UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

BEDGEAR, LLC
Petitioner

v.

SHEEX, INC.
Patent Owner

Case To Be Assigned
U.S. Patent No. 8,402,580

DECLARATION OF SABIT ADANUR IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 8,402,580

Declaration of Sabit Adanur
In Support of Petition for *Inter Partes* Review of U.S. Patent No. 8,402,580

I, Sabit Adanur, declare as follows:

I. Overview

1. I am over 21 years of age and otherwise competent to make this Declaration. I make this Declaration based on facts and matters within my own knowledge and on information provided to me by others.

2. I have been retained as an expert witness to provide testimony on behalf of Bedgear, LLC as part of the above-captioned *inter partes* review proceeding. I understand that this proceeding involves U.S. Patent No. 8,402,580 ("the '580 patent") entitled "Fabric System." I am also being retained as an expert in proceedings involving U.S. Patent Nos., 8,566,982 ("the '982 patent"), and 9,109,309 ("the '309 patent"), each also entitled "Fabric System" (the '580, '982 and '309 patents collectively are referred to as "the Sheex patents"). I understand that one or more separate petition for *inter partes* review have been filed for each of the Sheex patents.

3. I understand that the '580 patent was filed on October 12, 2011 and issued on March 26, 2013, and that the '580 patent is currently assigned to Sheex, Inc. It is also my understanding that the '580 patent is a continuation of and claims priority to U.S. Ser. No. 12/569,659, filed on Sep. 29, 2009, which claims the

benefit of U.S. Provisional Patent Application Ser. No. 61/101,049 filed Sep. 29, 2008. It is my understanding that this date represents the earliest possible filing date to which the ‘580 patent is entitled.

4. I have reviewed and am familiar with the specification and prosecution history of the Sheex Patents. A copy of the ‘580 patent has been provided as Bedgear 1001. As I explain in more detail below, I am familiar with the technology at issue as of the earliest possible filing date of the ‘580 patent.

5. Below is a list of the information that I considered in arriving at my opinions:

a. The ‘580 patent and its prosecution history.
b. The ‘982 patent and its prosecution history.
c. The ‘309 patent and its prosecution history.
d. Petitions for *Inter Partes* Review of the Sheex patents.
e. Adanur, S., Wellington Sears Handbook of Industrial Textiles, Technomic Publishing Co., (CRC Press 1995).
f. Knitted Fabrics, Manufacture and Processing, Ciba-Geigy, 1976.
g. Spencer, D. J., Knitting Technology, Woodhead Publishing Limited, 1989.
h. Gajjar, B. J., Warp Knit Fabrics Technologies, Emerald Ink Publishing, 2007.
i. Chemstrand Co., Spandex Technology (Chemstrand 1965).
j. Man-made fiber and Textile Dictionary, Celanese Corporation, 1981, 1985.
k. Dictionary of Fiber and Textile Technology, Hoechst Celanese, 1990.

l. Adanur, S., Knitting Fundamentals, Class Notes for PFEN 2270 Introduction to Engineered Fibrous Materials.

m. Jeanne Stauffer, Sewing Smart with Fabric at 139 (2004)

n. Various knitting machine manufacturers brochures

o. Various knitted fabric sample structures from different manufacturers

p. US Patents Nos. 4,461,048 , 5,127,115, 5,415,924, 5,287,573, 5,636,380, 6,006,550, 6,016,591, 6,532,608, 6,782,590, 6,779,368, 2003/0154748, 2004/0132367, 2005/0027094, 2005/0193490, 6,412,540, 6,164,092, 6,167,825, 7,370,380, 2008/0233368, 7,240,383, 7,774,865, 2001/0014981, 7,945,970, 7,360,378

q. *Fiber Usage in Home Textiles 2007* (Dec. 12, 2007), http://www.researchandmarkets.com/reports/c77257

6. I have also reviewed and am familiar with the following prior art, which I understand is being used by Bedgear in the Petitions for *Inter partes* Review of the Sheex patents:

a. U.S. Patent No. 7,200,883 to David W. Haggerty ("Haggerty" provided as Ex. 1002).

b. U.S. Patent No. 3,696,475 to Heinz Fleissner ("Fleissner" provided as Ex. 1003).

c. U.S. Patent Application Publication No. 2005/0284189 to Richard F. Stewart ("Stewart" provided as Ex. 1004).

7. I have been asked to provide my technical review, analysis, and insight regarding the above-noted references, which I understand supports the basis for the grounds of rejection set forth in the Petitions.

8. I am being compensated at my normal consulting rate for my time spent in preparing this Declaration. I am being separately reimbursed for any out-of-pocket expenses. My compensation does not depend in any way on the outcome of this proceeding or the nature of my opinions.

9. I have no stake in the outcome of this proceeding or any related litigation or administrative proceedings.

10. I have been advised that Bryan Cave LLP represents the Petitioner Bedgear, LLC in this matter. I have no direct financial interest in the Petitioner. I have no direct financial interest in Petitioner, Sheex, Inc., or the Sheex patents.

II. My Background and Qualifications

11. My qualifications for forming the opinions set forth in this Declaration are listed in this section and provided in Exhibit Bedgear 1006, which is my curriculum vitae ("CV") which also includes a list of my publications and a list of the cases and proceedings over the last few years in which I have been deposed and/or testified as an expert.

12. I have extensive experience in knitting and knitted fabrics. My family had a knitting business in Istanbul, Turkey, where we had circular knitting machines; we also had a hand operated flat knitting machine to make knitted goods. I worked in that business during summer vacations before I came to the U.S.

13. I have a B.S. in Mechanical Engineering, an M.S. in Textile Engineering and Science, and a Ph.D. in Fiber and Polymer Science. During my M.S. and Ph.D. studies at North Carolina State University, I took several courses and lab sessions in fabric formation including knitting.

14. I have been teaching knitting technology and structure of knitted fabrics since I joined Auburn University in 1992. I have taught the following courses which include knitting technology and knitted fabric structures:

a. PFEN 2270 Introduction to Engineered Fibrous Materials
b. PFEN 3300 Fibrous Product Testing and Instrumentation
c. PFEN 4300 Engineered Fibrous Structures
d. PFEN 6250 Advanced Engineering Fibrous Structures
e. PFEN 7210 Fabric Formation and Properties
f. TE 225 Fabric Design and Manufacturing
g. TE 460 Mechanics of Textile Manufacturing Processes and Systems
h. TXTN 3450 Technical Textiles

15. Some of these courses involved laboratory sessions in which we used both circular and flat warp and weft knitting machines to teach the students. For example, in the Fall 2015 semester, I taught PFEN 2270 which includes a chapter in knitting technology and knitted fabrics.

16. One of my Ph.D. students did his dissertation on a patented hybrid weaving/knitting machine to produce woven/knitted fabrics. We published the following articles as a result of that work:

- Adanur, S., and Onal, L., "Analysis of a Novel 3D Hybrid Woven/Knitted Fabric Structure, Part II: Mechanical Model to Predict

Modulus and Extension", Textile Research Journal, 74(10), 865-871, October 2004.

- Onal, L., and Adanur, S., "Analysis of a Novel 3D Hybrid Woven/Knitted Fabric Structure, Part I: Geometric Model and Verification", Textile Research Journal, 74(9), 827-832, September 2004.

17. We made the following presentations about this project:

- Onal, L., and Adanur, S., "A Novel 3D Structure, 3D Hybrid Woven/Knitted Fabric", Proceedings of The Fiber Society 2003 Spring Symposium, "Advanced Flexible Materials and Structures: Engineering with Fibers", June 30-July 2, 2003, Loughborough, England.
- Adanur, S., and Onal, L., "Design Characterization of a Novel 3D Hybrid Knitted/Woven Fibrous Structure for Composites", Proceedings of the 2003 NSF Design, Service and Manufacturing Grantees and Research Conference, January 6-9, 2003, Birmingham, AL.
- Adanur, S., Gumusel., L. and Bas, H., "A Novel 3D Woven-Knit Hybrid Fabric for Composites", Techtextil North America Symposium, April 1-3, 2008, Atlanta, GA.

18. My book entitled "Wellington Sears Handbook of Industrial Textiles" (Technomic/CRC Press, 1995) includes a chapter on knitting technology and knitted fabrics.

19. I have attended many ATME-I (American Textile Machinery Exhibition-International) textile machinery shows in the USA, ITMA machinery shows (International Textile Machinery Association) in Europe (Milan, Paris, Birmingham, Munich), and TechTextile show in China. In these shows, I kept myself up to date with the latest developments in textile machinery and fabrics, including knitting machinery and knitted fabrics. As a result, I have a large

collection of knitting machine brochures and knitted fabric samples, which I use in my classes.

20. Between 2008 and 2015, I was retained as an expert witness by multiple textile companies in cases involving knitted fabric structures. Earlier, I did consulting work for Eaton Corp., Milwaukee in woven and knit reinforcements for composites. I also did consulting work for Hoechst Celanese, Spartanburg, SC in developing a warp knitted structure using elastomeric monofilament fiber.

III. My Expertise and the Person of Ordinary Skill in the Art

21. As a result of my more than thirty years of experience in textile engineering, I am very familiar with fabric systems including bedding. My experience working with industry, with undergraduate and post-graduate students, with colleagues from academia, and with engineers practicing in industry has allowed me to become directly and personally familiar with the level of skill of individuals and the general state of the art.

22. A person of ordinary skill in the art as of the earliest possible filing date (hereinafter a "POSITA") would generally have a bachelor's degree in textile engineering and science, or a similar field. Two years of experience in the field of textile manufacturing might substitute for formal education.

23. It is my opinion that a POSITA would have at least two years' experience with all aspects of knitted bedding material from the conceptual stage

through design, development, commercialization, and manufacturing, including basic knowledge of the functional requirements of bedding material and a comprehensive understanding of the range of material choices, as well as construction techniques and processes used to create the various types of bedding materials. For example, such a person would have the skills and capabilities to identify knitting machines, knitted fabric structures and their major properties as well as finishing machines and processes.

IV. Applicable Legal Standards

24. I am not an attorney and do not expect to offer any opinions regarding the law. However, I have been informed of certain legal principles relating to patent claim construction and validity that I relied upon in reaching the opinions set forth in this report.

Obviousness

25. It is my understanding that obviousness is determined from the vantage point of a person of ordinary skill in the art at the time the invention was made. In order to be considered invalid under this ground, I understand that the proposed combination of asserted references must teach or suggest each and every claim feature and that the claimed invention as a whole must have been obvious at that time to one of ordinary skill in the art. My understanding is that one should avoid the use of "hindsight" in assessing whether a claimed invention would have

been obvious. For example, an invention should not be considered in view of what persons of ordinary skill would know today, nor should it be reconstructed after the fact by starting with the claims themselves and/or by reading into the prior art the teachings of the invention at issue. Accordingly, I understand that the term "obvious" has both a legal and a technical meaning. When the term "obvious" is used throughout this declaration, my opinions and conclusions will be directed to the technical meaning of obvious (*i.e.*, whether the subject matter was within the technical grasp of a person of ordinary skill at the time of the invention).

26. It is my understanding that obviousness cannot be proven by mere conclusory statements or by merely showing that an invention is a combination of elements that were already previously known in the prior art. Rather, it is my understanding that a party challenging a patent in an *inter partes* review proceeding must further establish by a preponderance of the evidence that there was an apparent reason with some rational underpinnings that would have prompted a person of ordinary skill at the time of the invention to have combined and/or altered these known elements to arrive at the claimed invention. Such reasons might include, for example, teachings, suggestions, or motivations to combine that would have been apparent to a person of ordinary skill in the art.

Claim Language

27. I understand that, in *inter partes* review proceedings, claim terms are to be given the broadest reasonable construction in light of the specification as would be read by a person of ordinary skill in the relevant art.

28. As the result of my education and experience, I believe that I understand how the asserted claims of the Sheex patents would be understood by a person of ordinary skill in the art applying the above standard.

Admitted Prior Art

29. I understand that valid prior art may be created by admissions of the applicant. For example, a statement by an applicant in the specification or made during the prosecution of the application can be an admission. The admission may then be treated as prior art, and relied upon for both anticipation and obviousness determinations.

V. Overview Of The Technology At The Time Of The Sheex Patents

30. The Sheex patents generally relate to bed coverings or sheets that include two or more portions of fabric made by a knitting process. '580 patent at Abstract, 1:15-20, 3:51-62. Knitting is one of five different ways of constructing fabric. WELLINGTON at 87. The other four methods of constructing fabric include weaving, braiding, tufting, and nonwoven manufacturing. *Id.* Weaving is the interlacing of warp and weft yarns over and under each other, and is typically found in, for example, a dress shirt. *Id.* Braiding is also made of interlacing two

sets of yarns over and under each other at an angle. *Id.* A fabric shoe lace is an example of a braided fabric. *Id.* Tufting is a method typically used to manufacture carpets. *Id.* In tufting, surface yarns are stitched to a base fabric, coated, and joined with a secondary backing. Nonwoven fabrics are constructed by entangling fibers together. *Id.* A disposable wipe is an example of a nonwoven fabric.

31. Knit fabrics are typically formed by constructing a series of interlocking loops of one or more yarns. *Id.* at 127. Yarns are typically constructed of textile fibers that are twisted or otherwise held together. *Id.* at 66.

32. Fibers can be natural or synthetic (*i.e.*, manmade). WELLINGTON at 37. Natural fibers can be obtained from plants (*e.g.* cotton) or animals (*e.g.* wool). *Id.* Synthetic fibers are generally made from polymers using different techniques such as melt spinning (*i.e.*, extrusion), dry spinning, and wet spinning. *Id.* at 40. In melt spinning, polymer is melted by heat and extruded through tiny holes in a spinneret on the extruder. *Id.* at 57. The extruded fibers are cooled down with air or water, which then form solid fibers. In dry and wet spinning, a polymer is dissolved in a chemical, the solution is passed through the spinneret holes, and then the solvent is removed. The synthetic fibers produced by these methods can generally be made to any length. Synthetic fibers can be made of one or more polymers. *Id.* at 40.

33. Yarns can be classified as staple yarns and continuous filament yarns. Staple yarns are made by twisting short fibers (natural fibers or synthetic fibers that are cut into short lengths after fiber spinning) together. This can be done in one of four different ways: ring spinning, open-end (rotor spinning), air-jet spinning and friction spinning. Continuous filament yarns are made of very long fibers (as they come out of the fiber spinning machine) and slightly twisted.

