside edges are respectively coupled to at least one side wall (in this Figure, one of the lengthwise sheets), and at least one inside edge is coupled to the bottom sheet:

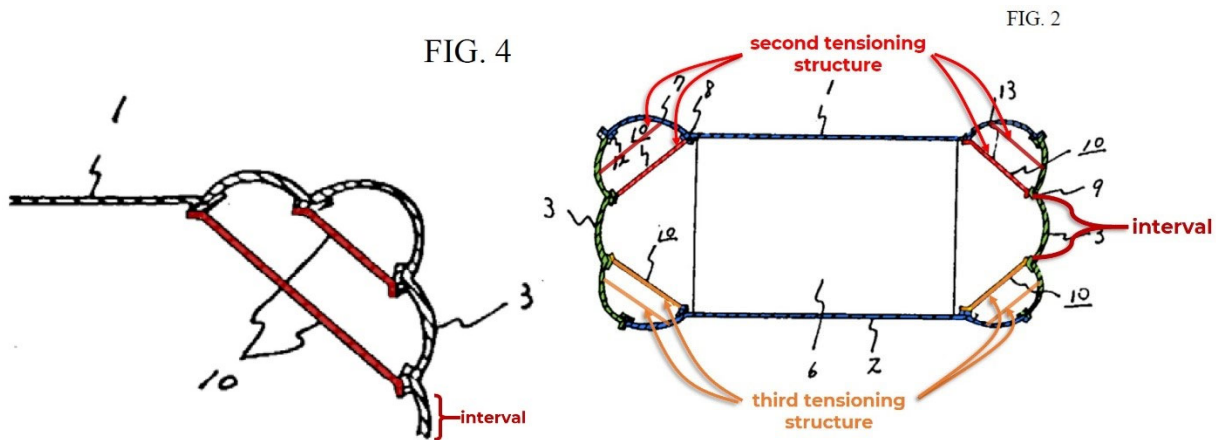


(*Id.*; Ex. 1002, ¶142.)

Aoki therefore discloses or renders obvious all limitations of claim 1 of the '633 Patent. (Ex. 1002, ¶¶129-143.)

- b. wherein said second tensioning structure and said third tensioning structure are disposed at an interval.***

Aoki discloses this limitation. (Ex. 1005, 4, Figs 2, 4; Ex. 1002, ¶149.) As shown in the annotated Figures below, the second tensioning structure (in red) and third tensioning structure (in orange) are disposed at an interval:



(Ex. 1005, Figs. 2 and 4; Ex. 1002, ¶149.)

Aoki therefore discloses or renders obvious all limitations of claim 3 of the '633 Patent. (Ex. 1002, ¶¶148-150.)

2. Claim 4

- a. The inflatable bed according to claim 1,***

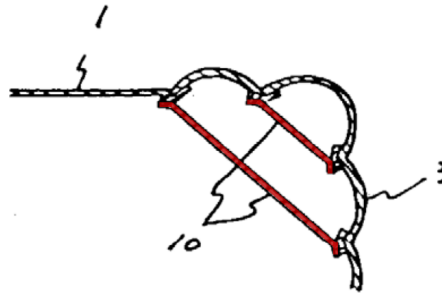
As discussed above, Aoki discloses or renders obvious all of the limitations of claim 1. (*Supra* §X.A.1.a.)

- b. wherein said second tensioning structure comprises at least two first I-beams, an outside edge and an inside edge of each of said first I-beams are respectively coupled to said side wall and said top sheet adjacent, the at least two first I-beams are disposed at an interval.*

Aoki discloses this limitation. (Ex. 1005, 4, Fig. 4; Ex. 1002, ¶¶152-153.)

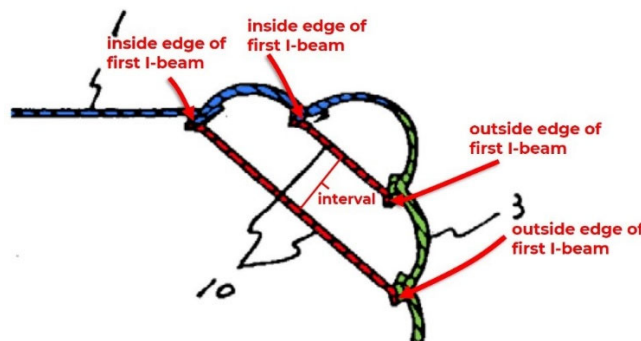
As shown for example in annotated Figure 4 below, each of Aoki's diagonal bracing hanging sheets comprising the second tensioning structure (in red) constitutes an I-beam:

FIG. 4



(Ex. 1005, Fig. 4.) As shown in the further annotated Figure 4 below, Aoki discloses that an outside edge and an inside edge of each of the I-beams are respectively coupled to the side wall and top sheet adjacent, and the two first I-beams are disposed at an interval:

FIG. 4



(Ex. 1005, Fig. 4.)

Aoki therefore discloses or renders obvious all limitations of claim 4 of the '633 Patent. (Ex. 1002, ¶¶151-154.)

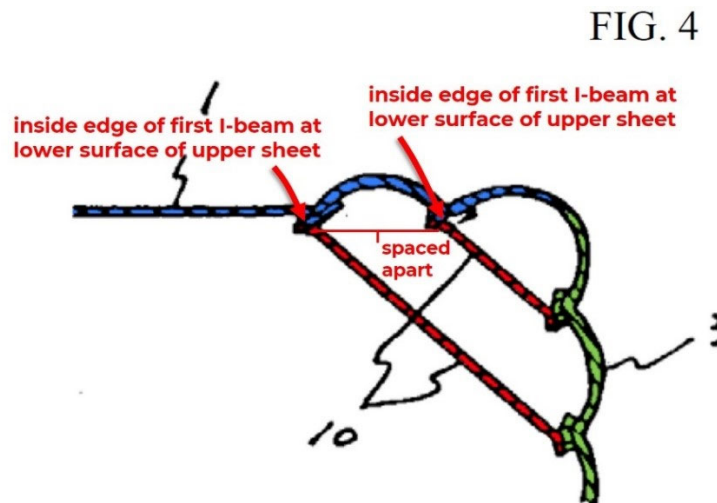
3. Claim 5

a. The inflatable bed according to claim 4,

As discussed above, Aoki discloses or renders obvious all of the limitations of claim 4. (*Supra* §X.A.2.)

b. wherein said at least two first I-beams are spaced apart from each other at a lower surface of said top sheet.

Aoki discloses this limitation. (Ex. 1005, Fig. 4; Ex. 1002, ¶156.) As shown in annotated Figure 4 below, Aoki discloses that two diagonal bracing hanging sheets (I-beams) comprising the second tensioning structure are spaced apart from each other at a lower surface of the upper sheet:



(Ex. 1005, Fig. 4.)

Aoki therefore discloses or renders obvious all limitations of claim 5 of the '633 Patent. (Ex. 1002, ¶¶155-157.)

4. Claim 6

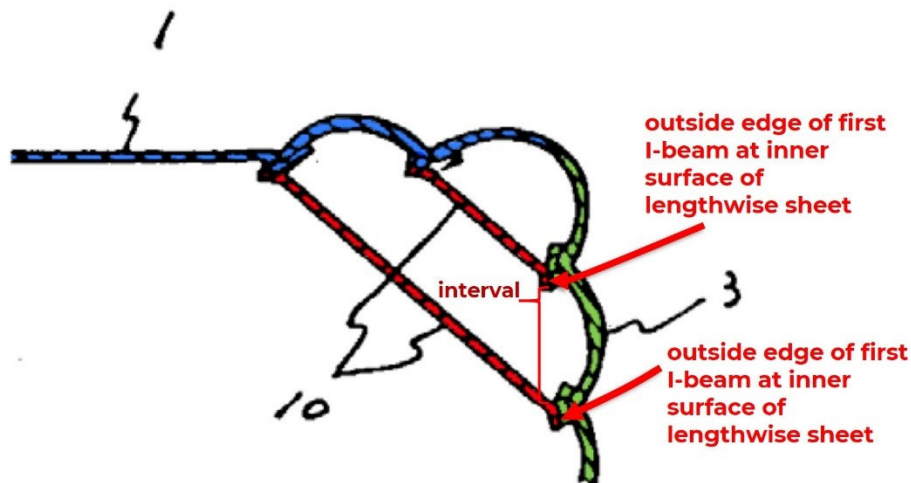
a. *The inflatable bed according to claim 4,*

As discussed above, Aoki discloses or renders obvious all of the limitations of claim 4. (*Supra* §X.A.2.)

b. *wherein said at least two first I-beams are disposed at an interval on an inner surface of said side wall.*

Aoki discloses this limitation. (Ex. 1005, Fig. 4; Ex. 1002, ¶159.) As shown in annotated Figure 4 below, Aoki discloses that two diagonal bracing hanging sheets (I-beams) comprising the second tensioning structure are disposed at an interval on an inner surface of the lengthwise sheet (side wall):

FIG. 4



(Ex. 1005, Fig. 4.)

Aoki therefore discloses or renders obvious all limitations of claim 6 of the '633 Patent. (Ex. 1002, ¶¶158-160.)

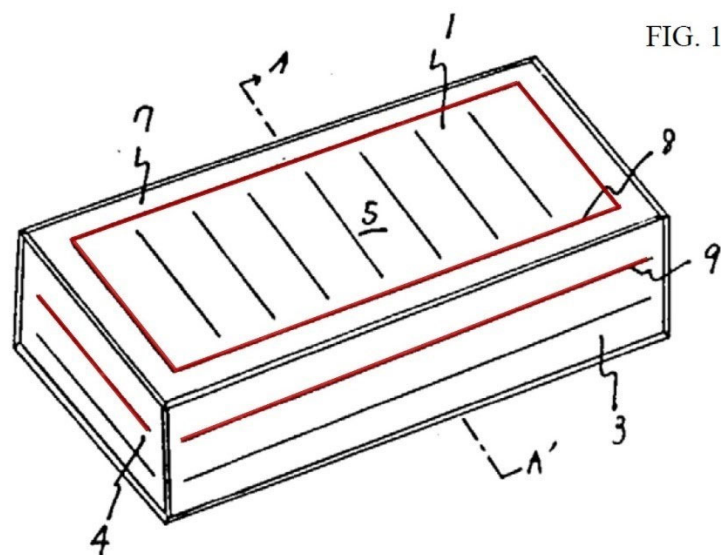
5. Claim 7

a. The inflatable bed according to claim 4,

As discussed above, Aoki discloses or renders obvious all of the limitations of claim 4. (*Supra* §X.A.2.)

b. wherein said at least two first I-beams as a whole are of a continuous annular structure or a segmental annular structure.