34. Yarns can be made of one type of fiber or multiple types of fibers. As a result, there could be several ways to combine different fibers in a yarn. Different yarn properties can be obtained by mixing different fibers together. For example, polyester fibers can be mixed with spandex fibers in a yarn to achieve a hybrid yarn with a desired strength and elasticity suitable for performance fabrics.

35. When describing the construction of knit fabrics, the following terms are commonly used in reference to the way the fabrics are formed and machines that are commonly used:

- Course: horizontal row of successive loops.
- Wale: vertical column of loops.
- Count: total number of wales and courses per square inch of fabric.
- Stitch density: total number of loops in a square area.
- Gauge: number of needles per unit width. Gauge has a direct correlation with the fineness or coarseness of the fabric (*e.g.*, the higher the gauge, the more fine the fabric). Fabrics constructed with a high gauge typically use finer yarn, because of the density with which

the needles knit the fabric. Fine fibers may also be used with low gauge machines, but will generally result in an open lace or open stitch pattern. On the other hand, low gauge machines may be used to knit fabrics with thick fibers. A table of typical gauges and exemplary knits fabrics is given in Table 1.

Table 1 Typical gauges and fabrics in knitting

Gauge	Fabric
2.5-5	Thick, heavy yarn, for use in sweaters
5-8	Finer yarn for use in medium set sweaters
8-12	For use with light sweaters
14-18	Men's underwear
18-32	Outerwear (T-shirts, sweatshirts, polo shirts)
22-30	Athletic Apparel
40	Pantyhose, swimwear, lingerie

WELLINGTON at 127.

- Stitch: the loop formed at each needle (the basic repeating unit of knit fabric structure)

36. Knitted textiles are generally divided into warp-knitted and weft-knitted on the basis of how the loops of the fabrics are constructed. *Id.* Generally, weft-knitted textiles are constructed by crimping yarn into loops along a horizontal axis, whereas warp-knitted textiles are constructed by crimping yarn into loops along a vertical axis as shown below in Figure 1. *Id.*; CIBA-GEIGY, KNITTED FABRICS, MANUFACTURE AND PROCESSING, 55 (1976). There are different subcategories of loop structures within the broader categories of "weft knit" fabrics and "warp knit" fabrics. For example, weft knit fabrics can further be classified as single knits and double knits. Two subcategories of warp knitting include tricot or raschel knit fabrics.

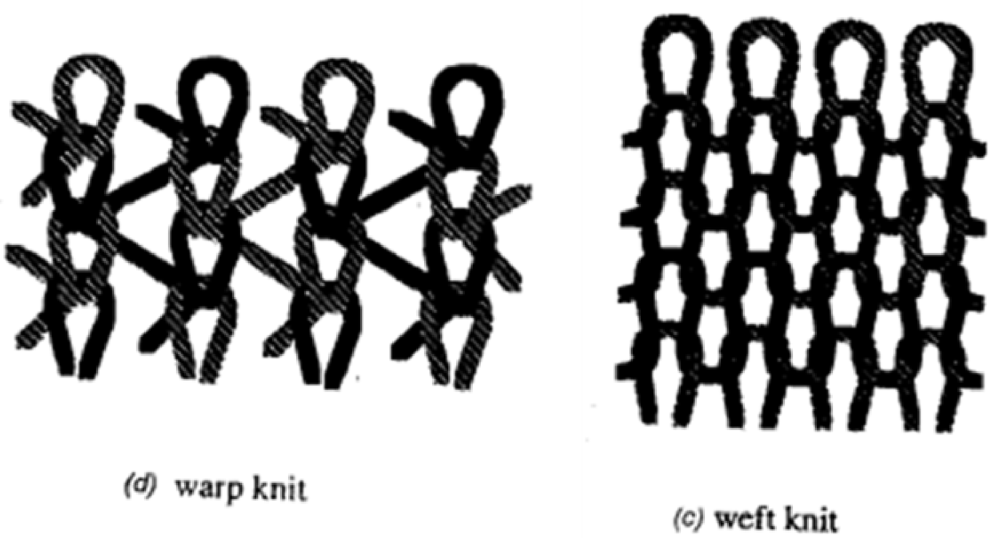

Figure 1. Warp-knitted fabric structure (left) and weft-knitted fabric structure (right). WELLINGTON, at p. 85.

37. The choice in knitting machine used to create a fabric depends on the type of loop structure desired. While different knitting machines may be used to create weft knit or warp knit fabrics, a particular knitting machine will govern the manner in which loops of the knit are formed. The weft or warp knit structures are generally formed using either a flat or circular knitting machine. WELLINGTON at p. 127; CIBA-GEIGY, at pp. 9, 11, 12; GAJJAR, B. J., WARP KNIT FABRICS TECHNOLOGIES 9 (Emerald Ink Publishing, 2007).

38. The Sheex patents state that circular knitting is a form of weft knitting. '580 patent at 2:57-3:4. A POSITA would have understood that although both flat knitting machines and circular knitting machines may be used to produce warp-knitted or weft-knitted textiles that circular knit machines were more commonly used for weft knit fabrics, and that flat knitting machines were more commonly used for warp knitting. WELLINGTON at 128-129; *see also* CIBA-GEIGY, at 11; GAJJAR, at 9. *Cf.* '580 patent at 2:57-3:4.

39. Circular weft knit machines typically utilize a rotating cylinder. *See* WELLINGTON at 128. Needles are placed on the circumference of the cylinder drum and are engaged by cams which cause needles to move up and down. Yarn is fed to the needles to form the interlocking loops of the knit structure. In flat weft knitting machines yarn is fed to a moving head that reciprocates along the machine width.

Table 2 Classification of knits

<table>
<tr><td colspan="2" rowspan="2"></td><td colspan="2">Arrangement of Needles in the Knitting Machine</td></tr>
<tr><td>In one line (flat)</td><td>In a circle (circular)</td></tr>
<tr><td rowspan="2">Direction of thread</td><td>Lengthwise in the fabric (warp)</td><td>Flat warp knit fabric</td><td>Circular warp knit fabric</td></tr>
<tr><td>Crosswise in the fabric (weft)</td><td>Flat weft knit fabric</td><td>Circular weft knit fabric</td></tr>
</table>

In circular weft knitting, the fabric is formed in a hollow tube shape whereas in flat knitting, the fabric is formed in a planar shape. The diameter of a hollow tube of fabric produced by a circularly knit machine depends in part on the size of the circular knitting machine itself. Machinery for manufacturing circularly knit fabrics was well-known and in widespread use long before the earliest possible filing date of the '580 patent. '580 patent at 2:57-3:4, 2:15-22, 7:65-8:5. For example, circular knitting has been used to manufacture fabrics since at least 1907. *See* DAVID J. SPENCER, KNITTING TECHNOLOGY, 76 (2nd Ed., 1997).

40. In warp knitting machines, multiple yarns are wound on a beam; each yarn is fed into a needle. WELLINGTON at 130. Warp knitting is usually performed with flat machines, where needles are placed on a bar on the machine, and each needle is fed a separate yarn. Warp knitting with circular machines was well known to POSITAs long before the earliest possible filing date of the '580 patent,

however warp knitting was–and still is–most commonly performed with flat knitting machines. As explained above, flat weft knitting machines produce a planar knit fabric. Warp knit and weft knit fabrics can generally be constructed from a wide variety of different yarns.

41. Circular weft knit fabrics typically exhibit several characteristics, such as the ability to:

- Be either fully fashioned or cut to shape and sewn
- Form a run in the wale direction if a yarn breaks
- Stretch in the course direction
- Recover from wrinkling and folding

WELLINGTON at 130. These characteristics are suitable for various end-use applications. *See* '580 patent at 1:59-62. For example, circular weft knit fabrics are used in apparel (lingerie, underwear, infants' wear, hosiery products, sweaters, outerwear, swimsuits), household items (crib mattresses, upholstery, furniture, mattress covers and pads), and industrial applications (medical products such as artificial arteries and bandages, reinforcing structures in helmets and hoses, flexible composites and geotextiles). *See, e.g.,* WELLINGTON at 475.

42. Elasticity is one characteristic that is particularly useful with athletic apparel. WELLINGTON at 475; *see also* U.S. Pat. No. 5,415,924 ("Elasticity … is an essential feature of any garments worn by bicyclists and surfers who prefer garments which are snug but flexible and comfortable."); 6,006,550 ("[T]he fabric

has good elasticity properties, is durable, and remains stable when pulled or stretched. Furthermore, the fabric has good washability characteristics, and dries quickly due to its airy nature. As a result, the fabric has particular advantages in the manufacture of athletic apparel"). Elasticity reflects the ability of a fabric to adapt to a new shape in the presence of a load, and recover to its original shape after the load is removed. WELLINGTON at 575. Thus, it was also well known that fabrics with elasticity were useful in bedding applications. For example, fabrics with high elasticity could be used in fitted sheets to fit a wider range of bed and mattress sizes, and enhance the comfort of a bed sheet to a user. *See e.g.,* U.S. Pat. No. 6,532,608 ("Elasticity of the fabric permits use with a range of mattress thicknesses, and further provides an enhanced level of comfort to the user."); U.S. Pat. Pub. No. 2003/0154748 ("This overall blend of spandex and poly-cotton fibers creates a knitted fabric having resilience, elasticity and versatility beyond that of a traditional poly-cotton blend fabric. This knitted fabric is used to produce fitted contour sheets which retain shape better, are more easily handled, and have a greater life than standard poly-cotton blend sheets."). A fabric's elasticity is typically a result of the type of yarn and loop structure used to knit the fabric. The elasticity due to the fabric's yarn is in part based on the viscoelasticity of the yarn's fibers. *Id.* Viscoelasticity is a measure of the fiber's ability to stretch or strain (also known as "elongation") in response to an applied stress (such as a weightbearing load), and the fiber's ability to recover from that load. *Id.* at 575. Fibers with high recovery were known as elastomeric. *See* '695 at 1:35-43("[H]ard yarns, which are not elastomeric, do not provide a recovery force to rearrange the knit stitches."). It was well known that spandex was considered an elastomeric yarn. U.S. Pat. No. 6,164,092 ("[I]t is preferred that the material be made of the elastomeric textile fiber known as spandex"). It was also well known that spandex has particularly high elongation and elastic recovery properties. WELLINGTON at 568.

43. With respect to loop structure, a weft knit fabric contains several crimps along the horizontal axis as shown above in Figure 1. When the fabric is pulled along this direction, the crimps expand, causing the fabric to stretch. This is also true in the vertical direction to a lesser extent. The loop structure and elasticity of the fibers will cause the loops to retract to their crimped state when tension is released. In this way, the fabric's loops function like springs that stretch under tension, and retract when the tensioning forces are released. Warp knit fabrics, by contrast are less elastic because of the geometry of the loop structures. As Figure 1 above shows, there are less crimps along the vertical or horizontal axis that causes the fabric to stretch.

44. Some fibers are more elastic than others. For example, spandex is a highly elastic type of fiber, and when included in greater amounts of a yarn,

increases the elasticity of the fabric. WELLINGTON at 816. The term "spandex" refers to the industry-wide generic name given to fibers based on the chemistry of the fibers and their physical properties. WELLINGTON at 37. It is a manufactured fiber in which the fiber forming substance is a segmented polyurethane molecular structure. *Id.* at 50. Polymers have chemical names assigned by the International Union of Pure and Applied Chemistry ("IUPAC") based on their chemical components. Thus, the chemical name for spandex fiber is polyurethane.

45. The polyurethane structures can be formed by a variety of different processes. For example, the specific steps and conditions used by Dupont Inc. form their proprietary version of spandex known as Lycra®. Different processes may result in different properties in the fiber. Polyurethane-urea is a copolymer that is a subclass of polyurethane. *See e.g.*, U.S. Pat. Pub. 2005/0027094 ("The polyurethane can be a polyurethaneurea, which is a sub-class of polyurethane."). The Sheex patents state that spandex—which is also commonly referred to as elastane—"is a polyurethane-polyurea copolymer that was invented by DuPont." *Id.*; *see also* '580 patent at 4:21-30. A POSITA would have understood from this discussion of spandex in the '580 patent that both polyurethane and polyurethane-polyurea copolymers were well-known types of spandex, and commonly used for their "exceptional elasticity." '580 patent at 4:21-30; *see also* ("Polyurethane/urea elastomers in the form of fibers and films have found wide acceptance in the textile

industry.”). Because of spandex’s exceptional elasticity and strength, spandex has typically been used in materials and textiles such as elastic bands, protective apparel, athletic wear and bedding. WELLINGTON at 50.

46. After a fabric is manufactured (*e.g.*, using circular knitting), the fabric undergoes one or more finishing processes. Finishing processes can involve mechanically treating the fabric (*e.g.*, heat setting the fabric), or chemically treating the fabric (*e.g.*, applying dye or chemicals to a fabric). WELLINGTON, at 173-174. There are many reasons for finishing of fabrics such as, for example, imparting properties onto the fabric, improving durability, or setting dyes. *Id.* The imparted properties can include for example various functional qualities, such as moisture management, UV protection, anti-microbial properties, thermo-regulation, and wind and water resistance. Heat setting processes are generally used to permanently set the twist and crimps of the fabric’s yarns. *Id.* It was well known to a POSITA to use heat setting to finish performance fabrics. For example, it was well known that heat setting of fabrics containing spandex would increase the fabric’s dimensional stability. *Id.* at 174; ‘695 patent at 2:55-59 (explaining that heat setting stabilizes the spandex). It was also well known to use a heat setting process to finish bedding fabrics. *See, e.g.*, U.S. Pat. No. 5,127,115 (describing a mattress cover, explaining that “[d]uring the finishing process, the nylon-covered synthetic threads are heat-set on a tenter frame.”).

47. Some of these finishing processes require the fabric be kept relatively flat as it is passed through a finishing machine. Otherwise, the fabric may interfere with the finishing process. WELLINGTON at 161-162; '580 patent at 8:6-23. If the fabric is non-flat (*e.g.*, by having waves, undulating centers, sags, or wrinkles), the effectiveness or quality of the finishing process may become impaired. WELLINGTON at 161-162. For example, a finish or dye may not be taken up uniformly by the fibers, wrinkles may be permanently set, the strength of the fabric may be reduced, fabric width or weight may be improper, distortions may form resulting in bowing or skewing, or the fabric may catch a roll, or similar component that is used to convey or pass the fabric through a finishing machine. WELLINGTON at 161-162.

48. Finishing machines use different components to flatten wrinkles and sags out of a knit fabric before it is passed through the machine. For example, some processes cut the circular knit fabric open and attach its edges to a tenter frame or tenter pins which are used to apply tension and flatten waves, wrinkles, or sags in the fabric before being passed through a heat set machine. *See* '695 patent at 2:45-47; U.S. Pat. No. 6,016,591 at ("In order to carry out the heat setting of the raw tubular goods, it has conventionally been necessary to first cut open the tubular goods along the lengthwise direction, *i.e.* so as to open the tubular goods into a flat single layer knitted web, which is then held under tension in a tentering

frame in a flat planar condition, whereupon the heat fixing is carried out in a heat fixing apparatus."). A tenter frame typically includes a pair of traveling chains fitted with clips or fine pins on horizontal tracks. Care is usually taken to limit the amount of tension applied to the fabric, because excessive tension will cause a loss in the elasticity of the fabric. CHEMSTRAND at 159. If the fabric is wider than the width of the tenter frame, then the fabric will wrinkle or sag, interfering with the finishing process. With other processes, the circular knit fabric is not cut open and is heat set by passing through the machine in tubular form. In these processes, the circular knit fabric is still flattened to prevent the unwanted distortions in the fabric described above.

49. A fabric will sag when the forces in the knit structure and fiber pulling the fabric inwards are greater than the tension being applied to the fabric, causing the fabric to bag or crumple in the center. Knit fabrics are especially prone to sagging because of their loop structures. When manufactured at large widths, forces pulling the fabric in and down are greater than the forces of the loop structures and yarns support the circular knit fabrics, causing the fabric to sag. The Sheex patents describe this property of circularly knit elastic performance fabrics, explaining that at larger widths the sagging interferes with the finishing process, making it difficult to impossible. '580 patent at 8:6-23. Performance fabrics with high elasticity in particular create sagging issues. *See id.*

50. The Sheex patents describe some fabrics as "performance fabrics." As I describe in more detail below, a POSITA would have understood the term "performance fabrics" to have a particular meaning when read in the context of the patent's claims, specification, and file history. However, generally speaking, a POSITA would have understood that a fabric's performance depends in part on the fiber and yarn structure of its constituent materials, as well as the finishing processes that it receives. The Sheex patents state that "performance fabrics" provide functional qualities such as moisture management, UV protection, anti-microbial protection, thermal regulation, wind resistance and water resistance. It was well known to a POSITA that performance fabrics had these properties. *See, e.g.,* U.S. Pat. Nos. 6,782,590; 6,779,368; 2004/0132367; 6,412,540; WELLINGTON 361-362. A POSITA would have understood that some of these properties are imparted on a fabric during the finishing processes. WELLINGTON at 475.

51. It was well known to a POSITA that performance fabrics containing spandex were typically manufactured using "high-gauge" circular knitting machines because these fabrics required dense knitting with thin yarn. A POSITA would have understood that "high gauge" could refer to machines with 17 gauges or more, which indicates that at least 17 cylinder needles are contained in one inch. *See* '580 patent at 7:52-61. High-gauge circular weft knitting was well-known long before the time of the Sheex patents, and was commonly used to manufacture

performance fabrics for various products, including athletic apparel. '580 patent at 2:57-3:4, 3:39-43, 7:23-31 & 48-55, 7:65-8:6; WELLINGTON at 475.

52. Circular weft knit machines were also commonly used to form bed sheets, because these machines are usually faster and more ubiquitous than other machines. The Sheex patents state that pre-existing circular knitting machines were limited in that high gauge circular knit performance fabrics could "only be made to a maximum size of 72.5 inches without losing the integrity of the spandex in the fabric." '580 patent at 7:29-32. A POSITA would have understood that integrity is lost when, for example, the structure of the loops are damaged or broken, the viscoelasticity of the fibers has changed, or the fabric's dimensional stability has been altered, causing additional sagging or runs in the fabric. Although a fabric should not lose its integrity merely because it is knit at 72.5 inches or higher, a POSITA would have understood that at the maximum width limitation, the amount of tension needed to keep the fabric flat could damage the elasticity or dimensional stability of the fabric as described above.

53. According to the Sheex patents, performance fabrics were not previously used for bed sheets because of their tendency to sag at certain widths, which would interfere with a finishing process. '580 patent at 2:14-24, 2:66-3:2 (although "normal bed sheet panels can be 102 by 91 inches or larger," the machinery available for high-gauge circular knitting "can only produce a fabric

with a maximum width of approximately 90 inches."), *id.* at 7:229-32 (high-gauge circular knit fabrics "can only be made to a maximum size of 72.5 inches without losing the integrity of the spandex . . . [y]et normal sheet panels are 102x91 inches."), 7:6-23. However, in my opinion, this alleged inability to use performance fabrics in bed sheets refers to the Applicant's particular experience with a limited set of knitting and finishing machines. *See, e.g.,* U.S. Pat. No. 7,370,380 ("The systems and methods described herein are directed, inter alia, to bedding articles…. One layer includes a channeled fiber material, such as Coolmax®, and may serve to wick away moisture as the user sleeps …."); U.S. Pat. Pub. 2008/0233368 ("By combining this phased temperature buffering with the rapid moisture wicking fiber/fabric properties of known fibers and fabrics, the physical discomforts of "hot flashes" can be further mitigated or eliminated. It is contemplated that this technology may be applied to both clothing and bedding (mattress pads, sheets, pillowcases, and fill)."); *Fiber Usage in Home Textiles 2007* (Dec. 12, 2007), http://www.researchandmarkets.com/reports/c77257 ("Manufacturers have successfully adapted performance apparel technologies for use in home textile products. For example, bed sheets are being made from Coolmax and Thermolite fabrics").

54. The file history of the '580 patent states that the finishing machines the Applicant was using had an apparent threshold at which the width of the fabric

would interfere with the finishing process. To address this, the Applicant simply finished multiple pieces of fabrics at a shorter width, and then joined them to create a fabric 90 inches wide. A POSITA would have found it obvious to finish the fabric portions and then join them together to create a fabric 90 inches wide. In my opinion, a POSITA would have also understood that the fabric could be finished at larger widths by utilizing larger finishing machines and/or tenter frames. For example, a POSITA would have understood that circular knitting machines such as the ones manufactured by Orizio, Terrot and others available before the earliest possible filing date of the '580 patent could produce wide circularly knit fabrics, and that heat setting machines manufactured by Noya Mekatronik or Guruson and available before the earliest possible filing date of the '580 patent could have been used to finish the wide circularly knit fabrics. Thus, a POSITA would have used understood that a larger machine could be used instead of attempting to finish a wide and sagging piece of fabric with a narrow finishing machine.

55. After a circular knit fabric is knit, cut, and finished, it may then be joined to other pieces of fabric. The Sheex patents state that the fabrics are joined together by stitching in order to make a bed sheet. Stitching is the combining of two or more pieces of fabrics to obtain a larger piece in the desired shape. This concept was well known long before the earliest possible filing date of the Sheex patents. For example, seaming was a well-known technique for joining large

sheets of geotextiles together to form fabrics well over 90 inches wide. *See*, *e.g.*, WELLINGTON at 303-305. Geotextiles are usually constructed of permeable materials and used in civil engineering applications. Such techniques for joining fabrics have long been used in civil engineering applications, such as for example to cover large areas such as runways, highways, and landfills. As additional examples, fabrics have been joined to be well over 90 inches wide to construct parachute fabrics, coverings for airplanes, fabrics for camouflage, and fabrics for roofs or stadium covers (*e.g.*, the Georgia Dome in Atlanta, and the Alliance Arena in Munich). As discussed in more detail below, these techniques for joining together multiple portions of fabric to construct finished fabrics, including bed sheets and covers that were at least 90 inches wide were well known to a POSITA. *See, e.g.,* Haggerty Abstract, 1:28-38, 3:34-42, 4:41-46, FIG. 4; Seago at Abstract, 5:61-6:21, 7:30-8:21, FIGS. 3, 4; U.S. Patent No. 7,240,383 (provided as Ex. 1010, "Stewart II") at Title, Abstract, 2:45-3:41, FIG. 1; U.S. Patent No. 5,287,573 (provided as Ex. 1011, "Ritacco") at Abstract, 1:35-50, 2:5-7, 2:27-29, FIG. 1; U.S. Patent Application Publication No. 2005/0193490 (provided as Ex. 1012, "MacDonald") at Abstract, ¶¶ [0016], [0017], [0020], [0024], FIGS. 1, 7.

56. The '580 patent states that flatlock stitching is used to join portions of the fabric to create a sheet. '580 patent at 4:40-44. Flatlock stitching typically involves abutting two fabric edges against each other, instead of overlapping and

folding the two edges in the seam area. In particular, the abutted fabric edges are joined together with a thread as a single layer, without increasing the thickness in the seam area that would otherwise result from overlapping the two edges. Because flatlock stitches reduces the overall thickness of a seam, they are more comfortable for consumers when applied to form-fitting apparel, such as underwear, pajamas, and athletic wear. Flatlock stitching existed long before the Sheex patents and has been used extensively in apparel manufacturing, including their common application in underwear, pajamas, and athletic wear. *See, e.g.,* U.S. Pat. No. 7,774,865 (describing an athletic support garment constructed with flat lock stitch seams); U.S. Pat. Pub. 2001/0014981 at ¶ [0029] ("Insofar as the article of clothing is dimensioned and seamed to achieve high tension over the wearer's body, it is preferred, as already widely practiced in racing swimwear, to use Flatlock or Flatseam"), U.S. Pat. No. 7,945,970 at 2:60-67 ("Preferably, the pieces are assembled together by flatlock or whipstitch type stitching, advantageously making use of crimped type yarn … so as to ensure that the presence of the stitching does not lead to non-uniformity in the mean elasticities….").

57. The '580 patent identifies several examples of fabrics that are purportedly performance fabrics, including Coolmax® and ThermaStat®. '580 patent at 2:54-56. A POSITA would have understood that these fabrics have properties that make them suitable for a variety of end-use applications, and were

well-known long before the ‘580 patent. For example, Coolmax® is made by Invista and offers a fiber based moisture management system. The fabric structure used in Coolmax® causes perspiration to move away from the body through the fabric and to evaporate. *See, e.g.,* U.S. Pat. 7,360,378 at 2:41-55 (“[T]he wicking properties of inner layer 105 are inherent in wicking fibers 145 …. [E]mbodiments of fiber 145 include those sold respectively, under the registered trademarks, CoolMax® and Aqwateck®.”) This results in the fabric feeling cooler and more comfortable. Coolmax® was well-known before the earliest possible filing date of the ‘580 patent. *See* ‘580 patent at 2:44-46 (stating that Coolmax is described in U.S. Pat. No. 5,636,380); *see also* U.S. Pat. 7,360,378 at 2:41-55. ThermaStat® is another example of a performance fabric, which was made by DuPont and has better insulation properties than other fabrics. The micro-sized hollow core polyester fiber wicks perspiration away from the skin, keeping the skin dry. In 2000, the ThermaStat® products were relaunched under the name of Thermolite® by DuPont. Accordingly, ThermaStat® was well-known long before the earliest possible filing date of the ‘580 patent. Thermax™ is another example of a performance fabric that is a fiberglass reinforced polyisocyanurate foam insulation material. This material was well-known and produced by Dow long before the earliest possible filing date of the ‘580 patent.

VI. The '580 Patent

58. The '580 patent explains that there are many factors that contribute to sleep quality, such as maintaining an environment that is cool and comfortable. '580 patent at 1:33-36, 52-55. The '580 patent also states that providing moisture resistant bedding would improve sleep. *Id.* at 1:63-2:4. The '580 then states that "performance fabrics" would be uniquely suited for use in bedding products because of their ability to maximize breathability and heat transfer, which in turn would promote cool and comfortable sleep. *Id.* at 55-62. In addition to these functional qualities, the '580 patent states that performance fabrics also have moisture management, UV protection, anti-microbial, thermo-regulation, and wind/water resistance qualities. *Id.* Moreover, the '580 patent states that the wicking properties of performance fabrics would improve sleep because of the discomfort that arises from body sweat, environmental moisture, and other bodily fluids. *Id.* at 2:5-13.

59. These discussions appear under the heading entitled "Background of the Invention", and under a subheading entitled "Description of Related Art." The '580 patent further states that these performance fabrics were invented and patented by others, and cites to third party patents that explain the details of their properties. For example, the '580 patent discusses several examples of performance fabrics that were invented by other applicants, and described in other

patents. Specifically, the '580 patent states that CoolmaxQ, ThermastatQ, and ThermaxB were invented and disclosed in U.S. Pat. No. 5,636,380, and provided wicking capabilities. While these discussions describe these well-known performance fabrics and their properties, it also describes the alleged needs and problems with their use in the industry. *Id.* at 2:1-14. For at least these reasons, a POSITA would have understood from these discussions that performance fabrics were well-known before the '580 patent, and that they exhibited these functional qualities. *See, e.g.,* U.S. Pat. No. 7,360,378. This is also consistent with my understanding, which is that performance fabrics and their beneficial properties were well-known and commonly used in various applications long before the earliest possible filing date of the '580 patent. WELLINGTON at 475 -477.

60. A POSITA would have also understood that elasticity was another well-known beneficial property of circular knit performance fabrics. Specifically, the Background section of the patent states that circularly weft knit fabrics provide better stretch properties than warp knit fabrics. '580 patent at 3:13-15. A POSITA would have understood from this discussion that elasticity was a well-known property of circularly knit performance fabrics. This is also consistent with my understanding, which as described above, is that elasticity is based in part on a fabric's loop structure and fiber viscoelasticity. Because of the loop structure of circularly knit fabrics, a POSITA would have understood that a circularly knit

performance fabric has greater elasticity. The '580 patent further states that circular knit fabric provides greater multi-directional stretch. *Id.* at 6:38-40. Although this is discussed under the heading entitled "Detailed Description of Preferred Embodiments," a POSITA would have further understood this to be a property of circularly knit performance fabric, because this property is discussed in connection with known warp knitting machines and their known properties. *Id.* at 6:32-39.

61. Although discussed under the heading titled "Brief Summary of the Invention," a POSITA would have also understood from the patent's discussion of spandex that elasticity was a well-known property of spandex-based circularly knit performance fabrics. Specifically, the '580 patent describes this property in connection with spandex, a well-known fiber, and the problems of the prior art bed sheets. For example, the '580 patent states that spandex-based fabrics were well-known and commonly used for their widely recognized property of elasticity. Further, the '580 patent states that spandex was already known in the US by its generic name ("spandex"), and by "elastane" elsewhere. *Id.* at 4:21-29. The '580 patent also states that the polyurethane-polyurea copolymer version of spandex had already been invented by DuPont, and that the "Lycra" brand of spandex had become "famous." '580 patent at 4:21-29. Like the cooling and moisture-wicking properties described above, the '580 patent links the elasticity of the performance

fabric with the problems of the prior art bedding products, such as bunching, sliding, and non-smooth surfaces. *Id.* at 4:9-20, 21-29. A POSITA would have clearly understood from this discussion that spandex and its elastic properties were well known and commonly used before the earliest possible filing date of the ‘580 patent.