Aoki discloses or suggests this limitation. (Ex. 1005, 1, 4-5, Figs. 1, 3; Ex. 1002, ¶162.) As shown in Figure 1 below, Aoki discloses that the diagonal bracing hanging sheets (in red) are adhered to the lower surface of the upper sheet and along the side walls in an annular shape:



(*Id.*, Fig. 1; Ex. 1002, ¶162.) As discussed above, Aoki discloses using two or more diagonal hanging bracing sheets for each corner of the inflatable bed; moreover, it would have been obvious to a POSA to apply Figure 4’s teaching of multiple diagonal bracing hanging sheets to each corner of the inflatable bed disclosed in Figures 1 and 2. (*Supra*, §X.A.1.a.v; Ex. 1002, ¶162.) Aoki discloses that using two or more diagonal bracing hanging sheets makes it possible to “achieve perpendicularity of the peripheral areas” and maintain “the upper sheet ... and the side sheets ... at an approximate 90-degree angle.” (Ex. 1005, 4-5.) Thus, Aoki discloses or suggests that the diagonal hanging bracing sheets (two first I-beams) provided along each side of the inflatable bed are of a continuous annular structure or segmental annular structure, as they collectively comprise a continuous or segmental annular shape. (Ex. 1002, ¶162.) Indeed, the ’633 Patent contemplates separate, individual I-beams spanning four sides of the inflatable bed to fall within the scope of “segmental annular structure.” (*See, e.g.*, Ex. 1001, 7:41-50, 9:56-59, Figs. 8, 14.)

Aoki therefore discloses or suggests all limitations of claim 7 of the ’633 Patent. (Ex. 1002, ¶¶161-163.)

6. Claim 8

a. The inflatable bed according to claim 1,

As discussed above, Aoki discloses or renders obvious all of the limitations of claim 1. (*Supra* §X.A.1.a.)

b. wherein said third tensioning structure comprises at least two second I-beams, an outside edge and an inside edge of each of said second I-beams are respectively coupled to the side wall and said bottom sheet adjacent, the at least two second I-beams are disposed at an interval.

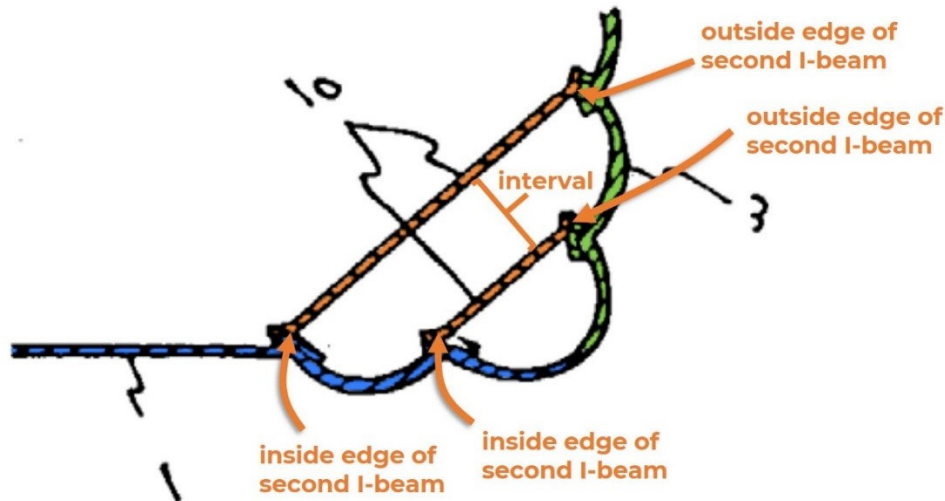
Aoki discloses this limitation. (Ex. 1005, 4-5, Fig. 4; Ex. 1002, ¶¶165-167.)

This limitation is similar to the limitation of claim 4, except it applies to the third tensioning structure instead of the second tensioning structure. Because Aoki discloses providing the same diagonal bracing hanging sheets to each corner of the air mattress, Aoki discloses this limitation for the same reasons it discloses the limitation of claim 4. (*Supra*, §X.A.2.b; Ex. 1005, 4-5.)

As explained above, Aoki discloses a third tensioning structure comprised of multiple pairs of diagonal bracing hanging sheets (10) adhered between the bottom sheet and each of the side walls. (Ex. 1005, 4; *supra*, §X.A.1.a.vi.) As also explained above, each of the diagonal bracing hanging sheets constitutes an I-beam. (*Supra*, §X.A.2.b; Ex. 1005, Fig. 4.)

As shown in the annotated Figure below (which is Figure 4 rotated 180 degrees about the X-axis to show the bottom orientation of the air mattress), Aoki

discloses that an outside edge and an inside edge of each of these second I-beams are respectively coupled to the side wall and bottom sheet adjacent, and the two I-beams are disposed at an interval:



(Ex. 1005, Fig. 4; Ex. 1002, ¶167.)

Aoki therefore discloses or renders obvious all limitations of claim 8 of the '633 Patent. (Ex. 1002, ¶¶164-168.)

7. Claim 9

a. The inflatable bed according to claim 8,

As discussed above, Aoki discloses or renders obvious all of the limitations of claim 8. (*Supra* §X.A.6.)

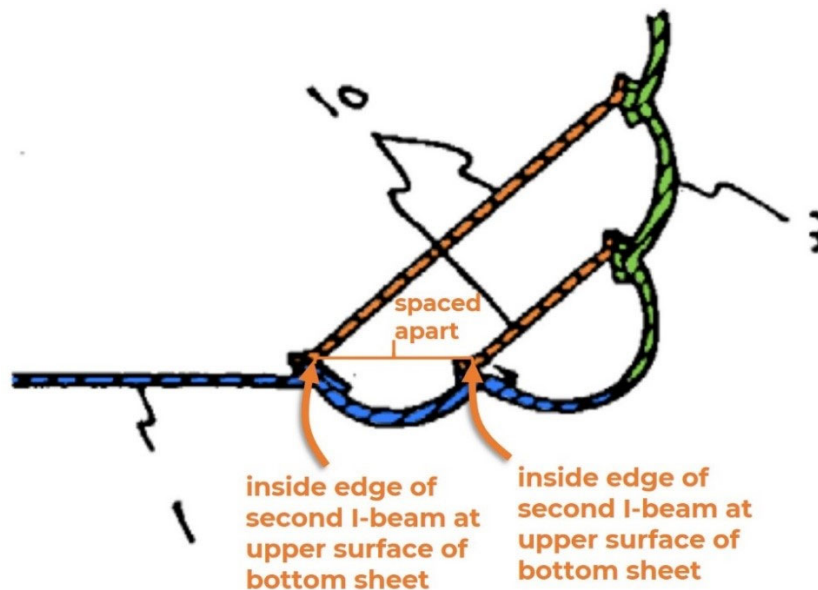
b. wherein said at least two second I-beams are spaced apart from each other at an upper surface of said bottom sheet.

Aoki discloses this limitation. (Ex. 1005, 4-5, Fig. 4; Ex. 1002, ¶¶170-171.)

This limitation is similar to the limitation of claim 5, except it applies to the third

tensioning structure instead of the second tensioning structure. Because Aoki discloses providing the same diagonal bracing hanging sheets to each corner of the air mattress, Aoki discloses this limitation for the same reasons it discloses the limitation of claim 5. (*Supra*, §X.A.3.b; Ex. 1005, 4-5.)

As shown in the annotated Figure below (which again is Figure 4 rotated 180 degrees about the X-axis to show the bottom orientation of the air mattress), Aoki discloses that two diagonal bracing hanging sheets (second I-beams) comprising the third tensioning structure are spaced apart from each other at an upper surface of the bottom sheet:



(Ex. 1005, Fig. 4; Ex. 1002, ¶171.)

Aoki therefore discloses or renders obvious all limitations of claim 9 of the '633 Patent. (Ex. 1002, ¶¶169-172.)

8. Claim 10

a. The inflatable bed according to claim 8,

As discussed above, Aoki discloses or renders obvious all of the limitations of claim 8. (*Supra* §X.A.6.)

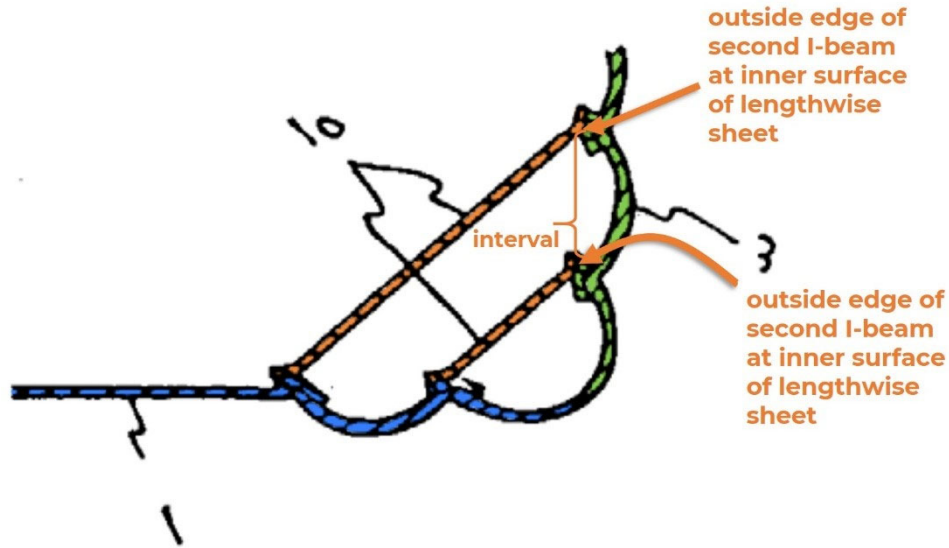
b. wherein said at least two second are disposed at an interval on the inner surface of said side wall.⁴

Aoki discloses this limitation. (Ex. 1005, 4-5, Fig. 4; Ex. 1002, ¶¶174-175.)

This limitation is similar to the limitation of claim 6, except it applies to the third tensioning structure instead of the second tensioning structure. Because Aoki discloses providing the same diagonal bracing hanging sheets to each corner of the air mattress, Aoki discloses this limitation for the same reasons it discloses the limitation of claim 6. (*Supra*, §X.A.4.b; Ex. 1005, 4-5.)

As shown in the annotated Figure below (which again is Figure 4 rotated 180 degrees about the X-axis to show the bottom orientation of the air mattress), Aoki discloses that two diagonal bracing hanging sheets (second I-beams) comprising the third tensioning structure are disposed at an interval on an inner surface of the lengthwise sheet (side wall):

⁴ Although the claim states “said at least two second,” it appears that this claim is intended to recite “said at least two second I-beams,” as “second I-beams” are referenced in claim 8, from which this claim depends.



(Ex. 1005, Fig. 4; Ex. 1002, ¶175.)

Aoki therefore discloses or renders obvious all limitations of claim 10 of the '633 Patent. (Ex. 1002, ¶¶173-176.)