62. Moreover, a POSITA would have understood that because of the discussions of the fitting problems of bed sheets, and because the performance fabric can include spandex, the elastic properties of spandex-based performance fabrics were well known. *Id.* This is also consistent with my understanding, which is that spandex and its elastic properties were well known long before the ‘580 patent. WELLINGTON at 50, 555-606, 816. It is also consistent with my understanding that spandex-based performance fabrics and their elastic properties were well known. WELLINGTON at 476.

63. The ‘580 patent explains that to obtain the full benefits and advantages of performance fabrics, circular knitting must be used. *Id.* at 3:16-18. The ‘580 patent then discusses circular knitting in the Background section, and its common application in the athletic apparel. *Id.* at 2:57-58. For example, the ‘580 patent states that the process of feeding yarn to circular knitting machines is described in U.S. Pat. No. 7,117,695. ‘580 patent at 2:66. Circular weft knitting is then compared to warp knitting in several sections of the patent. *Id.* at 3:5-15,

6:33-39. Specifically, the ‘580 states that circular weft knitting provides greater multi-dimensional stretch than warp knitting. *Id.* A POSITA would have understood from these discussions that the process of circular weft knitting was a well-known process because it was described and patented in the ‘695, and discussed in the Background section of the patent. A POSITA would have also understood from these discussions that elasticity was a well-known property of circular weft knitting. This is also consistent with my understanding, which is that circular weft knitting and its elastic properties were well known long before the ‘580 patent. WELLINGTON at 126.

64. The ‘580 patent also discusses circular knit machinery in various sections of the patent, including the Background section. For example, the ‘580 patent describes the cylinder and cam components of a circular knitting machine, and states that the ‘695 patent describes the process of feeding it with yarn. *Id.* at 2:60-3:4 (“The yarns to be knitted are fed from packages to a carrier plate ….”). The ‘695 patent, in turn, provides examples of circular knitting machines, such as Pai Lung Circular Knitting Machine Models PL-FS3B/T and PL-XS3B/C. ‘695 patent at 9:59-66. A POSITA would have understood from these discussions that circular knit machinery was well-known and commonly used, because the ‘580 patent describes them in the Background section of the patent, and because they are described in the ‘695 patent.

65. This is also consistent with one of the alleged benefits of the '580 patent, which is that the claimed performance fabric could be constructed using circularly knit machinery that was already available and in use. For example, the '580 patent states that the invention allows for manufacture by machinery that was already available and in use. *See*, *e.g.*, 3:40-43; 6:40-44. A POSITA would have understood from these statements that the circular knit machinery for constructing the claimed performance fabric was already well known and commonly used. This is also consistent with my understanding, which is that circular knitting machines were well-known and commonly used. WELLINGTON at 128 (showing a circular weft knit machine).

66. While the '580 patent discusses circularly knitting machines in other sections of the patent, a POSITA would have understood that these discussions added details about the circularly knit machinery that were well-known. For example, in the section entitled "Detailed Description of Preferred Embodiments," the '580 patent explains that circular knit machines may be high-gauge, which denotes 17 or more needles per inch. *Id.* at 7:46-55. A POSITA would have understood that high-gauge circular knit machines were well-known, as the '695 patent provides several examples of high gauge circular knit machinery. '695 patent at 9:59-67. This is consistent with my understanding that high gauge

circular knit machines were well known long before the earliest possible filing date of the ‘580 patent.

67. A POSITA would have understood from the description of bedding manufacturing equipment in the ‘580 patent that flatlock stitching was a well-known technique to join performance fabrics, because it is discussed under the heading “Background of the Invention” and in connection with machinery that was already in use. ‘580 patent at 3:5-8. This is also consistent with my understanding, which is that flatlock stitching was well known long before the earliest possible filing date of the ‘580 patent.

68. According to the ‘580 patent, the circular knit machinery that is typically used for bedding is different than the machinery used for athletic wear. *Id.* at 3:5-15. For example, the ‘580 patent states that bed sheets are not typically knit with circular knitting machines. *Id.* The ‘580 patent further states that some machinery can only produce a fabric with a maximum width of approximately 90 inches. *Id.* To produce wider circular knit performance fabrics for bedding, the ‘580 patent states that a circular knit machine of at least 48 inches in diameter would be necessary. *Id.* However, according to the ‘580 patent, the industry was unsure if it was possible to knit and finish fabrics at these large sizes. *Id.* The Sheex patents also state that certain high-gauge circular knit performance fabrics begin to lose their integrity when they are made 72.5 inches wide. *Id.* at 7:29-31.

Thus, the alleged problem of the '580 patent was creating a fabric wide enough to use as a bedsheet using smaller-sized circular knitting machines since 48 inches and higher diameter machines were available.

69. The '580 patent also discloses finishing processes, including heat setting. For example, the '580 patent states in a section under the heading titled "Background of the Invention" that the machines used to construct high gauge circular knit fabrics cause limitations in the "finished" width of a fabric. '580 patent at 2:14-18. The '580 patent also states that the '695 patent describes processes for circular knitting, which in turn, describes the process of open-width finishing and heat setting. '695 patent at 2:23-67. A POSITA would have understood from these discussions that finishing processes, including heat setting process, for circular weft knit fabrics were well known, because they are describe under the heading titled "Background of the Invention" and in connection with circular knitting processes described in the '695 patent. This is also consistent with my understanding that it was well known to a POSITA to use a finishing process, such as heat setting, to finish circular weft knit fabrics, performance fabrics, and bedding materials.

70. It was also well known to a POSITA that these elastic performance fabrics had an increased tendency to sag. According to the Sheex patents, this tendency to sag occurred at specific widths that would have resulted in problems

with the manufacturing and finishing with certain machines and processes. '580 patent at 7:29-34, 7:67-8:28.

71. The alleged "solution" of the '580 patent addresses this problem by joining two or more smaller pieces of fabric to create a finished fabric that is 90 inches wide. *See* '580 patent at 3:51-55. ("[T]he present invention is a method of making a finished fabric comprising at least two discrete performance fabric portions, and joining [them] to form the finished fabric."), 7:35-44, claim 1. However, the '580 patent does not describe any modification or improvement to the performance fabric, circular knitting processes, or circular knitting machines that were well-known, commonly used, and conventional to a POSITA. Instead, the Sheex patents attempt to create the claimed "finished fabric" using these conventional circular knitting machines and fabrics. *See* '580 patent at 3:39-43 ("the present invention is a high-gauge circular knit fabric for use in bedding . . . while allowing for manufacture by machinery presently available and in use."), 7:24-27 (same), 6:40-44 (explaining that the finished bed sheet is constructed by joining fabric "produced by available circular knitting machines"). In fact, the '580 patent emphasizes that its alleged invention can be used with the machinery that was available and in use. *Id.* at 3: 40-43. Thus a POSITA would have understood that the alleged invention merely involved using well known performance fabric, circular knitting processes, and circular knitting machines to

construct two pieces of performance fabric and join them together. A POSITA would have understood that this was simple and straightforward.

72. An example of the claimed finished fabric (in the form of a bed sheet) is illustrated in FIG. 2, reproduced below.

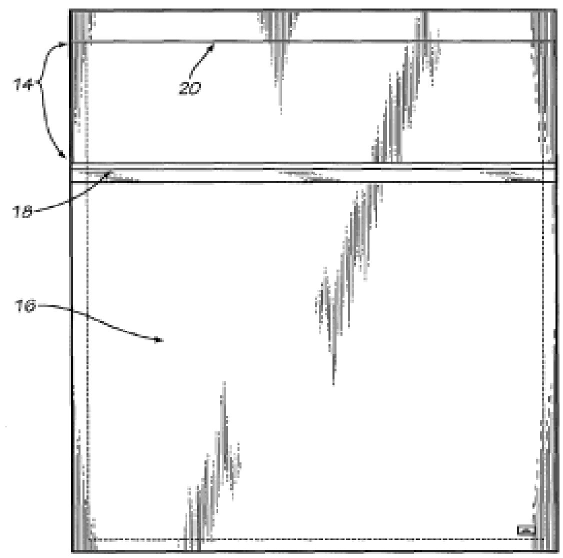

FIG. 2

73. The bed sheet shown in FIG. 2 is 91 inches wide and 102 inches long. ‘580 patent at 6:58-63. The “main portion” portion of the sheet is shown as 16 and is joined to a “sewn-on portion” along their edges by “stitching 14.” *Id.* The main portion and sewn-on portion can be joined together by, for example, flat-lock stitching. ‘580 patent at 3:61-65, 6:60-61, 7:3-6, FIGS. 3D & 3E. By joining different portions of fabric, a bed sheet that is 91 inches wide may be created. ‘580 patent at 6:14-18 & 40-46, FIG. 1.

74. According to the Sheex patents, the sag in performance fabrics at these widths interferes with finishing processes. *Id.* at 8:5-22. A POSITA would have understood that the alleged invention addresses the sag property of the performance fabric by creating smaller pieces of fabric and then joining them.

75. According to the Sheex patents, the solution was to use these conventional and well understood manufacturing techniques with well-known fabrics and materials to: (i) join together two or more discrete fabric portions to form a finished fabric at least 90 inches wide; and (ii) use elastic performance fabric to make bed sheets.

76. As I explain above, the machines, fabrics, and finishing techniques of the Sheex patents were well known, and conventional at the time of the Sheex patents. The fact that a performance fabric is created to make a "bed sheet" simply describes an end use application for the finished fabric; it does not add to or modify the finished fabric itself. Further, the concept of joining together two or more pieces of fabric was not only simple and straightforward, but was also in widespread use long before the Sheex patents.

VII. Construction of Certain Claim Terms

77. I understand that Bedgear has proposed that the broadest reasonable interpretation of the term "performance fabric having an elasticity . . ." is "a fabric with elastic fibers that would have too much sag and would interfere with a

finishing process if it is circularly knit wider than 72.5 inches." I agree with Bedgear that this construction is consistent with the Sheex specifications and the language of the challenged claims, as well as how a POSITA would have understood this term in the context of the Sheex patents.

78. The specification states that "the material is manufactured from performance fabric, which can include, for example, varying amounts of one or more of Lycra, Coolmax, Thermax, and Themastat." '580 patent at 6:18-21, 4:21-29, 2:35-66. In particular, the specification states that "[b]y using circular-knit performance fabric, the fabric is able to provide elasticity in all four directions" and "the sheet has elastic properties." *Id*., 6:22-29. For example, the specification repeatedly discloses that the claimed performance fabric can include spandex fibers, which were known to be highly elastic. *Id*. at 4:13-20 ("The present high gauge circular knit fabrics . . . can include spandex"); 4:21-22 (explaining spandex is "known for its exceptional elasticity."); 7:43-46 ("Because the bedding is made from performance fabric with spandex, it stretches to permit multiple and custom sizing."). A POSITA would have also understood from the discussion of spandex that the claimed performance fabric would include an elastic fiber, such as spandex, to allow the fabric to stretch and recover in order to fit beds and mattresses of different sizes. This is also consistent with my understanding, which

is that elasticity is based in part on the loop structure and viscoelasticity of the yarns of the fabric.

79. The specification states that these elastic performance fabrics had more sag, particularly at greater fabric widths, which caused problems with finishing processes. '580 patent at 8:1-5 ("higher levels of spandex in the performance fabric tend to pull the width in" and "the spandex can reduce an otherwise 94-inch circumference fabric tube to one with a 60-65 inch finished width."); 8:6-14 ("[w]ith performance fabric, it tends to sag in the middle – increasingly so with greater widths—making finishing difficult to impossible above a certain threshold."). The specification also states that "[a] possible 90-inch finished [fabric] width is contingent upon having a good finishing set-up capable of handling the present performance fabric." *Id.*, 8:10-12.

80. The patent explains that, "[w]hen using the circular knitting machine, the high gauge performance fabrics can only be made to a maximum size of 72.5 inches **without losing the integrity of the spandex in the fabric**." '580 patent at 7:29-32 (emphasis added); 7:32-34 (explaining that "normal sheet panels are 102x91 inches," which "presents problems when manufacturing sheets from [these spandex-based] performance fabrics."). Accordingly, a POSITA would have understood from the specification that the claimed high-gauge circular-knit performance fabric portion is a fabric with elastic fibers (*e.g.*, spandex fibers) that

would have too much sag and would interfere with a finishing process if it is circularly knit wider than 72.5 inches.

VIII. Overview of the Prior Art

81. I understand that Bedgear relies on certain asserted prior art references in the Petitions. In this section I briefly summarize these references (along with the admitted prior art) that are relied upon in the asserted grounds.

A. Admitted Prior Art (APA)

82. As I explain below, the '580 patent describes systems, methods, machinery, and materials for knitting that were conventional and well known to POSITAs long before the earliest possible filing date of the '580 patent (hereinafter "APA"). This includes at least the statements in column 1, line 21 – column 3, line 44, column 4, lines 21–29, 6:40-44, and column 7, line 24 – column 8, line 14, as well as the portions of the prosecution history cited and discussed below. A POSITA would have understood that the systems, methods, machinery, and materials described in these sections were conventional and well-known. I understand that these teachings can be relied upon for both anticipation and obviousness determinations.

B. Haggerty

83. Haggerty states that it generally relates to "bi-sectional bed sheets." Haggerty at Title, 1:28-31; FIG. 1. Specifically, Haggerty describes techniques for

constructing bed sheets that have two sections made from different fabric materials. *Id.* at Abstract, 1:28-34 & 45-49; FIGS. 1-5. A POSITA would have understood that having two sections constructed from different fabric materials enables a single bed to provide two different sections with different properties, such as for example, different heating characteristics. *Id.* at Abstract, 1:17-31. Haggerty states that the two fabric sections may be joined by various techniques to construct the finished bed sheets, such as for example, sewing or stitching the two sections together along the middle of the sheet. *Id.* at 3:34-42 (explaining that "each bi-section [is] seamed together via a continuous stitch 46 that runs the length of the flat bi-section sheet"), 1:36-2:17, FIGS. 1-5. A POSITA would have understood that Haggerty teaches bed sheets (*i.e.*, finished fabrics) formed from two separate fabric portions joined together along their respective edges.

84. Haggerty states that its bed sheets can be used for beds of varying types and sizes, including "king size, queen size, and full size beds." Haggerty at 4:41-42. Specifically, Haggerty explains that "[t]he dimensions of a king size bed are approximately . . . for the flat sheet about 108"x102"." *Id.* at 4:42-46, 4:46-48. A POSITA would have understood that the description of such a bed sheet for a king sized bed—having a width of 102"—teaches a finished fabric that is over 90 or more inches wide. Additionally, a POSITA would have understood that Haggerty teaches that its sheets can be formed using two different fabric sections

made of any suitable materials. Haggerty at Abstract, 1:34-36 ("one section for example is cotton, the other section is polar fleece), 2:5-9 (each bi-sectional sheet has "sections composed of different fabrics [f]or example, cotton and polar fleece."). A POSITA would have understood that in some embodiments described in Haggerty, one bi-section would be cotton, and another polar fleece. *Id.* at 5:59-62.

C. Stewart

85. Stewart is directed to a circular-knit bed sheet with improved durability and comfort properties. Stewart at ¶¶[0002], [0007]. Stewart states that circular knit bedding products that include blended yarns such as spandex have become increasingly popular. *Id.* However, Stewart further explains that as the usage of such products have increased, several issues concerning their durability have been identified. *Id.* at ¶[0006]. Specifically, Stewart explains that circular knit fabrics exhibited a high propensity to develop "pinholes" caused by breaks in the knitted chain structure, and to undergo chaining where the sheet tears apart along a broken thread line. *Id.* Stewart also explains such fabrics have poor dimensional stability. *Id.*

86. Stewart states that the improved durability is accomplished by non-pile circular knitting a spun yarn and a synthetic filament yarn. *Id.* at ¶ [0007]. Specifically, Stewart explains the circular knit bed sheet may be constructed in a

conventional fashion using at least one spun yarn and at least another synthetic filament yarn. *Id.* at ¶ [00015]. According to Stewart, the synthetic filament yarn has an elongation-at-break- point of not more than 50%, and does not have loose filament-ends sticking out along its length. *Id.*at ¶ [0015]. Stewart states that the synthetic yarns may be combined with spun yarn in any suitable ratio, and then constructed using customary methods and equipment. *Id.* at ¶¶ [0018], [0020].

IX. Analysis of the Prior Art with Respect to the Claims of the '580 Patent

A. APA with Haggerty

87. A POSITA would have understood that the alleged claimed invention of the Sheex patents was well-known and conventional in the art; the challenged claims simply require two or more fabric portions be joined together to form a finished fabric that is at least 90 inches wide. *Id.* As I explain above, the concept of joining portions of fabric together to construct a wider finished fabric was very well known in the art.

88. In particular, forming multiple smaller portions of circular knit fabric, including one portion comprising high-gauge circularly knit elastic performance fabric, as was well known in the art, and then joining them together in order to construct a 90-inch wide finished fabric would have involved common sense to a POSITA. Specifically, a POSITA would have understood that two shorter pieces of fabric could be joined together if certain machines prevented a single piece of

performance fabric from being created at a larger width. When faced with the problem that such elastic performance fabrics could not be manufactured at larger widths, a POSITA would have understood that multiple fabric portions at smaller widths could be formed and then joined together.

89. A POSITA would have also understood this from the teachings if Haggerty. Specifically, Haggerty teaches that bed sheets (*i.e.*, finished fabrics) are formed from two separate fabric portions that are joined together along their respective edges. A POSITA would have understood from Haggerty how to join two pieces of fabric together.

90. A POSITA would have understood to combine the teachings of the APA and Haggerty. Both are directed to techniques for constructing various finished fabrics, including bed sheets, using different fabric materials. '580 patent at Abstract; Haggerty at Abstract. In particular, based on the teachings in Haggerty, a POSITA would have understood that two or more portions of the circular knitted elastic performance fabrics described in the APA could be formed separately and then joined together in order to construct a finished fabric at least 90 inches wide.

91. As I explain above, a POSITA would have also understood to use performance fabrics in bedding. For example, it was well known to construct bed sheets from performance fabrics such as Coolmax. *Fiber Usage in Home Textiles*

2007 (Dec. 12, 2007), http://www.researchandmarkets.com/reports/c77257 ("Manufacturers have successfully adapted performance apparel technologies for use in home textile products. For example, bed sheets are being made from Coolmax and Thermolite fabrics").

92. A POSITA would have been motivated to combine these teachings for a number of reasons. For example, one benefit to joining two separate fabric sections together is the ability to have sections with different fabric materials and/or properties; each bed occupant may adjust the bed sheet to have warming characteristics that suits their preference. Haggerty at 1:17-24; *see also id.* at Abstract, 1:28-31, 4:16-33. As discussed above, it was well known that there were width limitations associated with manufacturing and finishing elastic performance fabrics using certain types of machines. '580 patent at 2:14-23, 2:65-3:3, 7:29-39, 8:4-8:10. Because of these width limitations, a POSITA would have been motivated to join together two or more fabric portions in order to construct a finished fabric over 90 inches wide. For a POSITA, this would have amounted to a simple combination of well-known elements. The machines and materials for constructing high-gauge circular knitted elastic performance fabrics were well known long before the Sheex patents, and would have been used conventionally when creating the claimed circular knit performance fabric. It was also well known that two pieces of performance fabrics could be joined together with

stitching to create a larger performance fabric. The stitching would have been implemented in a conventional and routine manner. Joining the two pieces of circular knit performance fabric would have resulted in a fabric sheet over 90 inches wide, and useable as a bed sheet. This result would have been predictable. *Id.*

93. Accordingly, as described in this section, it is my opinion that the APA and Haggerty teach or suggest each and every limitation of claims 1-14, and 18-19.

1. The APA with Haggerty teaches a finished fabric at least 90 inches wide

94. It was well known to POSITAs that APA finished fabrics, such as bed sheets and athletic apparel, were constructed with different types of fabrics. *See generally* '580 patent at cols. 1 & 2. This includes performance fabrics, which the APA teaches "are made for a variety of end-use applications." *Id.* at 1:59-60, 2:44-45 ("[i]n the athletic apparel industry, moisture wicking fabric has been used to construct athletic apparel"), 2:45-56 (acknowledging that U.S. Patent No. 5,636,380 discloses a spandex-based performance fabric used for making various garments). Finished fabrics were also constructed with circular knit fabrics. One process that may be used to form such circular knit fabrics is, for example, the process described in U.S. Patent No. 7,117,695 (provided as Ex. 1013, "the '695 patent"). *Id.* at 2:57-3:2, '695 patent at Abstract, 1:19-26, 6:43-57.

95. A POSITA would have understood from the patent's discussion of circular knit machinery that APA finished fabrics at least 90" wide were well known. '580 patent at 2:66-3:2 ("the machinery presently available for [circular knitting] can only produce a fabric with a maximum width of approximately 90 inches"), 3:3-4 ("sheets can have dimensions of 91 inches by 102 inches or greater), 7:66-8:1 ("[a] top width in the 90-inch range is currently possible using a circular knit fabric formed on a 36-38-inch diameter machine").

96. Additionally, as I explain in more detail below, Haggerty also describes forming bed sheets that are more than 90 inches wide. Haggerty explains how to join two separate fabric sections together to form a flat sheet that is wide enough to fit a king size bed, which a POSITA would have understood would be at least 90 inches wide. Haggerty at 4:41-46 (explaining that the bi-sectional flat sheets for king size beds have dimensions of "about 108'x102'"), 4:63-65, 5:21-23, FIG. 1.

97. As I discuss above, a POSITA would have combined these teachings. Specifically, a POSITA would have understood that two or more portions of the circularly knit elastic performance fabrics could be joined together to construct a finished fabric, resulting in a bed sheet at least 90 inches wide.

2. The APA with Haggerty teaches a first circular knitted fabric portion and a second circular knitted fabric portion

98. As I explain above, a POSITA would have understood from the '580 patent that circular knitting was a well-known process for constructing portions of performance fabric. '580 patent at 2:57-58. For example, a POSITA would have understood to circularly knit performance fabric construct athletic apparel. One well known process for constructing such performance fabrics is described in U.S. Patent No. 7,117,695. *Id.* at 2:58-3:3, '695 patent at Abstract, 1:19-26, 6:43-57. Specifically, the '695 patent explains that Lycra® may be used in yarns for constructing a circular knit performance fabric, that can later be included in various finished fabrics. '695 patent at 6:43-57 ("The spandex preferably is a commercially available elastane product for circular knitting, such as Lycra® types T162, T169, and T562."), Abstract, 1:19-2:22. A POSITA would have understood this to be a well-known process for constructing a performance fabric because it describes circular knitting with spandex yarns and finishing the fabric.

99. As I explain above, a POSITA would have understood that circular knitting machinery was well known and readily available. '580 patent at 2:14-22 ("the manufacturing of high gauge circular knit fabrics [is] dictated by the machine used in its construction" and "[a]t present, [such] performance fabrics are manufactured . . ."), 2:66-3:2 ("the machinery presently available for this [circular knitting] method of manufacture . . ."), 7:47-55, 7:66-8:1; Exhibit 1007 at pp. 179-181 (acknowledging that "portions of fabric [circularly] knitted at a high gauge

already existed" and were available from fabric suppliers). In fact, the '580 patent states the claimed invention can provide superior performance properties while allowing for the manufacture by machinery presently available and in use. '580 patent at 3:38-44 ("the present invention is a high gauge circular knit fabric [which] allow[s] for manufacture by machinery presently available and in use."), 6:40-44 (describing a bed sheet "that can be produced by available circular knitting machines"); 7:24-32. *Id.*

100. A POSITA would have understood how to construct a finished fabric out of two (*i.e.*, "first" and "second") discrete performance fabric portions in light of the teachings in Haggerty. Haggerty describes how to form bi-sectional bed sheets by joining together at least two separate fabric sections. Haggerty at Abstract, 1:28-34 & 45-49, 3:34-43; FIGS. 1-5. For example, Haggerty describes a "bi-sectional flat sheet 44 [that] includes cotton fabric bi-section 16D and polar fleece fabric bisection 18D, each bi-section being seamed together via a continuous stitch 46 that runs the length of the flat bi-section sheet 44." *Id.* at 3:34-43, 2:44-51 (explaining that the two fabric sections are joined via "a continuous stitch 14 that is continuous along the approximate middle of the fitted sheet 11."), FIGS. 1, 4. A POSITA would have understood from the discussion of bi-sections that a finished fabric could be made of at least two discrete fabric portions that are joined together (*i.e.*, two bi-sections).

101. When combined with what was well known and conventional, a POSITA would have understood that two or more discrete performance fabric portions could be formed by circular knitting as taught in the APA (*i.e.*, a first circular knitted performance fabric portion and a second circular knitted performance fabric portion), and that they could be joined together to construct a finished fabric as taught in Haggerty. *Id.*; *see also* Haggerty at 5:59-62 (explaining that any suitable types of fabric may be used to construct its bi-sectional bed sheets). A POSITA would have been motivated to combine these teachings for a number of reasons. For example, a POSITA would have done so to provide finished fabrics having fabric sections with different characteristics, and to create a finished fabric with larger widths. For a POSITA, this would have been a simple combination of well-known elements (*i.e.*, circular knit performance fabrics, as taught in the APA, and finished fabrics having two or more discrete fabric sections, as taught in Haggerty) using well-known prior art techniques in order to yield a predictable result (*i.e.*, a finished fabric with two or more portions of circular knit fabric). *Id.*

3. The APA with Haggerty teaches at least one of the discrete fabric portions comprising a performance fabric that has been circularly knit at 17 gauges or higher

102. A POSITA would have understood that finished fabrics and end products that include performance fabrics were well known long before the earliest

possible filing date of the ‘580 patent. ‘580 patent at 1:58-61 (“[p]erformance fabrics are made for a variety of end-use applications, and can provide multiple functional qualities, such as moisture management . . .”), 2:14-22 (describing “high gauge circular knit fabrics” and explaining that “[a]t present, [such] performance fabrics are manufactured with a maximum width of under 90 inches”), 2:43-53 (“[i]n the athletic apparel industry, moisture wicking fabric has been used to construct athletic apparel.”). For example, the APA describes Coolmax, Thermax, Thermastat or Lycra® as performance fabrics, which can be used to construct athletic apparel. *Id.* at 2:44-56, 2:54 (referring to the fabric disclosed in the ‘380 patent as “performance fabric such as this type”). A POSITA would have understood that these performance fabrics were well-known and conventional before the earliest possible filing date of the ‘580 patent. For example, a POSITA would have understood from U.S. Patent No. 5,636,380 (provided as Ex. 1014, “the ‘380 patent) which is described in the background section of the ‘580 patent, that these performance fabrics can be used as a “high moisture evaporation fabric” for use in constructing various garments. *Id.*; ‘380 patent at Abstract, 3:21-32, 3:57-4:25.

103. It was well known to a POSITA that such performance fabrics were being manufactured with high-gauge (*i.e.*, 17 gauge or higher) circular knitting machines. A POSITA would have understood that “high gauge” circular knitting

referred to the use of machines with at least 17 gauges. ‘580 patent at 7:47-55 (explaining that “[h]igh gauge generally denotes 17 gauges or more” and “indicate[s] that 17 or more cylinder needles are contained in one inch.”). As I explain above, circular knitting machines with at least 17 gauges were well known to POSITAs and in widespread use for the manufacture of performance fabrics. ‘580 patent at 2:14-22 (“[t]here are width limitations in the manufacturing of high gauge circular knit fabrics” and “[a]t present, [such] performance fabrics are manufactured . . . .”) (emphasis added); Exhibit 1007 at pp. 179-181 (acknowledging that “portions of [performance] fabric [circularly] knitted at a high gauge already existed” and were available from fabric suppliers).

104. For example, the APA describes several such machines in the ‘695 patent. The APA uses the ‘695 patent to explain some conventional circular knitting processes and machinery that were known before the Sheex patents. The techniques describes in the ‘695 patent are for circular knitting various fabrics, including spandex-based performance fabrics. ‘695 patent at 6:43-57. The ‘695 patent described at least two models of high gauge circular knit machines: (1) Pai Lung Circular Knitting Machine Model PL-FS3B/T, with 16 inches cylinder diameter, 28 gauge (needles per circumferential inch), and 48 yarn feed positions; and (2) Pai Lung Circular Knitting Machine Model PL-XS3B/C, with 26 inches cylinder diameter, 24 gauge, and 78 yarn feed positions. A POSITA would have

understood that these machines are high-gauge machines because they were 24 and 28 gauge. *Id.* at 9:59-67 ("Circular knit elastic single jersey fabrics with bare spandex plated with hard yarn for the examples were knit on"). A POSITA would have also understood that the use of these machines to construct performance fabrics was well known because the '580 patent describes the use of these machines to create well known athletic apparel and well known fabrics with spandex. A POSITA would have also understood from the '580 patent that these machines were well-known and commonly used before the earliest possible filing date of the '580 patent.