9. Claim 11

a. The inflatable bed according to claim 8,

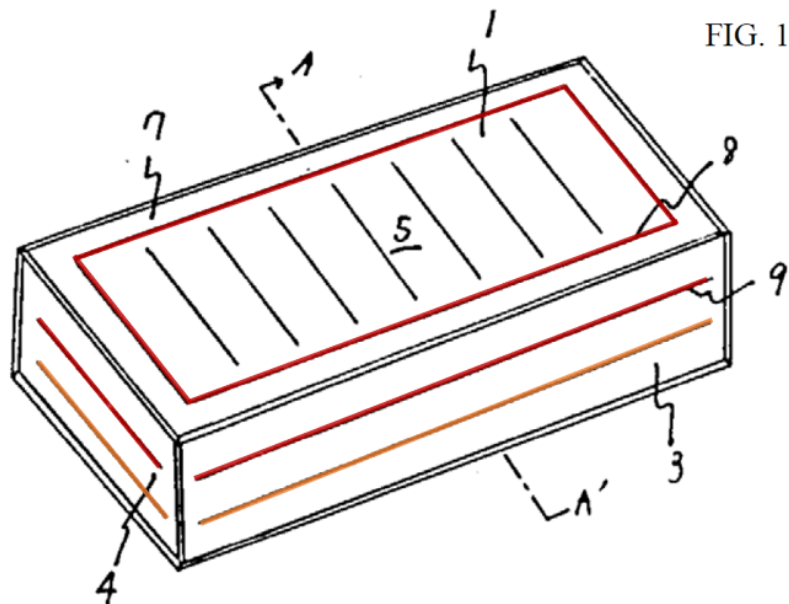
As discussed above, Aoki discloses or renders obvious all of the limitations of claim 8. (*Supra* §X.A.6.)

b. wherein said at least two second I-beam as a whole are of a continuous annular structure or a segmental annular structure.

Aoki discloses or suggests this limitation. (Ex. 1005, 4-5, Figs. 1, 2, 4; Ex. 1002, ¶¶178-180.) This limitation is similar to the limitation of claim 7, except it applies to the third tensioning structure instead of the second tensioning structure. Because Aoki discloses providing the same diagonal bracing hanging sheets to

each corner of the air mattress, Aoki discloses this limitation for the same reasons it discloses the limitation of claim 7. (*Supra*, §X.A.5.b; Ex. 1005, 4-5.)

As shown in Figure 1 below, Aoki discloses that the diagonal bracing hanging sheets (in orange) comprising the third tensioning structure collectively comprise an annular shape:



(Ex. 1005, Fig. 1; Ex. 1002, ¶179.) Although the bottom sheet is not shown in this Figure, the annular shape can further be seen in the diagonal bracing hanging sheets comprising the second tensioning structure (in red) in the annotated Figure 1 above. (*Supra*, §X.A.5.b.) This orientation would be the same for the diagonal bracing hanging sheets comprising the third annular structure, as Aoki discloses the same use of diagonal bracing hanging sheets for all corners of the air mattress in order to maintain rough perpendicularity of the entire periphery. (Ex. 1005, 4-5; Figs. 1, 2; Ex. 1002, ¶179.)

As discussed above, Aoki discloses using two or more diagonal hanging bracing sheets for each corner of the inflatable bed; moreover, it would have been obvious to a POSA to apply Figure 4's teaching of multiple diagonal bracing hanging sheets to each corner of the inflatable bed disclosed in Figures 1 and 2. (*Supra*, §X.A.1.a.v; Ex. 1002, ¶180.) Aoki discloses that using two or more diagonal bracing hanging sheets makes it possible to “achieve perpendicularity of the peripheral areas” and maintain “the lower sheet and the side sheets ... at an approximate 90-degree angle.” (Ex. 1005, 4-5.) Thus, Aoki discloses or suggests that the diagonal hanging bracing sheets (two second I-beams) provided along each side of the inflatable bed are of a continuous annular structure or segmental annular structure, as they collectively comprise a continuous or segmental annular shape. (Ex. 1002, ¶180.) Indeed, the '633 Patent contemplates separate, individual I-beams spanning four sides of the inflatable bed to fall within the scope of “segmental annular structure.” (*See, e.g.*, Ex. 1001, 7:41-50, 9:56-59, Figs. 8, 14.)

Aoki therefore discloses or suggests all limitations of claim 11 of the '633 Patent. (Ex. 1002, ¶¶177-181.)

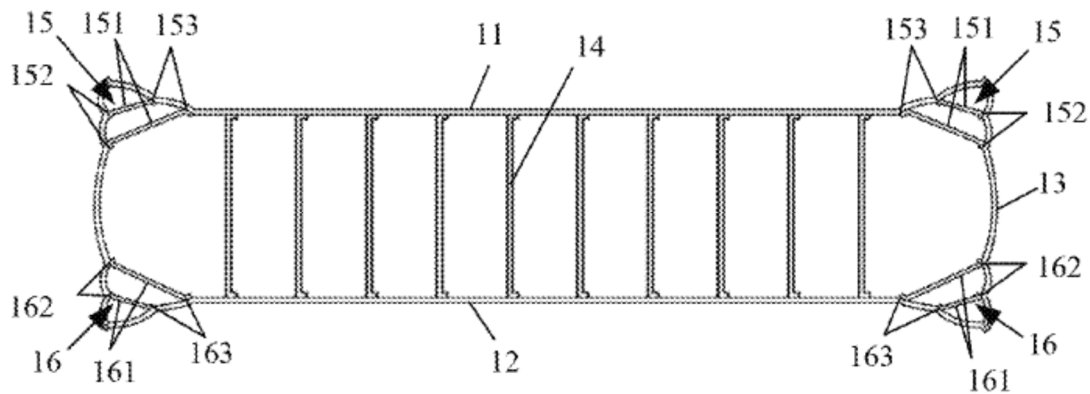
10. Claim 17

a. The inflatable bed according to claim 1,

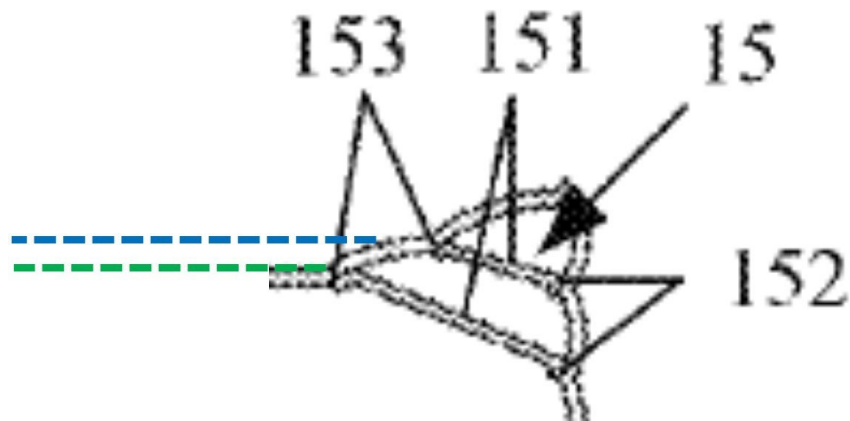
As discussed above, Aoki discloses or renders obvious all of the limitations of claim 1. (*Supra* §X.A.1.a.)

- b. wherein a location where said top sheet is located in the inside part of an upper edge of said second tensioning structure is lower than the location where said top sheet is located in the outside part of the upper edge of said second tensioning structure.***

A POSA's understanding of this limitation would be informed by Figure 5 of the '633 Patent:



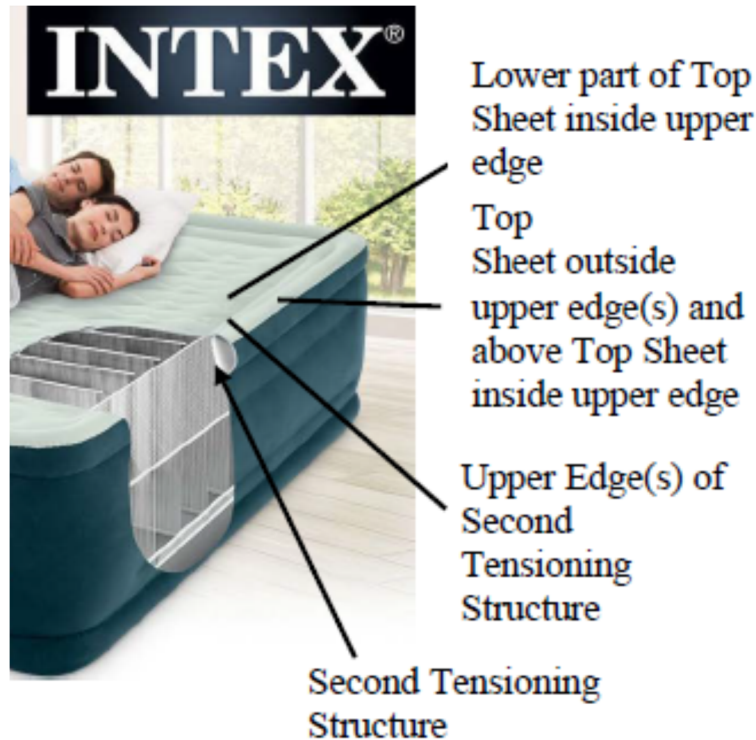
(Ex. 1001, Fig. 5; Ex. 1002, ¶183.) As shown in the below annotated close-up of the upper right corner of Figure 5, the green dashed line reflects the “location where said top sheet is located” at “the inside part” of an upper edge of the tensioning structure (i.e., closer to the inside portion of the inflatable bed), and the blue dashed line reflects a “location where said top sheet is located” at “the outside part” of this upper edge (i.e., closer to the outside portion of the inflatable bed). As reflected by the two dashed lines, the “location where said top sheet is located” at the inside part (green dashed line) is “lower” (closer to the ground) than the “location where said top sheet is located” at the outside part (blue dashed line):



(Ex. 1002, ¶183.)

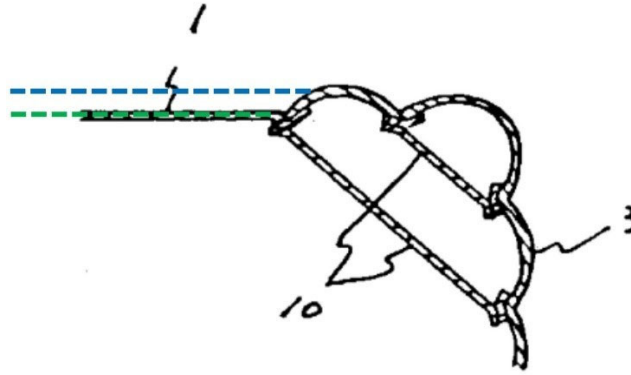
Indeed, this is consistent with Patent Owner’s own initial infringement contention for this claim,⁵ in which Patent Owner alleges that an inflatable bed with a top sheet that is “lower” at a location where it is closer to the inside portion of the bed, relative to an upper edge of a tensioning structure, than a location where it is closer to the outside portion, relative to the upper edge of the tensioning structure, meets this claim limitation:

⁵ Patent Owner appears to no longer be asserting claim 17 in the District Court Litigation. However, Patent Owner has refused to covenant that it will not assert this claim against Petitioner. (See Ex. 1056.)