4. The APA with Haggerty teaches the performance fabric having an elasticity such that it has a tendency to sag by an amount greater than a threshold amount of sag determined by a finishing process

105. Performance fabrics were well-known long before the Sheex patents. *See e.g.,* WELLINGTON 475-478. As I discuss below, the properties of performance fabrics were also well-known long before the Sheex patents.

106. A POSITA would have understood that "elasticity" and "tendency to sag more than an amount permitted by a finishing process" are properties that are inherent to in the performance fabrics. The '580 patent states that performance fabrics provide elasticity in all four directions. '580 patent at 4:21-29 ("[s]pandex—or elastane—is a synthetic fiber known for its exceptional elasticity . . . that was invented by DuPont"); *see also* '695 patent at 1:44-65, 2:55-64, 6:43-53

(discussing the known elongation percentages of spandex and other performance fabrics). This is consistent with my understanding. As I explain above, a fabric's elasticity depends on several factors, including the types of fibers in the fabric, and the loop structures that the fabric is constructed of. The effective amount of "elasticity" of the fabric depends on various factors, including the types and relative percentages of materials in the fabric. Circular weft knit fabrics including spandex necessarily provide a general elasticity, because of the formation of the loop structures and the viscoelasticity of the spandex fibers. Therefore, elasticity is an inherent property of a circular knit spandex-based performance fabric.

107. As I explain above, a POSITA would have understood from the '580 patent that the performance fabrics will necessarily have a tendency to sag at increasing widths, including a width that affects a certain finishing process. Specifically, the '580 patent states that "[w]ith performance fabric, it tends to sag in the middle—increasingly so with greater widths—making finishing difficult to impossible above a certain threshold [width]." '580 patent at 8:5-9; *see also id.*, 7:24-32 (stating that, when using "presently available" circular knitting machines, "the high gauge performance fabrics can only be made to a maximum size of 72.5 inches without losing the integrity of the spandex."). The '580 patent also states that "higher levels of spandex in the performance fabric tend to pull the width in."

'580 patent at 7:66-8:4. A POSITA would have understood from these discussions that sagging would necessarily occur in the claimed performance fabrics.

108. This is also consistent with my understanding. As I explain above, the loop structure and material of the yarn cause the fabric to compress inwards towards the center. As a result, the fabric sags.

109. Heat setting processes were well known finishing processes. A POSITA would have understood to heat set a circularly knit fabric in order to, for example, set the fabric's dimensional stability. As I explain above, heat setting processes typically require the fabric to be flat. At large widths, the sagging of the performance fabric would interfere with the heat setting process. Specifically, a POSITA would have understood that the elasticity and width of the performance fabric would have inherently exhibited a tendency to sag.

110. The properties of the performance fabric were well known long before the earliest possible filing date of the '580 patent. For example, spandex was known to have very high elasticity. The "elasticity" and "sag" properties described in the APA are the same as the elasticity and sag properties in the finished fabric claimed in the '580 patent. As I discuss above, the claimed finished fabric can be manufactured using the same known machinery and the same known materials as those described in the APA. A POSITA would have understood that the APA fabric materials could be supplied to the APA circular knitting and finishing

machines in a conventional and known manner to predictably produce the finished fabric. These same machines and materials would have therefore resulted in the same "elasticity" and "sag" properties of the claimed performance fabric.

111. It was also well known that the elasticity or elongation of the spandex caused increased sag in the fabric. For example, the '695 patent is described in the APA as disclosing conventional circular knitting machinery and processes. As explained in the '695 patent, "knit fabric can more easily deform or stretch, by compressing or elongating the individual knit stitches" and, as a result, these "fabrics may experience permanent deformations or 'bagging'." '695 patent at 1:26-43. In particular, the '695 patent explains that, after the spandex-based fabric exits the circular knitting machine, "the stretched spandex in the fabric will retract to compress the fabric stitches so that the fabric is reduced in dimensions." *Id.* at 3:1-6, 3:11-13 (this "stitch compression reduces fabric dimensions and increases fabric basis weight."), 3:27-43 (explaining that the spandex significantly compresses the fabric in both the length and width directions). In other words, the spandex causes the fabric to contract inwards and increase in weight, thereby causing more sag in the middle of the fabric. A POSITA would have understood from these discussions that performance fabrics with these well-known properties of higher elasticity had a higher tendency to sag.

112. A POSITA would have understood from the '580 patent that the high elasticity and sagging tendency of the claimed performance fabrics led to problems with certain finishing processes. For example, a POSITA would have understood from the '695 patent that reducing sag can reduce the amount of skew in a finishing process. *Id.* at 3:27-43, 8:36-9:46 (explaining that, because the disclosed circular knit elastic fabrics have reduced stretch, *i.e.*, less sag, they "have significantly reduced skew during process in either open-width or tubular finishing processes compared to prior art fabrics," thereby reducing deformities during finishing). This is also consistent with my understanding, that bagging, sagging, and wrinkles in a circular weft knit performance fabric could interfere with the heat setting process.

113. The APA describes tentering pins or devices that stretch the fabric to keep it flat while it was fed through the machine. '695 patent at 2:23-63. Tentering devices were commonly used to keep the fabric flat and make sure it was fed evenly through the finishing machine. *See e.g.*, U.S. Pat. No. 6,016,591. A POSITA would have understood that based on the structure and dimensions of the finishing machines and the size of the fabric being used, the fabric would sag to a point at which the fabric could not be stretched flat. For example, a POSITA would have understood that a fabric wider than the tenter frames or pins used for passing fabric through a heat setting machine would have resulted in in sag, and

that the sag would have caused the uneven distribution of heat or dye, and resulted in for example, skewing or bowing. As I explain above, there is a certain amount of sag that would interfere with a finishing process, such as for example, getting caught in a roll or similar component of a machine, causing the fabric to bow or skew. A POSITA would therefore have understood that the exceptionally high elasticity of the claimed performance fabrics would result in an amount of sag that exceeded a threshold amount for a finishing process.

5. The APA with Haggerty teaches the sag would interfere with the finishing process if the performance fabric were circularly knit at greater than a 72.5 inch circumference

114. As I discuss above, elasticity and tendency to sag were well known properties of the claimed performance fabrics and were described in the APA. A POSITA would have understood that the claimed performance fabric would have increasingly sagged at larger widths. As I also explain above, at some width, the sag would reach a threshold that interferes with a finishing process, such as for example, heat setting.

115. As I explain above, the performance fabrics can be made using APA machinery and APA fabric materials that were known and in use before the earliest possible filing date of the Sheex patents. '580 patent at 7:24-27. The Sheex patents also state that using then available circular knitting machines with 36-38 inch diameters, a "top-width in the 90 inch range" is possible. *Id.* at 7:66-67. The

Sheex patents also state that, when using these then-available "circular knitting machine[s], the high gauge performance fabrics can only be made to a maximum size of 72.5 inches without losing the integrity of the spandex in the fabric." *Id.* at 7:24-27. In a communication from the Patent Office to the Applicant, the Examiner stated that the "72.5" inch restriction is a well-known and inherent characteristic of spandex. Exhibit 1008 at pp. 478-503. Thus, a POSITA would have understood that if the claimed performance fabrics are circularly knit at a width greater than 72.5 inches (*i.e.*, the circumference of the tube of fabric exiting the machine), the resulting fabric would have necessarily sagged. A POSITA would have also understood that such a sag would interfere with a finishing process, such as heat setting.

116. For example, a POSITA would have understood that if the performance fabric was wider than the tenter frames or pins used for passing fabric through a heat setting machine, the performance fabric would have resulted in sag, and that the sag would have caused the uneven distribution heat or dye, and resulted in for example, skewing or bowing.

117. A POSITA would have understood that this property is an inherent property of the performance fabrics. As I explain above, the integrity of a fabric may be lost when, for example, the fabric's dimensional stability has been altered, causing additional sagging or runs in the fabric. As I also explain above, the

claimed performance fabrics compress inward towards the center. At larger widths, the performance fabric increasingly compresses inwards, increasing the amount of sag, thereby reducing the fabric's integrity. A POSITA would have understood that such a loss would occur when the spandex-based performance fabric is constructed at widths greater than 72.5 inches. In particular, a POSITA would have understood that the machines and materials used by the Sheex Applicant exhibited a specific threshold width (*e.g.*, 72.5 inches) at which such a loss of integrity would occur. The specific threshold could be based on a number of factors, such as for example, the percentage of spandex included in the performance fabric. '695 patent at 1:44-65, 2:55-64, 6:43-53 (describing that the percentage of spandex affects the elongation and compression of the fabric).

118. A POSITA would have also found this restriction obvious given the description of the fabric materials and machines in the APA. As I explain above, the APA teaches the fabric materials and machinery for constructing the claimed performance fabrics. Further, the fabric materials would have been supplied to the machinery, and the machinery would have been operated in accordance with its normal and ordinary usage to predictably create the claimed performance fabric. A POSITA would have therefore understood that using the same APA fabric materials and APA machinery in the same manner would have resulted in a knit

performance fabric with the same sagging characteristics, and in particular, with the same "72.5" inch threshold.

119. A POSITA would have understood that circularly knit performance fabrics that have experienced a loss in integrity would exhibit additional sag in the fabric, and also interfere with finishing processes. As I discuss above, a POSITA would have understood that a loss of integrity in the spandex of the fabric would cause increased sag in the fabric, and too much sag in the fabric would have interfered with a finishing process such as heat setting. For example, the Sheex patents describe several conventional finishing processes, such as the ones described in the '695 patent for use, and which make use of a tenter frame. '695 patent at 2:23-54. It was well-known at the time of the Sheex patents that, unless sufficient tension was applied to the fabric on the tenter frame, the fabric would sag in the middle and cause bowing and skewing. '695 patent at 9:39-46; Fleissner at 1:49-66.

6. The APA with Haggerty teaches the first and second fabric portions are discrete and are joined along respective edges of the two portions to form the finished fabric

120. As I explain above, the APA teaches circular knit fabrics, including high-gauge circular knit elastic performance fabrics, are used to form various finished fabrics and end products. The APA does not describe the step of joining together at least two portions of such circular knit fabric in order to form a finished

fabric. However this would have been obvious to a POSITA for several reasons. As I explain above, stitching, cutting and sewing techniques for joining together multiple portions of fabric were well known and routinely used long before the Sheex patents. Such techniques are described in numerous prior art references. *See, e.g.,* WELLINGTON at 205-213, 303-306, 487-488, 503-504; '695 patent at 3:33-36. As a result, it would have been obvious for a POSITA to form multiple portions of the circular knit fabrics taught by the APA, and then join them together at their respective edges to construct a finished fabric. In my opinion, joining together two or more fabric portions would have involved nothing more than common sense. *Id.*

121. In my opinion, this feature is also taught by Haggerty. Haggerty describes techniques for constructing "bi-sectional bed sheets," such as fitted and flat sheets, which have two fabric sections formed from different fabric materials. *Id.* at Title, Abstract, 1:28-34 (one embodiment is a "fitted bed sheet having at least two sections, one section having a fabric that is different from the other section's fabric."), 1:45-49, 2:44-46 ("FIG. 1 illustrates a fitted sheet/flat sheet combination 10 where each fitted and flat sheet are comprised of two fabric sections."), FIGS. 1-5. This allows for a bed sheet to have two sections with different properties or characteristics. *Id.* at Abstract ("a flat sheet having two sections each section being of a different fabric such that the different materials cause different warming

characteristics), 1:17-31. An example of Haggerty's bi-sectional bed sheet is illustrated in FIG. 4, reproduced below:

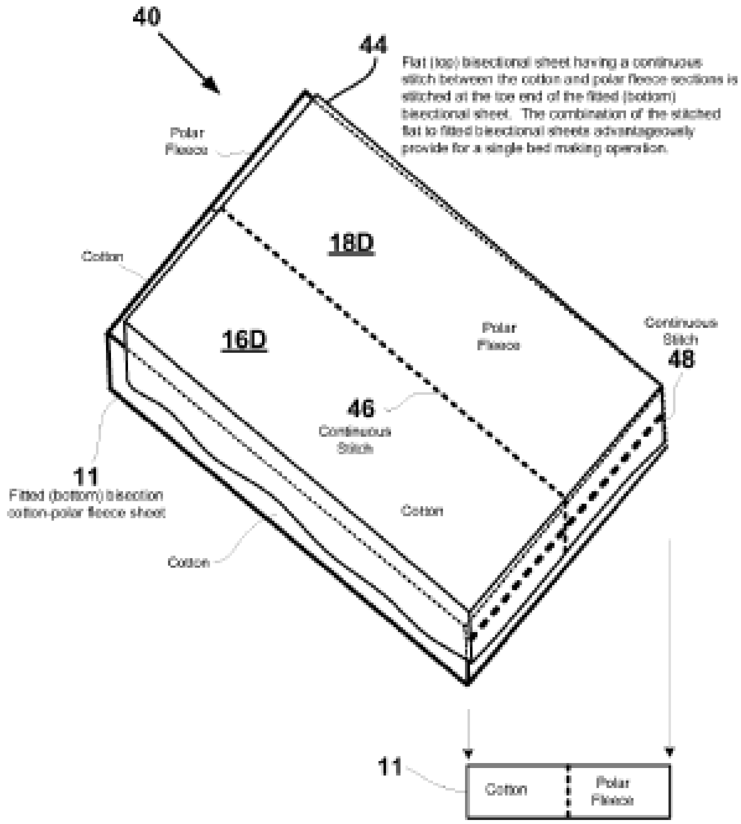

Fig. 4

122. In the exemplary bed sheet shown above, there is a "bedding system 40" which includes "a bi-sectional flat sheet 44" and a "fitted sheet 11." *Id.* at 3:34-38, FIG. 4. As the example shows, there is a cotton fabric bi-section 16D on the left side and a polar fleece fabric bi-section on the right side. *Id.* at 3:38-40, FIG. 4; *see also id.* at 2:44-51, FIG. 1. Haggerty teaches that these two different fabric sections are joined along their respective inner edges. Various techniques can be used for joining the two fabric sections together, such as sewing, seaming or

stitching inner edges of the fabric sections (*i.e.*, in the middle of the bed sheet). Haggerty at 1:36-2:17, 3:34-42, FIGS. 1-5. For example, to form the bed sheet shown in FIG. 4 shown above, a continuous stitch 46 can be used to seam each bi-section together. Haggerty at 3:38-42; *see also id.* at 2:44-51 ("Uniting the [two fabric sections] is a continuous stitch 14 that is continuous along the approximate middle of the fitted sheet 11."), FIG. 1.

123. As I discuss above, it would have been obvious to a POSITA at the time of the Sheex patents to combine the teachings of the APA and Haggerty. In particular, it would have been obvious to a POSITA to stitch two or more discrete performance fabric portions, as taught by the APA and then join the fabric portions together along their respective edges, as taught by Haggerty. A POSITA would have been motivated to do so for a number of reasons, including the ones described in Haggerty and the APA. Haggerty at Abstract, 1:17-31, 4:16-33 (discussing the benefits of using different fabric sections with different characteristics in finished fabrics), 5:59-62 (explaining that the fabric bi-sections can include other types of fabric materials); '580 patent at 2:15-24, 2:66-3:4 (discussing well-known width limitations associated with manufacturing and finishing high-gauge circular knit performance fabrics). For example, a POSITA would have been motivated to do so to create a bed sheet with different fabric sections having different characteristics.

124. For a POSITA, the use of the high-gauge circular knit elastic performance fabrics and bed sheets with different fabric sections were well-known prior art elements and easy to combine. A POSITA would have used the APA machinery and APA fabric materials in a conventional and routine manner to predictably create two fabric bi-sections made of the claimed performance fabrics. A POSITA would have understood that conventional fabric sewing and/or stitching techniques could be used to stitch the performance fabric bi-sections together along their respective inner edges. A POSITA would have understood that the sewing and stitching techniques could be conventionally applied to join the two bi-sections predictably to achieve the seamed bed sheet. A POSITA would have understood that the APA machinery and APA fabrics could be predictably used to yield finished fabric at least 90 inches wide and having multiple discrete portions of circular knit fabric.

7. The APA with Haggerty teaches the finished fabric includes "piping"

125. Claim 2, which depends from claim 1, further requires piping. A POSITA would have understood that the use of "piping" in some finished fabrics is a well-known aesthetic technique. Specifically, a POSITA would have understood that piping involves sewing a narrow piece of material over the edges of a finished fabric in order to improve its appearance. *See*, *e.g.*, U.S. Patent No, 4,461,048 (provided as Ex. 1016, "Allaire") at Abstract, 4:1-20 ("in order to enhance the

beauty of the sheet, a piping or a trim may also be employed about the edges of the sheet"). Piping was well-known and used with various kinds of finished fabrics, including bed sheets, for decades before the Sheex patents. *Id.* It therefore would have been obvious to add piping to the finished fabrics taught by the APA and Haggerty. A POSITA would have been motivated to do so for a number of reasons. For example, a POSITA would add piping to improve the fabrics visual aesthetic. *Id.* For a POSITA, adding piping would have involved nothing more than a routine design choice. *Id.*

126. For at least the reasons above, it is my opinion that the APA and Haggerty teach or suggest each and every limitation of claim 2.

8. The APA with Haggerty teaches the first and second fabrics have different fabric characteristics

127. Claim 3 depends from claim 1 and further requires the first and second fabrics have different fabric characteristics. As I explain above, the different functional qualities of a performance fabric, such as elasticity and stretch properties, as well as moisture management, moisture wicking, UV protection, anti-microbial qualities, thermo-regulation, and wind and/or water resistance, were described in the APA. '580 patent at 1:59-66, 2:44-51. A POSITA would have found it obvious to use the APA machinery and APA fabric materials to create two bi-sections for use in a bedsheet.

128. It would have also been obvious to manufacture the two bi-sections as taught by the APA to have different fabric characteristics, as taught by Haggerty. As I explain above, Haggerty teaches that a POSITA would have been motivated to manufacture two fabric bi-sections to have different characteristics to provide different properties to occupants of a bed. It would have been obvious to a POSITA to use the APA machinery and APA fabric materials to construct fabric bi-sections (*i.e.*, a first and second fabric) to have different characteristics such as elasticity, moisture management, moisture wicking, UV protection, anti-microbial qualities, thermo-regulation, and wind and/or water resistance. For example, a POSITA would have understood that a first fabric portion could be formed to have higher elasticity or moisture wicking properties than a second fabric by using a greater amount of spandex fibers in the fabric yarn. The use of the fabric yarn in the APA fabric materials and APA machinery would be applied in a conventional manner to predictably form a fabric bi-section having higher elasticity than a second fabric bi-section constructed with yarn having less spandex fibers. A POSITA would have then found it obvious to join the first and second fabric bi-sections as taught by Haggerty. The sewing or stitching techniques to join the two bi-sections would have been no different, and would have predictably been used to create a bedsheet.

129. For at least the reasons above, it is my opinion that the APA and Haggerty teach or suggest each and every limitation of claim 3.

9. The APA with Haggerty teaches the fabric characteristics including moisture management, UV protection, anti-microbial, thermo-regulation, wind resistance, and water resistance

130. Claims 4-9 depend from claim 3 and further require that "at least one of the fabric characteristics" includes "moisture management" (claim 4), "UV protection" (claim 5), "anti-microbial properties" (claim 6), "thermo-regulation" (claim 7), "wind resistance" (claim 8), and "water resistance" (claim 9). In particular, the APA explains that "[p]erformance fabrics are made for a variety of end-use applications, and can provide multiple functional qualities, such as moisture management, UV protection, anti-microbial [properties], thermos-regulation, and wind/water resistance." '580 patent at 1:58-61; *see also id*. at 1:64-65(explaining that such fabrics "would include beneficial wicking among other properties), 2:44-56 (describing the '380 patent as disclosing a "moisture wicking" elastic performance fabric); Haggerty at Abstract, 1:17-31 (describing the use of fabrics with varying heating characteristics). Fabrics having these claimed characteristics were well-known long before the Sheex patents. For example, it was well known that fabrics used in clothing apparel have moisture management, UV protection, anti-microbial properties, thermo-regulation, and wind/water resistance. *See, e.g.,* US Pat. Nos. 6,782,590, 6,779,368, 2004/0132367,

6,412,540, WELLINGTON 361-362. Further, it was well known that fabrics with these characteristics could be constructed at larger sizes, such as for example, with the creation of tents, ship sails, stadium covers, and geotextiles used in civil engineering applications are performance fabrics. WELLINGTON at 208.

131. For at least the reasons above, it is my opinion that the APA and Haggerty teach or suggest each and every limitation of claims 4-9.

10. The APA with Haggerty teaches the performance fabric portion includes "a man-made fiber" that has "higher breathability than a cotton fabric", "higher heat transfer than a cotton fabric", and "higher moisture wicking characteristics than a cotton fabric"

132. Claims 10-12 depend from claim 1 and further require the performance fabric portion includes "a man-made fiber" that has "higher breathability than a cotton fabric" (claim 10), "higher heat transfer than a cotton fabric" (claim 11), and "higher moisture wicking characteristics than a cotton fabric" (claim 12).

133. A POSITA would have understood from the '580 patent that spandex is a form of a man-made fiber. The '580 patent describes performance fabrics containing spandex, and circular knit performance fabrics including man-made fibers. '580 patent at 2:44-56, 4:44-66; 6:14-21. A POSITA would have understood from these discussions that performance fabrics include manmade fibers because it was well known that spandex was a manmade synthetic fiber.

134. The ‘580 patent states that performance fabrics are “uniquely capable of promoting cool, comfortable – and therefore better – sleep, as these advanced fabrics maximize breathability and heat transfer” and “include beneficial wicking among other properties.” ‘580 patent at 1:55-59 & 65-66, 2:8-13. A POSITA would have understood from this discussion that performance fabrics had superior breathability and heat transfer properties. This is consistent with my understanding which is that it was well-known that fabrics including man-made fibers, such as spandex, provided higher breathability, heat transfer, and moisture wicking characteristics than cotton fabrics. WELLINGTON at 592, 596.

135. The ‘580 patent explains that these known performance fabrics were “tested side-by-side with commercially available cotton bed sheets” and, “[a]cross all tests, [they] outperformed cotton.” ‘580 patent at 4:41-5:12. In particular, the ‘580 patent states that “[t]esting has demonstrated that performance bedding made out of performance fabrics transfers heat away from the body up to two times more effectively than cotton” and that “[i]n addition to trapping less heat, performance bedding breathes better than cotton – up to 50% better, giving performance bedding a strong advantage in terms of ventilation and heat and moisture transfer.” *Id.* at 4:61-5:3, 5:4-11.

136. Based on these results, a POSITA would have understood that the claimed performance fabric described in the APA, which includes man-made fiber,

exhibits characteristics superior to cotton, including higher breathability, heat transfer and moisture wicking. As I explain above, these are properties of the performance fabrics and necessarily occur because the claimed performed fabrics are constructed from APA fabric materials and APA machinery, and are operated in the same conventional manner as described in the APA.

137. For at least the reasons above, it is my opinion that the APA and Haggerty teach or suggest each and every limitation of claims 10-12.

11. The APA with Haggerty teaches finished fabrics having a gauge of at least 17 gauges

138. Claim 13 depends from claim 1 and further requires the finished fabric having a gauge of at least 17. As I discuss above, a POSITA would have understood from the '580 patent that manufacturing performance fabrics using circular knitting machines, including high gauge circular knit performance fabrics was well known. '580 patent at 2:14-22 ("[t]here are width limitations in the manufacturing of high gauge circular knit fabrics" and "[a]t present, [such] performance fabrics are manufactured . . ."), 2:57-3:2, 7:47-52 ("High gauge generally denotes 17 gauges or more"). For example, the '695 patent describes conventional circular knitting machinery and processes *Id.* '695 patent at Abstract, 1:19-2:22, 6:43-57. In particular, the '695 patent expressly teaches knitting such performance fabrics using 24 and 28 gauge (*i.e.*, more than 17 gauge) circular knitting machines. '695 patent at 9:59-67.

139. It would have been obvious to a POSITA to use these high-gauge circular knit machines to construct the claimed finished performance fabric. A POSITA would have fed the APA fabric materials (*e.g.*, yarn including some amount of spandex), to the APA high-gauge circular knit machine in the same manner as described by the APA. The operation of the high gauge circular knit machine would have not changed, allowing a POSITA to predictably construct a fabric with a high gauge. For example, a POSITA could have fed the APA fabric materials to the 24 and 28 gauge machines described in the '695 patent to form a circularly knit performance fabric, which would have had a high gauge.

140. For at least the reasons above, it is my opinion that the APA and Haggerty teach or suggest each and every limitation of claims 13.

12. The APA with Haggerty teaches a finished fabric comprising a bed sheet

141. Claim 14 depends from claim 1 and further requires that the finished fabric comprises "a bed sheet". As I discuss above, a POSITA would have understood how to combine the APA with Haggerty to create a finished fabric with two or more discrete circular knit fabric portions joined together. A POSITA would have also understood from Haggerty that this finished fabric can be in the form of a bed sheet, such as a fitted and/or flat bed sheet. Haggerty at Title, Abstract, 1:28-49, 2:44-46, FIGS. 1-5. A POSITA would have also understood from Haggerty that these bed sheets may be used for (*i.e.*, to cover) different types

and sizes of beds, such as "king size, queen size, and full size beds." Haggerty at 4:41-48, FIG. 4. This is also consistent with my understanding, which is that performance fabrics could be used to create a bed sheet.

142. For at least the reasons above, it is my opinion that the APA and Haggerty teach or suggest each and every limitation of claims 13.

13. The APA with Haggerty teaches a knit fabric that includes polyurethanepolyurea copolymer fiber

143. As I discuss above, teaches POSITA would have understood that performance fabrics including spandex were well-known and commonly used to manufacture various finished fabrics. '580 patent at 2:44-3:2; '380 patent at Abstract, 3:21-32, 3:57-4:25; '695 patent at Abstract, 1:19-2:22, 6:43-57. As I explain above, a POSITA would have also understood from the '580 patent that "polyurethane-polyurea copolymer" was a type of spandex well-known long before the earliest possible filing date of the '580 patent. '580 patent at 4:21-29

144. A POSITA would have understood that the claimed performance fabric could be constructed using "polyurethane-polyurea copolymer" fiber in the same way that it is constructed with spandex. Specifically, a POSITA would have understood that after forming a yarn with "polyurethane-polyurea copolymer" fiber, the yarn would have been fed to an APA machine in a conventional manner to predictably yield a knit fabric. This is consistent with my understanding which is that circular knitting a performance fabric with polyurethane polyuria copolymer

fiber would be the same as circular knitting a performance fabric with polyurethane.

145. For at least the reasons above, it is my opinion that the APA and Haggerty teach or suggest each and every limitation of claims 18.

14. The APA with Haggerty teaches the polyurethane-polyurea copolymer fiber is included in the knit fabric in such a proportion that, if circularly knit at a high gauge, the knit fabric could be knit at no more than a 72.5 inch circumference without losing the integrity of the polyurethanepolyurea copolymer fiber

146. Claim 19 depends from claim 18 and further requires the polyurethane-polyurea copolymer fiber is included in the knit fabric in such a proportion that, if circularly knit at a high gauge, the knit fabric could be knit at no more than a 72.5 inch circumference without losing the integrity of the polyurethanepolyurea copolymer fiber. As I discuss above, the APA teaches performance fabrics manufactured using high-gauge circular knitting machines, including performance fabrics containing polyurethane-polyurea copolymer fibers. The '580 patent states that these claimed fabrics can be "manufacture[d] by machinery presently available and in use." '580 patent at 4:21-29, 7:24-27. The '580 patent also states that, when using these then-available "circular knitting machine[s], the high gauge performance fabrics can only be made to a maximum size of 72.5 inches without losing the integrity of the spandex in the fabric." *Id.* at 7:29-32.

147. A POSITA would have understood from these discussions that at widths greater than 72.5 inches this loss of integrity would have necessarily occurred in the claimed circularly knit performance fabrics, including performance fabrics made with polyurethanepolyurea copolymer fibers. This was confirmed during prosecution of the related '309 patent, in which the Examiner determined that this 72.5 inch restriction was well-known and inherent to spandex. Exhibit 1008 at pp. 478-503. Because the APA teaches the same fabric materials manufactured using the same machinery (*i.e.*, the claimed performance fabrics manufactured using prior art circular knitting machines) the APA teaches fabrics with the same "72.5" restriction recited in challenged claim 19.

148. It was well known that spandex had exceptionally high elasticity and compression properties. A POSITA would therefore have understood that creating the claimed circularly knit performance fabrics above a certain width would affect the integrity of the fibers or stitches in the fabric. '580 patent at 8:1-5 (acknowledging that performance fabrics up to 90 inches wide could be manufactured using the available machinery, but "higher levels of spandex in the performance fabric tend to pull the width in.").