(Ex. 1042 at 8.)

With this understanding of the meaning of this claim limitation, Aoki discloses this limitation. (Ex. 1005, Fig. 4.) As shown in the annotated Figure 4 below, Aoki discloses that a location where the top sheet is located at the inside part of an upper edge (**green** dashed line) of the second tensioning structure is lower than a location where the top sheet is located at the outside part of the upper edge (**blue** dashed line):



(*Id.*)

Aoki therefore discloses or renders obvious all limitations of claim 17 of the '633 Patent. (Ex. 1002, ¶¶182-185.)

B. Ground 2: Aoki in view of Lin '773 Renders Obvious Claims 3-14 and 17 of the '633 Patent

1. Claim 3

a. The inflatable bed according to claim 1,

As discussed above, Aoki discloses or renders obvious all of the limitations of claim 1. (*Supra* §X.A.1.a.) However, if the Board believes that Aoki's disclosure that the diagonal bracing hanging sheets are adhered to the outer surfaces at "adhesive positions" of the diagonal hanging bracing sheets and "adhesive sites" of the outer surfaces means that Aoki does not disclose that the diagonal hanging bracing sheets are "coupled" to the outer surfaces as recited in claim 1, this claim nonetheless would have been obvious over Aoki in view of Lin '773.

Aoki published in 1972. (Ex. 1005, Title Page.) A POSA considering materials for Aoki's tensioning structures in 2016 would have naturally looked to more recent teachings and knowledge in the art regarding suitable and advantageous materials and tensioning structures. (Ex. 1002, ¶188.) As described below, a POSA implementing Aoki would in particular have been motivated to look to Lin '773's teachings of advantageous tensioning structures for use in inflatable beds.

Lin '773 discloses improved tensioning structures that "join two pieces of material that are urged away from one another in use," including sheets comprising a double-layer air mattress. (Ex. 1009, 7:9-14, 7:62-8:3; *supra*, §IX.B.) As shown in annotated Figure 1 below, Lin '773 discloses that its tensioning structures may comprise a "plurality of substantially parallel strands 32" (yellow) that are captured between two weld strips 31 (red) at the top and bottom of the strands:

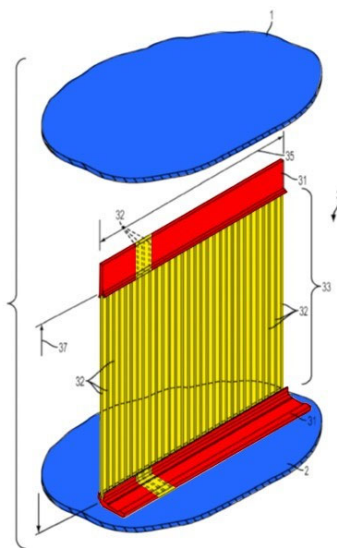


FIG. 1

(Ex. 1009, 7:17-22, 12:22-31, Fig. 1.) The weld strips, in turn, are welded to an “upper material 1” and “lower material 2,” such as the top and bottom sheets (blue) of an inflatable bed, as shown above and further in annotated Figure 3 below:

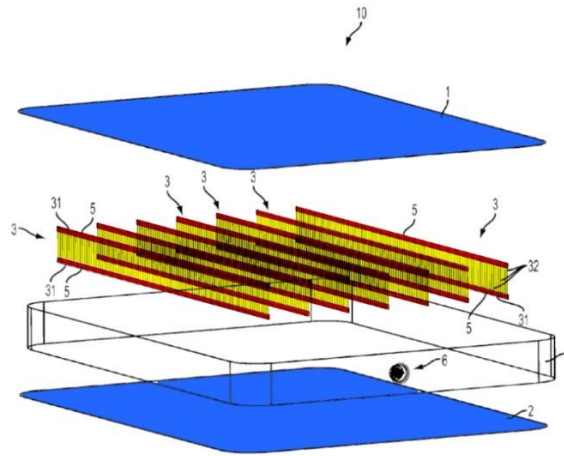


FIG. 3

(*Id.*, 7:22-25, 7:53-66, Fig. 3.)

Lin ’773 discloses that its tensioning structures serve to maintain the rectangular shape of the inflatable bed by preventing the surfaces of the bed from urging away from each other and thus taking on the shape of a balloon (*id.*, 1:38-52, 7:16-25, 8:47-55)—the same problem in the art to which Aoki is addressed (Ex. 1005, 1-2, 4-5). Lin ’773 further teaches that its tensioning structures provide numerous advantages over known tensioning structures, including providing high tensile strength while minimizing weight, materials, and costs. (*Supra*, §IX.B; Ex. 1009, 1:20-22; 6:52-56; 8:67-9:1; 9:52-55; 10:19-20; 16:17-31; 18:25-30; Ex. 1002, ¶190.)

A POSA would have thus been motivated to employ Lin ’773’s tensioning structures as the tensioning structures in Aoki’s air mattress, to achieve the advantages disclosed by Lin ’773. (Ex. 1002, ¶191.) Aoki does not limit the materials or attachment methods that may be used for its tensioning structures, but rather generally states that the tensioning structures may be sewn or “adhere[d]” to the top sheet, bottom sheet, and side walls. (Ex. 1005, 3.) Lin ’773, in turn, discloses advantageous materials, including weld strips and strands, as well as advantageous attachment methods, including welding, to achieve the objective of providing high tensile strength to maintain the shape of an inflatable bed. (Ex. 1009, 11:30-49.) A POSA would have a reasonable expectation of success in using Lin ’773’s design as a tensioning structure, as use of such materials as tensioning structures was well known before the Priority Date. (Ex. 1002, ¶191; *supra*, §VII.A.4.)

Moreover, a POSA would have known that it would be advantageous to use the same material for both Lin ’773’s weld strips and Aoki’s top sheet, bottom sheet, and side walls to achieve a secure welded connection. (Ex. 1002, ¶192.) A POSA would have known that use of plastic material for the outside surfaces and tensioning structures of Aoki would have been a simple substitution of more modern materials in place of Aoki’s hanging sheets. (*Id.*) Indeed, Patent Owner’s own expert in a prior IPR proceeding testified that “using PVC for the interior and

exterior components of a mattress was well-known in the art and in the background knowledge of a PHOSITA” before the Priority Date, and that “using the same material as the top and bottom side of the mattress and the extending parts would ensure that they could be suitably welded together.” (Ex. 1043, ¶¶21, 105.) Thus, a POSA would have known that using Lin ’773’s design for the tensioning structures in Aoki would be a simple substitution of one known element for another, and would have yielded predictable results. (Ex. 1002, ¶192.)

Accordingly, a POSA would have been motivated to use Lin ’773’s tensioning structures for Aoki’s diagonal hanging bracing sheets, and would have known that using the same plastic material for Lin ’773’s weld strips and the outer surfaces of Aoki would advantageously allow for a secure welded connection between the tensioning structures and outer surfaces. (*Id.*, ¶193.) As a result of this welded connection, the upper end and lower end of Lin ’773’s tensioning structures serving as Aoki’s vertical hanging sheets would be respectively coupled to the top and bottom sheets; the outside edges of Lin ’773’s tensioning structures serving as Aoki’s top diagonal bracing hanging sheets would be coupled to the side wall and the inside edges coupled to the top sheet; and the outside edges of Lin ’773’s tensioning structures serving as Aoki’s bottom diagonal bracing hanging sheets would be coupled to the side wall and the inside edges coupled to the

bottom sheet, as recited in claim 1 of the '633 Patent. (*Id.*, ¶193.) Aoki in view of Lin '773 therefore renders obvious claim 1. (Ex. 1002, ¶¶187-194.)

b. wherein said second tensioning structure and said third tensioning structure are disposed at an interval.

As discussed above, Aoki discloses this limitation. (*Supra*, §X.A.1.b.) Modifying Aoki to employ Lin '773's tensioning structures as the tensioning structures in Aoki's air mattress (*supra*, §X.B.1.a) would not alter this disposition of the second and third tensioning structures at an interval. (Ex. 1002, ¶204.) Aoki in view of Lin '773 therefore renders obvious claim 3 of the '633 Patent. (*Id.*, ¶¶203-205.)

2. Claim 4

a. The inflatable bed according to claim 1,

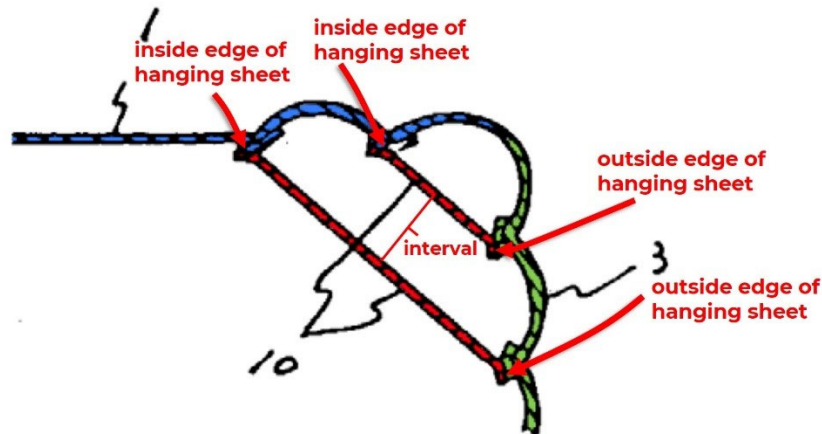
As discussed above, Aoki, either individually or in view of Lin '773, discloses or renders obvious all of the limitations of claim 1. (*Supra* §§X.A.1.a, X.B.1.a.)

b. wherein said second tensioning structure comprises at least two first I-beams, an outside edge and an inside edge of each of said first I-beams are respectively coupled to said side wall and said top sheet adjacent, the at least two first I-beams are disposed at an interval.

As explained above, and as shown in the annotated Figure 4 below, Aoki discloses that an outside edge and an inside edge of each of its diagonal bracing hanging sheets are respectively coupled to the side wall and top sheet adjacent, and

the hanging sheets are disposed at an interval:

FIG. 4



(Ex. 1005, Fig. 4; *supra*, §X.A.2.b.)

As shown in annotated Figure 3 below, Lin '773 discloses that its tensioning structures (3, yellow and red) comprise I-beams:

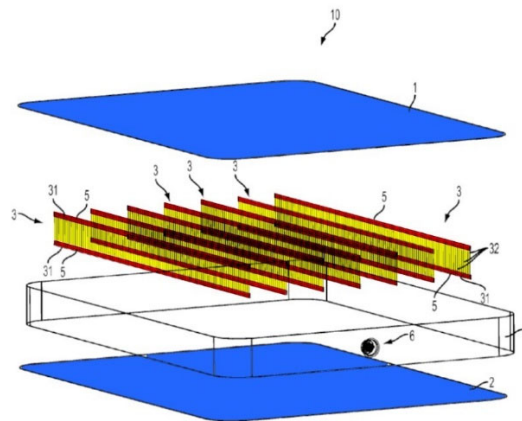


FIG. 3

(Ex. 1009, 7:53-8:3, 8:30-36, Fig. 3.)

As discussed above, a POSA would have been motivated to employ Lin '773's tensioning structures as the diagonal bracing hanging sheets in Aoki's air mattress. (*Supra*, §X.B.1.a.) Modifying Aoki to thus employ Lin '773's I-beam

tensioning structures would not alter the coupling of the two first I-beams to the side wall and top sheet adjacent, and the disposition of the two first I-beams at an interval. (Ex. 1002, ¶209). Aoki in view of Lin '773 therefore renders obvious claim 4 of the '633 Patent. (Ex. 1002, ¶¶206-210.)

3. Claim 5

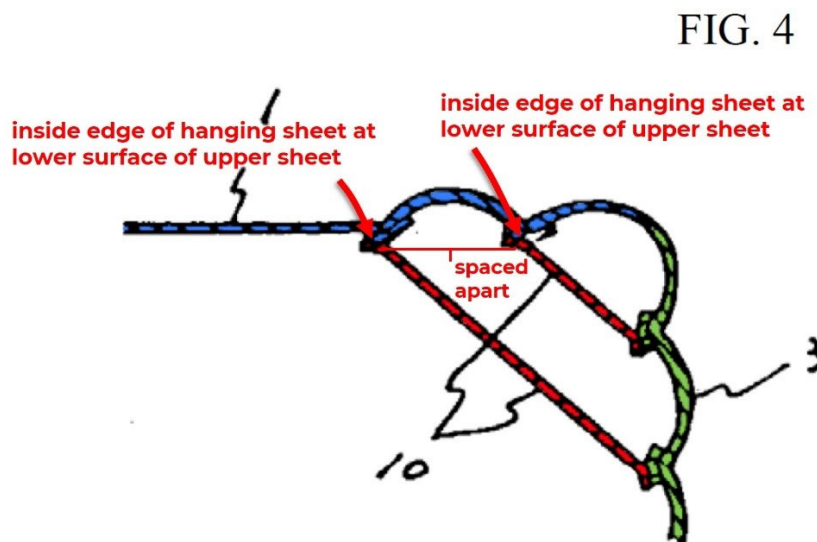
a. The inflatable bed according to claim 4,

As discussed above, Aoki in view of Lin '773 renders obvious claim 4.

(*Supra* §X.B.2.)

b. wherein said at least two first I-beams are spaced apart from each other at a lower surface of said top sheet.

As explained above, and as shown in the annotated Figure 4 below, Aoki discloses that two diagonal bracing hanging sheets comprising the second tensioning structure are spaced apart from each other at a lower surface of the upper sheet:



(Ex. 1005, Fig. 4; *supra*, §X.A.3.b.) As discussed above, a POSA would have been motivated to employ Lin '773's tensioning structures as the diagonal bracing hanging sheets in Aoki's air mattress. (*Supra*, §X.B.1.a.) Modifying Aoki to employ Lin '773's I-beam tensioning structures as the tensioning structures in Aoki's air mattress would not alter the spaced-apart disposition of the two first I-beams at a lower surface of the top sheet. (Ex. 1002, ¶211). Aoki in view of Lin '773 therefore renders obvious claim 5 of the '633 Patent. (*Id.*, ¶¶211-212.)

4. Claim 6

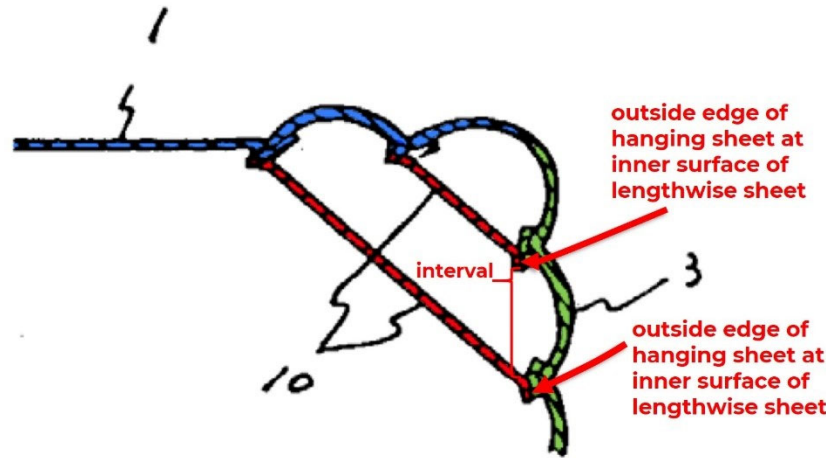
a. The inflatable bed according to claim 4,

As discussed above, Aoki in view of Lin '773 renders obvious claim 4.
(*Supra* §X.B.2.)

b. wherein said at least two first I-beams are disposed at an interval on an inner surface of said side wall.

As explained above, and as shown in the annotated Figure 4 below, Aoki discloses that two diagonal bracing hanging sheets comprising the second tensioning structure are disposed at an interval on an inner surface of the lengthwise sheet (side wall):

FIG. 4



(Ex. 1005, Fig. 4; *supra*, §X.A.4.b.) As discussed above, a POSA would have been motivated to employ Lin '773's tensioning structures as the diagonal bracing hanging sheets in Aoki's air mattress. (*Supra*, §X.B.1.a.) Modifying Aoki to employ Lin '773's I-beam tensioning structures as the tensioning structures in Aoki's air mattress would not alter the disposition of the two first I-beams at an interval on an inner surface of the side wall. (Ex. 1002, ¶213). Aoki in view of Lin '773 therefore renders obvious claim 6 of the '633 Patent. (*Id.*, ¶¶213-214.)

5. Claim 7

a. The inflatable bed according to claim 4,

As discussed above, Aoki in view of Lin '773 renders obvious claim 4.

(*Supra* §X.B.2.)

- b. wherein said at least two first I-beams as a whole are of a continuous annular structure or a segmental annular structure.***

As discussed above, Aoki discloses that its second tensioning structure (diagonal bracing hanging sheets adhered between the upper sheet and each of the side walls) as a whole are of a continuous annular structure or a segmental annular structure. (*Supra*, §X.A.5.b.) As also discussed above, a POSA would have been motivated to employ Lin '773's tensioning structures as the diagonal bracing hanging sheets in Aoki's air mattress. (*Supra*, §X.B.1.a.) Modifying Aoki to employ Lin '773's tensioning structures as the tensioning structures in Aoki's air mattress would not alter the resulting continuous or segmental annular structure of the two first I-beams. (Ex. 1002, ¶216). Aoki in view of Lin '773 therefore renders obvious claim 7 of the '633 Patent. (*Id.*, ¶¶215-217.)

6. Claim 8

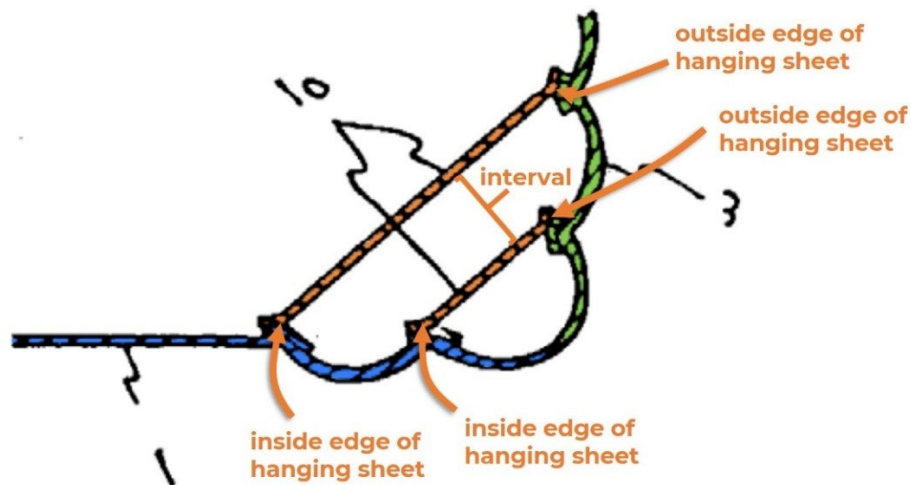
- a. The inflatable bed according to claim 1,***

As discussed above, Aoki, either individually or in view of Lin '773, discloses or renders obvious all of the limitations of claim 1. (*Supra* §§X.A.1.a, X.B.1.a.)

- b. wherein said third tensioning structure comprises at least two second I-beams, an outside edge and an inside edge of each of said second I-beams are respectively coupled to the side wall and said bottom sheet adjacent, the at least two second I-beams are disposed at an interval.***

This limitation is similar to the limitation of claim 4, except it applies to the third tensioning structure instead of the second tensioning structure. Because Aoki discloses providing the same diagonal bracing hanging sheets to each corner of the air mattress, the combination of Aoki and Lin '773 discloses this limitation for the same reasons it discloses the limitation of claim 4. (*Supra*, §X.B.2.b; Ex. 1005, 4-5.)

As explained above, and as shown in the annotated Figure below, Aoki discloses that an outside edge and an inside edge of each of its diagonal bracing hanging sheets are respectively coupled to the side wall and bottom sheet adjacent, and the two hanging sheets are disposed at an interval:



(Ex. 1005, Fig. 4; *supra*, §X.A.6.b.)

Modifying Aoki to employ Lin '773's tensioning structures as the tensioning structures in Aoki's air mattress (*supra*, §X.B.1.a) would not alter the coupling of the two second I-beams to the side wall and bottom sheet adjacent, and the disposition of the two second I-beams at an interval. (Ex. 1002, ¶220). Aoki in view of Lin '773 therefore renders obvious claim 8 of the '633 Patent. (*Id.*, ¶¶218-221.)

7. Claim 9

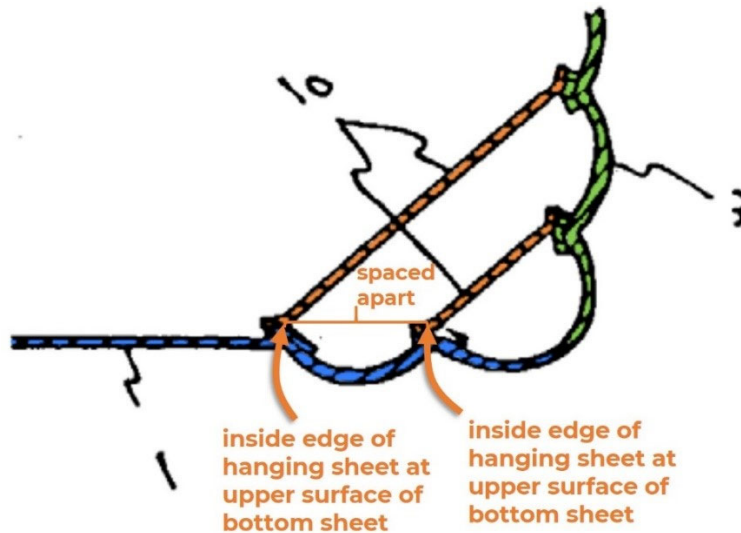
a. The inflatable bed according to claim 8,

As discussed above, Aoki in view of Lin '773 renders obvious claim 8.
(*Supra* §X.B.6.)

b. wherein said at least two second I-beams are spaced apart from each other at an upper surface of said bottom sheet.

This limitation is similar to the limitation of claim 5, except it applies to the third tensioning structure instead of the second tensioning structure. Because Aoki discloses providing the same diagonal bracing hanging sheets to each corner of the air mattress, the combination of Aoki and Lin '773 discloses this limitation for the same reasons it discloses the limitation of claim 5. (*Supra*, §X.B.3.b; Ex. 1005, 4-5.)

As explained above, and as shown in the annotated Figure below, Aoki discloses that two diagonal bracing hanging sheets comprising the third tensioning structure are spaced apart from each other at an upper surface of the bottom sheet:



(Ex. 1005, Fig. 4; *supra*, §X.A.7.b) Modifying Aoki to employ Lin '773's tensioning structures as the tensioning structures in Aoki's air mattress (*supra*, §X.B.1.a) would not alter the spaced-apart disposition of the two second I-beams at an upper surface of the bottom sheet. (Ex. 1002, ¶223). Aoki in view of Lin '773 therefore renders obvious claim 9 of the '633 Patent. (*Id.*, ¶¶222-224.)

8. Claim 10

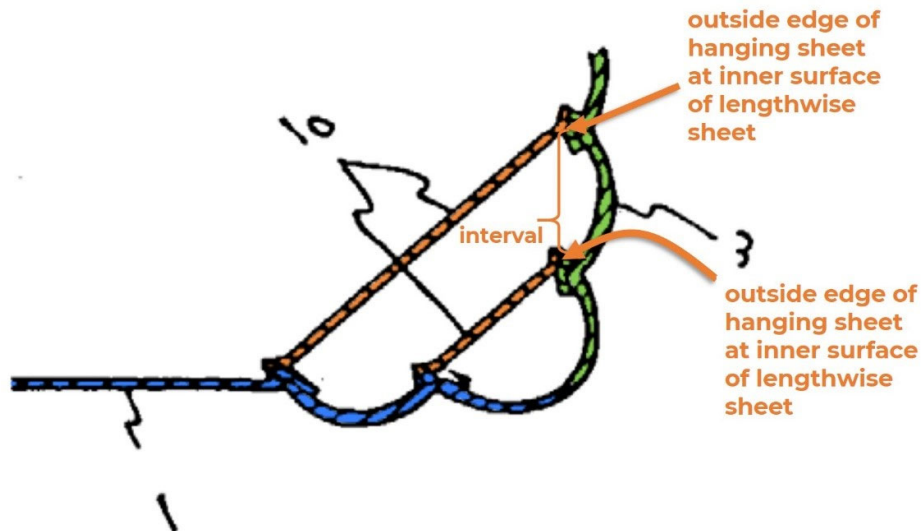
a. The inflatable bed according to claim 8,

As discussed above, Aoki in view of Lin '773 renders obvious claim 8.
(*Supra* §X.B.6.)

b. wherein said at least two second are disposed at an interval on the inner surface of said side wall.

This limitation is similar to the limitation of claim 6, except it applies to the third tensioning structure instead of the second tensioning structure. Because Aoki discloses providing the same diagonal bracing hanging sheets to each corner of the air mattress, the combination of Aoki and Lin '773 discloses this limitation for the same reasons it discloses the limitation of claim 6. (*Supra*, §X.B.4.b; Ex. 1005, 4-5.)

As explained above, and as shown in the annotated Figure below, Aoki discloses that two diagonal bracing hanging sheets comprising the third tensioning structure are disposed at an interval on an inner surface of the lengthwise sheet (side wall):



(Ex. 1005, Fig. 4; *supra*. §X.A.8.b) Modifying Aoki to employ Lin '773's tensioning structures as the tensioning structures in Aoki's air mattress (*supra*,

§X.B.1.a) would not alter the disposition of the two second I-beams at an interval on an inner surface of the side wall. (Ex. 1002, ¶225.) Aoki in view of Lin '773 therefore renders obvious claim 10 of the '633 Patent. (*Id.*, ¶¶225-226.)

9. Claim 11

a. The inflatable bed according to claim 8,

As discussed above, Aoki in view of Lin '773 renders obvious claim 8.

(*Supra* §X.B.6.)

b. wherein said at least two second I-beam as a whole are of a continuous annular structure or a segmental annular structure.

This limitation is similar to the limitation of claim 7, except it applies to the third tensioning structure instead of the second tensioning structure. Because Aoki discloses providing the same diagonal bracing hanging sheets to each corner of the air mattress, the combination of Aoki and Lin '773 discloses this limitation for the same reasons it discloses the limitation of claim 7. (*Supra*, §X.B.5.b; Ex. 1005, 4-5.)

As discussed above, Aoki discloses that its third tensioning structure (diagonal bracing hanging sheets adhered between the bottom sheet and each of the side walls) as a whole are of a continuous annular structure or a segmental annular structure. (*Supra*, §X.A.9.b.) Modifying Aoki to employ Lin '773's tensioning structures as the tensioning structures in Aoki's air mattress (*supra*, §X.B.1.a)

would not alter the resulting continuous or segmental annular structure of the two second I-beams. (Ex. 1002, ¶228). Aoki in view of Lin '773 therefore renders obvious claim 11 of the '633 Patent. (*Id.*, ¶¶227-229.)

10. Claim 12

a. The inflatable bed according to claim 1,

As discussed above, Aoki, either individually or in view of Lin '773, discloses or renders obvious all of the limitations of claim 1. (*Supra* §§X.A.1.a, X.B.1.a.)

b. wherein said first tensioning structure, said second tensioning structure and said third tensioning structure are all made of thermoplastic plastic sheet.

Lin '773 discloses that its tensioning structures may include weld strips that are “made of PVC,” and that the weld strips may be welded to the top and bottom sheets of the inflatable bed “by abutting one of weld strips 31 to one of upper and lower materials 1, 2 and then applying heat to melt and fuse the material of weld strips 31 to the abutting material.” (Ex. 1009, 8:12-20.)

A POSA would have known from these disclosures that these weld strips constituted thermoplastic plastic sheets. First, polyvinylchloride (PVC) is a known thermoplastic plastic sheet. (Ex. 1002, ¶232; Ex. 1046, 543; Ex. 1047, 1; Ex. 1048, Abstract.) Moreover, a POSA would have understood that connecting PVC by “applying heat to melt and fuse the material of weld strips 31 to the abutting

material” (Ex. 1009, 8:12-20), would necessarily require that the weld strips be thermoplastic. (Ex. 1002, ¶232; Ex. 1035, 4 (defining “thermoplastic” as “capable of softening or fusing when heated and of hardening again when cooled”).)

As discussed above, a POSA would have been motivated to employ Lin ’773’s tensioning structures as the vertical hanging sheets (first tensioning structure) and diagonal bracing hanging sheets (second and third tensioning structures) of Aoki’s air mattress. (*Supra*, §X.B.1.a.) As also discussed above, a POSA would have known that it would have been advantageous to use PVC for both Lin ’773’s weld strips and Aoki’s top sheet, bottom sheet, and side walls to achieve a secure welded connection. (*Id.*)

Accordingly, the combination of Aoki and Lin ’773 discloses or suggests first, second, and third tensioning structures that are made of thermoplastic plastic sheets. (Ex. 1036, 13 (defining “made of” as “to have been fashioned, whether by human agency or by nature, out of (certain materials); to have as its material, constituents, or component parts; to consist or be composed of”).) Aoki in view of Lin ’773 therefore renders obvious claim 12 of the ’633 Patent. (Ex. 1002, ¶¶230-235.)

11. Claim 13

a. The inflatable bed according to claim 1,

As discussed above, Aoki, either individually or in view of Lin '773, discloses or renders obvious all of the limitations of claim 1. (*Supra* §§X.A.1.a, X.B.1.a.)

b. wherein one or more of said first tensioning structure, said second tensioning structure and said third tensioning structure at least partially comprise mesh, laminated plastic sheet or a threads.

Lin '773 discloses that its tensioning structures are comprised of strands that “may be made of regular cotton, polyester, nylon ***thread*** made of multiple filaments twisted together, of the type typically used in clothing seams, or any other strand types,” and that “[t]hese regular ***threads*** provide substantial tensile strength at a very low cost.” (Ex. 1009, 8:64-9:1 (emphasis added).)

As discussed above, a POSA would have been motivated to employ Lin '773's tensioning structures as vertical hanging sheets (first tensioning structure) and diagonal bracing hanging sheets (second and third tensioning structures) of Aoki's air mattress. (*Supra*, §X.B.1.a) Accordingly, the combination of Aoki and Lin '773 disclose or suggest first, second, and third tensioning structures that at least partially comprise threads. (Ex. 1002, ¶238.) Aoki in view of Lin '773 therefore renders obvious claim 13 of the '633 Patent. (Ex. 1002, ¶¶236-239.)

12. Claim 14

a. The inflatable bed according to claim 13,

As discussed above, Aoki in view of Lin '773 renders obvious claim 13.

(*Supra* §X.B.11.)

b. wherein two side surfaces of said mesh or said threads are at least partially coupled integrally with two opposite plastic strips, said mesh and said threads are sandwiched between the two opposite plastic strips.

As shown in annotated Figure 1 below, Lin '773 discloses that its strands may be sandwiched between two weld strips (red) at the top and bottom of the strands:

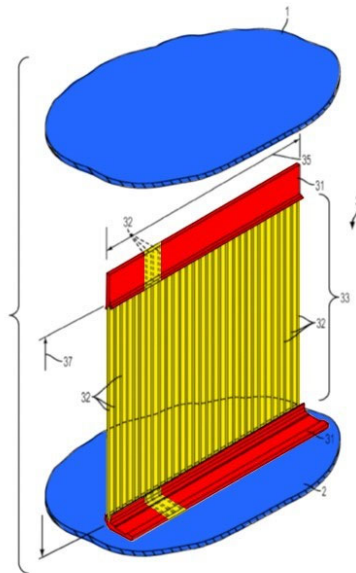


FIG. 1

(Ex. 1009, 7:17-22, 12:22-31, Fig. 1.) In particular, and as shown in annotated Figures 10 and 11 below, Lin '773 discloses that “two mutually opposed weld strips” (31, in red) may be disposed on either side of the strands (32, yellow) and

“‘trap’ or capture the strands therebetween, thereby contributing to a high-strength coupling interface”:

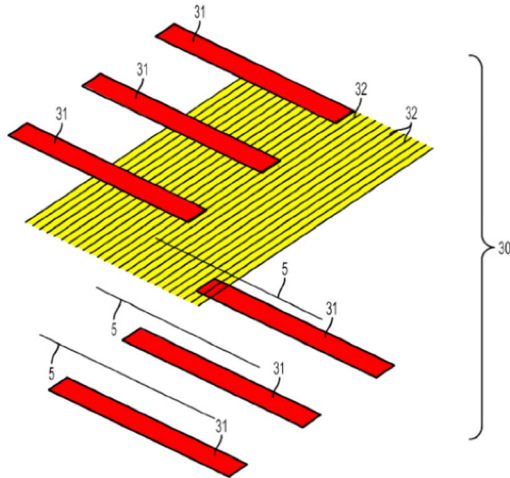


FIG. 10

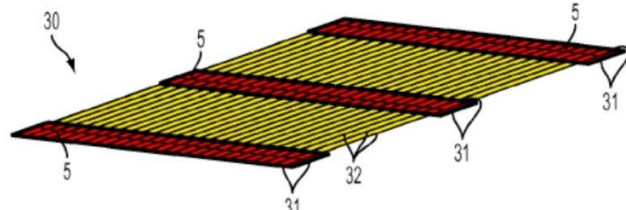


FIG. 11

(*Id.*, 12:22-28, Figs. 10, 11.) Lin ’773 discloses that this “dual layer tensioning structure 3 has improved strength and can be welded to” the top and bottom sheets (1 and 2) of the inflatable bed to prevent these sheets from urging away from each other as the bed is inflated. (*Id.*, 7:16-25, 8:47-55, 12:28-31, Figs. 1, 3.)

Lin ’773 further discloses that the weld strips may be made of plastic such as PVC. (Ex. 1009, Abstract, 2:8-26, 8:12-20; Ex. 1002, ¶242.) Lin ’773 further discloses that the weld strips may be “fixedly connect[ed]” to the strands by applying “heat or electromagnetic waves,” or by “any suitable welding method.” (Ex. 1009, 11:11-59.) A POSA would have understood that sandwiching the strands in between the weld strips and connecting them in this way would result in the strands being coupled integrally with the two opposite weld strips, as the

materials of both the strands and weld strips would be fused together. (Ex. 1002, ¶243.)

As discussed above, a POSA would have been motivated to employ Lin '773's tensioning structures as the diagonal bracing hanging sheets in Aoki's air mattress. (*Supra*, §X.B.1.a) Moreover, the process of coupling threads with plastic strips by sandwiching the mesh or threads between the plastic strips so that they are coupled integrally, was well-known before the Priority Date. (Ex. 1002, ¶244; Ex. 1015, ¶[0051], Fig. 5A.) Indeed, the Examiner came to this same conclusion in rejecting this claim during prosecution of the '633 Patent. (Ex. 1003, 448 (citing WO 2013/0130117 (Ex. 1052), which is a published parent PCT application of Lin '773).)

Accordingly, the combination of Aoki and Lin '773 discloses or suggests first, second, and third tensioning structures that at least partially comprise threads, with two side surfaces of the threads at least partially coupled integrally with two opposite plastic strips, and the threads are sandwiched between the two opposite plastic strips. Aoki in view of Lin '773 therefore renders obvious claim 14 of the '633 Patent. (Ex. 1002, ¶¶240-246.)

13. Claim 17

a. The inflatable bed according to claim 1,

As discussed above, Aoki, either individually or in view of Lin '773, discloses or renders obvious all of the limitations of claim 1. (*Supra* §§X.A.1.a, X.B.1.a.)

b. wherein a location where said top sheet is located in the inside part of an upper edge of said second tensioning structure is lower than the location where said top sheet is located in the outside part of the upper edge of said second tensioning structure.

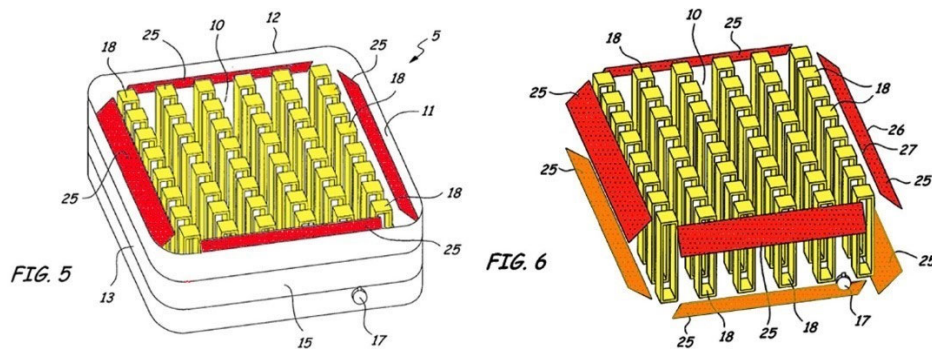
As described above, Aoki discloses this limitation. (*Supra*, §X.A.10.b.) Modifying Aoki to employ Lin '773's tensioning structures as the tensioning structures in Aoki's air mattress (*supra*, §X.B.1.a) would not alter the location where the top sheet is located in the inside part of an upper edge of the second tensioning structure and the location where said top sheet is located in the outside part of the upper edge of the second tensioning structure. (Ex. 1002, ¶¶253). Aoki in view of Lin '773 therefore renders obvious claim 17 of the '633 Patent. (*Id.*, ¶¶252-254.)

C. Ground 3: Aoki in view of Metzger Renders Obvious Claim 12 of the '633 Patent

As explained above, Aoki in view of Lin '773 renders obvious claim 12. (*Supra*, §X.B.10.) To the extent Patent Owner argues that claim 12's recitation that that the first, second, and third tensioning structure are all "made of

thermoplastic plastic sheet” means that the entirety of all three tensioning structures must be thermoplastic, claim 12 is nonetheless obvious in view of Metzger. (Ex. 1002, ¶¶272-278.)

As shown in annotated Figures 5 and 6 below, Metzger discloses a first tensioning structure (spaced coils 18, yellow) that “extend continuously within the air chamber from and between the first panel 7 and the second panel 8 of the air mattress,” and second and third tensioning structures (side support beams 25, red and orange) having “a first edge 26 adapted to be affixed to a side panel of the mattress ..., and a spaced second edge adapted to be affixed to either of the first panel 7 or the second panel 8,” which are provided “for each of the side panels of the air mattress”:



(Ex. 1010, 4:41-51, 5:12-59, Fig. 6.)

Metzger further discloses that each of the spaced coils and side support beams “may be formed of any flexible barrier material as known to those skilled in the art, including but not limited to, the use of polyvinylchloride, polyethylene, and

the like.” (*Id.*, 6:25-30.) Metzger discloses that the spaced coils and side support beams may be attached or affixed to the respective panels (top sheet, bottom sheet, and side walls) “by using any known heat welding, fusing, or bonding technique ..., all in conventional fashion so long as a durable edge connection is formed therebetween.” (*Id.*, 6-15-22.)

Accordingly, Metzger teaches that the spaced coils and side support beams (first, second, and third tensioning structures) may be made of thermoplastic plastic sheet. First, polyvinylchloride (PVC) is a known thermoplastic plastic sheet. (Ex. 1002, ¶275; Ex. 1046, 543; Ex. 1047, 1; Ex. 1048, Abstract.) Moreover, a POSA would have understood that connecting plastic by heat welding or fusing would necessarily require that the tensioning structures would be made of thermoplastic plastic sheet. (Ex. 1002, ¶275; Ex. 1035, 4 (defining “thermoplastic” as “capable of softening or fusing when heated and of hardening again when cooled”).)

As discussed above, a POSA considering materials for Aoki’s tensioning structures in 2016 would have naturally looked to more recent teachings and knowledge in the art regarding suitable and advantageous materials and tensioning structures. (*Supra*, §X.B.1.a; Ex. 1002, ¶276.) While a POSA would have been motivated to look to Lin ’773’s teachings of advantageous tensioning structures comprising two PVC weld strips at each end, a POSA would have also known from Metzger’s teachings that using tensioning structures comprised entirely of

thermoplastic would also accomplish the objectives of resisting deformation of an inflatable bed as it is inflated. (Ex. 1010, 1:29-44, 5:27-59; Ex. 1002, ¶276.)

Metzger discloses almost the same structures as Aoki (large-height inflatable mattress incorporating tensioning structures between the top and bottom sheets, top and side sheets, and bottom and side sheets), and both Aoki and Metzger are directed to solving the same problems—enhancing stability and preventing deformity in large-height air mattresses. (*Compare* Ex. 1005, 1-2, *with* Ex. 1010, 1:60-2:51.) A POSA choosing materials for Aoki’s tensioning structures would thus have been motivated to look to Metzger’s teachings of thermoplastic tensioning structures.

A POSA would have further known that it would have been advantageous to use PVC for both Aoki’s diagonal bracing hanging sheets and Aoki’s top sheet, bottom sheet, and side walls to achieve a secure welded connection. (Ex. 1002, ¶277.) A POSA would have known that use of PVC for the outside surfaces and tensioning structures of Aoki would have been a simple substitution of more modern materials for Aoki’s hanging sheets. (Ex. 1002, ¶277.) Indeed, Patent Owner’s own expert in a prior IPR proceeding asserted that “using PVC for the interior and exterior components of a mattress was well-known in the art and in the background knowledge of a PHOSITA” before the Priority Date, and that “using the same material as the top and bottom side of the mattress and the extending

parts would ensure that they could be suitably welded together.” (Ex. 1043, ¶¶21, 105.) A POSA would thus have known that using a tensioning structure comprised entirely of PVC (as disclosed in Metzger), or a tensioning structure comprised of PVC strips and threads (as disclosed in Lin ’773), would both have been obvious to try, and would have had a reasonable expectation of success in using either material as tensioning structures in the inflatable bed disclosed by Aoki. (Ex. 1002, ¶277.)

Accordingly, the combination of Aoki and Metzger discloses or suggests first, second, and third tensioning structures that are made of thermoplastic plastic sheets. Aoki in view of Metzger therefore renders obvious claim 12 of the ’633 Patent. (Ex. 1002, ¶¶271-279.)

D. Ground 4: Aoki in view of Lin ’773 and Liu Renders Obvious Claim 15 of the ’633 Patent

1. Claim 15

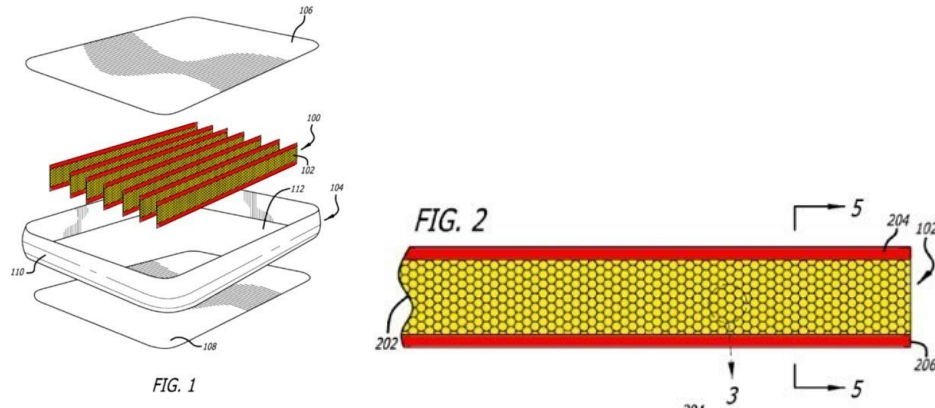
a. The inflatable bed according to claim 13,

As discussed above, Aoki in view of Lin ’773 renders obvious claim 13.
(*Supra* §X.B.11.)

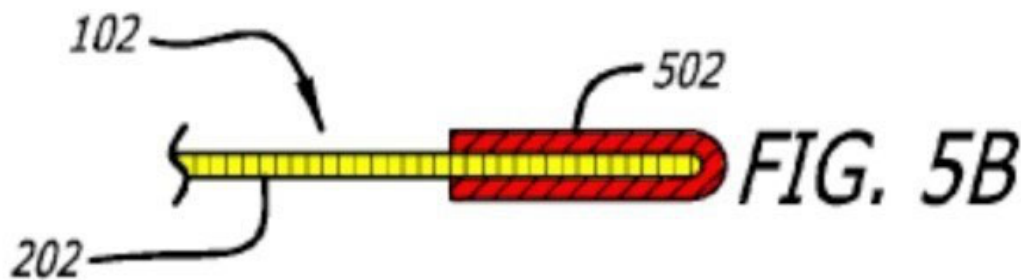
- b. wherein two side surfaces of said mesh or said threads are at least partially coupled integrally with an U-shaped plastic strip, said mesh and said threads are sandwiched between the U-shaped plastic strip.***

As discussed above, Lin '773 discloses that its tensioning structure may comprise strands made of threads sandwiched between plastic weld strips. (*Supra*, §X.B.11.b ; Ex. 1009, 7:17-22, 8:12-20, 8:64-9:1, 12:22-31, Figs. 1, 3, 10, 11.) As discussed further below, a POSA would have known that weld strips could “‘trap’ or capture the strands 32 therebetween,” as disclosed by Lin '773 (*id.*, 12:25-28), by two different means: (1) using two separate weld strips; or (2) using a single weld strip “folded over” the ends of the strands such that the weld strip was U-shaped and the strands were sandwiched between the weld strip. (Ex. 1002, ¶¶257.)

For example, and as shown in annotated Figures 1 and 2 below, Liu discloses that its tensioning structures may comprise two plastic weld strips (red) and a panel “made of a material having fibers that form an open cell mesh construction where the cells may be shaped, cut, or otherwise formed into various geometrical shapes” (yellow):



(Ex. 1015, ¶¶[0037], [0040]; Figs. 1, 2.) Liu further discloses that the fibers of the mesh construction “may be constructed by knotting or weaving together strands of materials such as twine, wire, string, or *threads*.” (*Id.*, ¶[0046] (emphasis added).) As shown below in annotated Figure 5B, Liu further discloses that “a single weld strip 502” (red) “may be used and folded about the lateral ends of the panel 202” (yellow) “such that one end of the weld strip is affixed to a bottom surface of the panel 202 and the opposite end of the strip is affixed to a top surface of the panel 202”:



(*Id.*, ¶[0052], Fig. 5B.)

Liu further discloses that its weld strips may be affixed to the mesh panel “using suitable coupling techniques, such as radio-frequency (RF) welding, hot-air

coupling (e.g., melting or welding), adhering (e.g., gluing) or other means known in the art.” (*Id.*, ¶[0051].) A POSA would have understood that folding the weld strip about the lateral ends of the mesh panel and then coupling it by radio-frequency welding or melting would result in the mesh being coupled integrally with the U-shaped weld strip, as the materials of both the panel and weld strip would be fused or integrated together. (Ex. 1002, ¶259.)

Liu teaches that such tensioning structures could be used to join the top and bottom sheets of a double-layer mattress, including “in combination with one another as required or desired for a particular design.” (Ex. 1015, ¶¶[0035]-[0040], [0063].) Liu further discloses that its tensioning structures “prevent over-expansion or ‘ballooning’ of the mattress” and thereby ensure that the air mattress does not become deformed (*id.*, ¶¶[0009]-[0010], [0040]-[0041], [0054])—the same problem in the art to which Aoki and Lin ’773 are addressed (Ex. 1005, 1-2, 4-5; Ex. 1009, 1:38-52, 7:16-25, 8:47-55). Liu further teaches that its tensioning structures provide various advantages over known tensioning structures, including facilitating the free flow of air from one portion of the air chamber to the next while being lightweight, “simple in structure, easy to manufacture, durable, and low in production cost.” (Ex. 1015, ¶¶ [0054], [0061].)

As discussed above, a POSA would have been motivated to employ Lin ’773’s tensioning structures in Aoki’s air mattress. (*Supra*, B.1.a.) A POSA

implementing Lin '773's tensioning structures in Aoki's air mattress would have been motivated to try either of the two principal ways to sandwich threads between weld strips—that is, either using two separate weld strips (as taught by Lin '773) or a single weld strip folded over the ends of the threads (as taught by Liu). (Ex. 1002, ¶261.) A POSA would have known that these two options constituted a finite number of identified, predictable solutions for sandwiching threads between weld strips in a tensioning structure, and would have a reasonable expectation of success in trying either option. (*Id.*) A POSA would have known that both options would yield a tensioning structure with threads effectively sandwiched between plastic, and that either solution would thus be obvious to try. (*Id.*) Moreover, the process of coupling mesh or threads with a plastic strip by “sandwiching” the mesh or threads between a U-shaped plastic strip so that they are coupled integrally, was well known before the Priority Date. (*Id.*) Indeed, the Examiner came to this same conclusion in rejecting this claim during prosecution of the '633 Patent. (Ex. 1003, 448.)

Accordingly, the combination of Aoki, Lin '773, and Liu disclose or suggest first, second, and third tensioning structures that at least partially comprise threads, with two side surfaces of the threads at least partially coupled integrally with a U-shaped plastic strip, and the threads are sandwiched between the U-shaped plastic

strip. Aoki in view of Lin '773 and Liu therefore renders obvious claim 15 of the '633 Patent. (Ex. 1002, ¶¶256-263.)

XI. DISCRETIONARY DENIAL IS NOT APPROPRIATE

A. *Fintiv*

The District Court Litigation is stayed pending resolution of this IPR petition and the other IPR petitions filed by Petitioner. (Ex. 1057.) Accordingly, “it is not necessary to analyze the *Fintiv* factors in detail” and discretionary denial on this basis is unwarranted. *Microsoft Corp. v. Throughputer, Inc.*, IPR2022-00528, Paper 12 at 26 (PTAB Sept. 19, 2022); *see also Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 at 5–6 (PTAB Mar. 20, 2020) (precedential) (“A district court stay of the litigation pending resolution of the PTAB trial allays concerns about inefficiency and duplication of efforts.”); *Lyft, Inc. v. Agis Software Dev. LLC*, IPR2022-00513, Paper 11 at 5-6 (PTAB June 2, 2022) (“Given the strong weight afforded a stay in the *Fintiv* analysis, we decline to exercise our discretion to deny institution under § 314(a) in view of the district court litigation.” (quotation marks omitted)); *Precision Planting, LLC v. Deere & Co.*, IPR2019-01052, Paper 19 at 10 (PTAB Jan. 7, 2020) (concluding that district court stay rendered moot the patent owner’s argument for discretionary denial).

B. 35 U.S.C. §325(d)

Denial under 35 U.S.C. §325(d) would not be appropriate under the two-part test set forth in *Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH*: (1) whether the same or substantially the same prior art or arguments were previously presented to the Office; and (2) whether Petitioner demonstrated that the Office erred in a manner material to the patentability of the challenged claims. IPR2019-01469, Paper 6 at 8-9 (PTAB Feb. 13, 2020) (precedential).

Neither Aoki nor Metzger was ever presented to or considered by the Examiner. (Ex. 1001, Title Page-2, (56); Ex. 1003.) While Liu was cited by the Examiner in support of his conclusion that certain limitations in dependent claims were well known in the art (Ex. 1003, 448, 450), Patent Owner's amendment to purportedly distinguish over Lin did not address these limitations or rejections based on Liu (*id.*, 484-486.) Thus, the Examiner never considered or adopted any arguments against this application of Liu, and in any event, Liu is presented in the Petition in combination with Aoki and Lin '773, which combination was not considered by the Examiner during prosecution. Similarly, while the publication (US2013/0228268) that published from the application that issued as Lin '773 was cited in a reference sheet by the Examiner (Ex. 1003, 452), this publication was not substantively discussed or applied by the Examiner during prosecution, and in any event, the combination of Aoki and Lin '773 was never considered by the

Examiner. Thus, the first prong of *Advanced Bionics* is not satisfied with respect to Liu or Lin '773. See, e.g., *Thorne Research, Inc. v. Trustees of Dartmouth College*, IPR2021-00491, Paper 18 at 8 (PTAB Aug. 12, 2021) (“The fact that one piece of art from the combination was previously presented and/or argued to the Office alone is insufficient to satisfy the first prong of *Advanced Bionics* two-part test....”); *Halliburton Energy Servs. v. U.S. Well Servs.*, IPR2021-01036, Paper 12 at 18-20 (PTAB Jan. 19, 2022); *Teradata Corp. v. SAP SE*, IPR2020-00943, Paper 12 at 23-24 (PTAB Nov. 25, 2020).

XII. CONCLUSION

For the foregoing reasons, Petitioner respectfully requests that IPR of claims 3-15 and 17 of the '633 Patent be instituted and that these claims be determined to be unpatentable.

FAEGRE DRINKER BIDDLE & REATH

Dated: January 21, 2023

By: /R. Trevor Carter/
R. Trevor Carter
Reg. No. 40,549

TYPE-VOLUME CERTIFICATION

Pursuant to 37 C.F.R. §42.24(d), Petitioner hereby certifies that this Petition for *Inter Partes* Review complies with the type-volume limitation of 37 C.F.R. §42.24(a). This Petition contains 13,844 words, excluding the parts of the Petition exempted by 37 C.F.R. §42.24(a), as calculated by Microsoft Word 2010, the word processing system used in its preparation.

FAEGRE DRINKER BIDDLE & REATH

Dated: January 21, 2023

By: /R. Trevor Carter/
R. Trevor Carter
Reg. No. 40,549

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. §42.105, I hereby certify that on January 21, 2023, I caused a true and correct copy of this Petition for *Inter Partes* Review in connection with U.S. Patent No. 10,687,633 and Exhibits 1001 – 1057 to be served via email and electronic file transfer to the following:

Dickinson Wright PLLC
John S. Artz (jsartz@dickinsonwright.com)
Steven A. Caloiaro (scaloiaro@dickinsonwright.com)

The above listed attorney of record for Patent Owner agreed to accept service of the petition and exhibits electronically.

FAEGRE DRINKER BIDDLE & REATH

Dated: January 21, 2023

By: /R. Trevor Carter/
R. Trevor Carter
Reg. No. 40,549