149. Specifically, as I explain above, a POSITA would have understood that at a threshold width, the fabrics would result in sag that would cause a loss of integrity in the fabrics with spandex. That is, after a threshold width, the tension

needed to flatten the fabric would impair the stretch properties of the fabric. Accordingly, it would have been obvious to a POSITA that, if a particular proportion of spandex was included in the performance fabrics as taught by the APA, these fabrics could only be circularly knit at high-gauge up to a maximum circumference (*e.g.*, 72.5 inches).

150. For at least the reasons above, it is my opinion that the APA and Haggerty teach or suggest each and every limitation of claims 19.

B. APA with Haggerty and Fleissner

151. As I discuss above, it is my opinion that the APA with Haggerty teaches all of the limitations in the challenged claims. In particular, a POSITA would have understood that high-gauge circular weft knit performance fabrics having the "sag" properties were well known.

152. These "sag" properties are also described in Fleissner. Fleissner states that it is generally directed to a "process and apparatus for tentering and heating textile materials" in order to finish knit fabrics. Fleissner at Title, Abstract, 1:10-34, FIGS. 1, 3. Fleissner explains that tentering devices were commonly used with various finishing machines so the fabric could be guided through the machine "while being stretched along its width," which enables "the width of the wide-stretched material [to be] substantially retained" during the finishing process. *Id.* at 1:10-34.

153. Fleissner states that "one of the problems encountered in the use of tentering devices is that the material sags between the tentering chains." *Id.* at 1:49-66. As explained in Fleissner this sagging causes various distortions in the fabric, such as the "formation of arcs" and oblique distortions. *Id.* Fleissner also specifically teaches that this sagging is particularly problematic when finishing wider "sensitive knit fabric[s]" (*e.g.*, fabrics above 3 meters wide). *Id.* A POSITA would have understood from Fleissner that knit fabrics with too much sag cause problems with finishing processes (*i.e.*, because the sag is greater than a threshold amount), and that this sag interferes with the finishing processes when the fabrics are knit above certain widths (*e.g.*, circularly knit above a 72.5 inch circumference).

154. A POSITA would have found it obvious to combine the teachings of Fleissner with those of the APA and Haggerty. A POSITA would have looked to Fleissner based on its disclosures related to finishing processes and machinery used to create finished fabrics. The APA and Fleissner are both related to heating processes and devices. '580 patent at 2:65-66; '695 patent at 2:23-67; Fleissner at 1:10-34. Moreover, Fleissner states that it was well-known to use tentering devices with finishing techniques for knit fabrics. Fleissner at 1:10-29. Thus, a POSITA would have understood from Fleissner that the high-gauge circular knit performance fabrics taught by the APA included the claimed "sag" properties.

155. Therefore, as I discuss in more detail below, the APA with Haggerty and Fleissner teaches or suggests each and every limitation of the challenged claims 1-14 and 17-18 of the '580 patent.

1. The APA with Haggerty teaches all of the limitations of claim 1 of the '580 patent

156. As I discuss above, the APA with Haggerty teaches several limitations of claim 1 of the '580 patent. For at least the same reasons as I explained above, the APA with Haggerty and Fleissner also teaches those limitations.

2. The APA in view of Haggerty, further in view of Fleissner teaches "the . . . fabric has a tendency to sag by an amount that is greater than a threshold amount of sag determined by a finishing process" and "the sag would interfere with the finishing process if the performance fabric were circularly knit at greater than a 72.5 inch circumference"

157. As I explain above, the APA teaches how to form finished fabrics using performance fabrics, including the claimed performance fabrics manufactured using high-gauge circular knitting machines. Exceptionally high elasticity is a property that is necessarily present in circular weft knit fabrics made with elastic fibers. As I explain above, such fabrics will necessarily sag. These fabrics have a tendency to sag that increases with the fabric's width.

158. Techniques for finishing circular knit performance fabrics, such as for example, heat-setting, stretching, wetting, drying, bleaching, and dyeing processes

were well known. '580 patent at 2:65-66; '695 patent at 2:23-67, 7:38-8:15. Some finishing processes included, for example, a "tentering device" to hold the fabric at its edges and keep the fabric flat. '695 patent at 2:23-54. It was also well-known that the fabric needed to be kept flat to avoid interfering with the finishing processes. For example, if there was too much sag in the fabric, skewing or bowing may occur, or the fabric may get caught in a roller or similar component of the machine.

159. Like the APA, Fleissner describes finishing processes and machinery for "knit fabrics" that include tentering devices. Fleissner at Title, Abstract, 1:10-34. The tentering devices and techniques in Fleissner attempt to improve the finishing process by eliminating distortions to the fabric that occur as the fabric is being guided through a finishing machine. *Id.* at 2:29-40, 2:51-3:35. Fleissner explains that "tentering" generally refers to securing a fabric along its edges and stretching it along its width while the fabric is being guided through the machine and a finishing process is performed, such as heating or drying. *Id.* at 1:25-34, 2:29-34.

160. Fleissner states that "one of the problems encountered in the use of tentering devices is that the material sags between the tentering chains." *Id.* at 1:49-51. Fleissner also states that this sagging causes various undesirable structural changes and distortions in the fabric during the finishing process. *Id.* at

1:49-66, 2:5-8, 2:29-34. For example, the sagging causes "the formation of arcs" in the fabric. *Id.* at 1:54-66. The sagging also results in other "oblique distortion[s]" and problems, such as causing "the loops or stitches in the marginal zones [of the fabric] to be stretched out of shape more readily and to a greater degree than those in the central zone." *Id.* "Arcs" in particular significantly affect the quality and integrity of the finished fabric. Accordingly, a POSITA would have understood from Fleissner that sagging of a fabric would interfere with a finishing process.

161. Fleissner states that arcs and other distortions are particularly problematic when "treating very wide webs of material," which have a "tend[ency] toward arc formation." Fleissner at 1:51-54, 1:56-61 ("In the case of wide webs of material, it is very difficult to fully eliminate oblique distortion and arcs" when using tentering devices). Fleissner states that in particular, sagging interferes with the finishing process when fabrics are knit above a particular width. Specifically, "in the case of sensitive knit fabric webs having a width of about 3 meters [*i.e.*, 118 inches] and more, a sagging of the material is disadvantageous." *Id.* at 1:60-66. At these widths, "the loops or stitches in the marginal zones are stretched out of shape more readily and to a greater degree than those in the cent[er]" of the fabric. *Id.* Based on the teachings of Fleissner, a POSITA would have understood that when sensitive knit fabrics such as high-gauge circular knit performance fabrics, are knit

at widths greater than 118 inches, they will sag by an amount that creates arcs and distortions during finishing processes.

162. A POSITA would have understood that when sagging in the fabric exceeded a threshold amount, distortions would occur in the tentering-based finishing processes. As explained above, a POSITA would have understood that the APA performance fabrics have a tendency to sag. Based on the teachings in Fleissner, a POSITA would have also recognized that the performance fabrics taught in the APA would sag by an increased amount, and would cause problems if these fabrics were circularly knit above certain widths (*e.g.*, 118 inches). The amount of sag in the fabric is based on the fabric's width and elasticity. As a result, it would have been obvious that, when these fabrics were high-gauge circularly knit above a certain width (*e.g.*, 72.5 inches), the amount of sag would interfere with the finishing process (*e.g.*, result in arcs and other distortions in the finished fabric).

3. The APA with Haggerty and Fleissner teaches all of the limitations of claims 2-14, and 18-19 of the '580 patent

163. As I discuss above, the APA with Haggerty teaches the additional limitations recited in each of dependent claims 2-14, and 18-19. Thus, for at least the same reasons, the APA in view of Haggerty, and further in view of Fleissner also teaches these dependent claim limitations.

C. Stewart with Fleissner

164. Stewart generally teaches techniques for manufacturing circular knit fabrics that can be used to form bed sheets, bedding products, and other finished fabrics. Stewart at Title, Abstract, ¶¶ [0002], [0007]. The finished fabrics described in Stewart are "circular knit in a conventional fashion" using a combination of spun yarn and "synthetic filament yarn." *Id.* at ¶ [0015]. Stewart explains that these yarns "may be made of any suitable material or combination of materials," such as "polyester or other acceptable polymers." *Id.* at ¶[0017]. These yarns may also include spandex. *See Id.* at ¶ ¶ [0005] (describing one fabric that "incorporates 4% spandex elastomeric yarn, in combination with cotton/polyester spun yarns."), [0020] (explaining that the fabrics may include various functional qualities such as an antimicrobial or flame-retardant finish).

165. The finished fabrics of Stewart are made from circular-knit performance fabrics "using customary methods and equipment, including, for example, any desired finishing treatment(s), cutting and sewing." Stewart at [0020]. The finishing treatments include, for example, finishing processes that apply different types of finishes to the fabric. *Id.* Stewart teaches joining portions of fabric together using customary methods. For example, Stewart teaches cutting and removing pieces of fabric, seaming the fabric, and/or sewing other pieces of material to the edges of the fabric. *Id.*

166. Stewart does not expressly state that its circular-knit elastic performance fabrics have "a tendency to sag" above a threshold amount determined by a finishing process, or that this sag would "interfere with the finishing process" if the fabric was knit wider than 72.5 inches. However, a POSITA would have understood that finishing these fabrics according to Fleissner would have resulted in such a sag.

167. As I discuss above, these "sag" properties are expressly taught by Fleissner. Specifically, when finishing knit fabrics with tentering devices, the material tends to sag in between the tentering chains. Fleissner at 1:10-18; 1:49-51. This sag, in turn, causes the formation of "arcs" and other distortions, which affect the quality and integrity of the finished fabric. *Id.* at 1:52-66, 2:29-34. A POSITA would have understood from Fleissner that sagging becomes a larger problem when treating very wide materials. Fleissner states that sagging is particularly problematic with sensitive knit fabric over 118 inches wide. Fleissner at 1:52-61, 2:60-66. Thus, a POSITA would have understood that finishing the circularly knit fabrics described in Stewart would result in sag.

168. A POSITA would have understood to combine the teachings of Stewart and Fleissner. Both references are directed to manufacturing finished fabrics, including knit fabrics. Stewart's explanation that "any desired finishing treatments" could be used with its fabrics would have taught a POSITA to look to

processes for finishing fabrics, such as those described in Fleissner. Stewart at [0020].

169. A POSITA would have understood from Stewart how to create the circular knit performance fabrics. Based on the teachings of Fleissner, a POSITA would have understood that such fabrics will necessarily sag, and that at large widths, these fabrics tend to sag above a threshold amount associated with a finishing process, causing arcs and other distortions in the fabric, interfering with the finishing process.

170. Therefore, as I discuss in more detail below, Stewart in view of Fleissner teaches and/or suggests each and every limitation of claims 1 - 14, 18 – 19 of the challenged claims of the Sheex patents.

1. Stewart teaches a finished fabric at least 90 inches wide

171. Stewart states that it is directed to techniques for manufacturing circular-knit fabrics used to form various bedding products, such as flat and fitted bed sheets (*i.e.*, finished fabrics). Stewart at ¶¶ [0004], [0007], [0019]-[0022], FIGS. 2, 4. Stewart explains, circular knitted fabrics offer greater utility in bedding, "because of the wider range of bed, mattress, and pillow sizes for which [they] may be utilized." *Id.* at ¶ [0004]. Stewart explains that "the fabrics of the invention may be used to form flat sheets . . . and other sized-specific flat-goods." *Id.* at ¶ [0024].

172. Although Stewart does not expressly state that the circular knit bed sheets were 90 inches wide, bed sheets of this size were well known. *See*, *e.g.,* Haggerty at 4:41-48, FIG. 4. A POSITA would have been motivated to create a bed sheet at such a width in order to, for example, fit a king size bed, which would have been over 90 inches wide.

2. Stewart teaches a first circular knitted fabric portion and a second circular knitted fabric portion

173. Stewart is specifically directed to the use of circular-knit fabrics, and in particular, to the use of circular-knit fabrics to form bed sheets, bedding products and other finished fabrics. Stewart at Title, Abstract, ¶ ¶ [0002], [0007] ("[t]he present invention provides circular-knit bedding, such as bed sheets and the like."), [0015] (explaining that "a tube 10 of non-pile circular-knit fabric 12 is circular-knit in a conventional fashion"), [0019] (describing a fitted bed sheet formed from the fabric 12), [0021], [0024] ("the fabrics of the invention may be used to form flat sheets . . . and other sized-specific flat-goods"), FIGS. 2, 4.

174. Stewart also states that its "sheet[s] may be made from the fabric 12 using customary methods and equipment, including . . . cutting, and sewing." Stewart at ¶ [0020]. Stewart states that this may include "cutting and removing a piece of fabric . . . and seaming the remaining corner fabric to form the various walls and edges of the sheet" and/or sewing binding strips "to one or more of the edges" of the sheet. *Id.* A POSITA would have understood from this that multiple

portions of Stewart's circular knit fabric could be formed because they describe cutting, removing, and then seaming pieces of fabric together. A POSITA would have understood that sewing two discrete performance fabric portions would have also been obvious to a POSITA because Stewart states that the sewing can be performed using customary methods. As discussed in more detail below, this feature would have also been obvious to a POSITA at the time of the '580 patent.

3. Stewart teaches at least one of the discrete fabric portions comprising a performance fabric that has been circularly knit at 17 gauges or higher

175. As I discuss above, Stewart describes techniques for circularly knitting fabrics that are used to form bed sheets and other finished fabrics. A POSITA would have understood that Stewart also teaches that these circular knit fabrics include performance fabrics, because Stewart teaches circular-knit fabric including spandex. Specifically, Stewart teaches the circular-knit fabrics may be formed by "non-pile circular-knitting at least one spun yarn and at least one synthetic filament yarn." Stewart at ¶ [0007]. The synthetic yarns in Stewart "may be made of any suitable material or combination of materials," such as "polyester or other acceptable polymers." *Id.* at ¶ [0017]. Spandex is a well-known synthetic polymer fiber. *See* '580 patent at 4:21-24 (acknowledging that spandex was a known "synthetic fiber" comprising a copolymer invented by DuPont). Stewart

also states knitted fabric that "incorporate[] 4% spandex elastomeric yarn, in combination with cotton/polyester spun yarns" were well known. *Id.* at [0005].

176. A POSITA would have also understood that the performance fabrics in Stewart have the functional qualities of the claimed performance fabrics. For example, Stewart states that its fabrics "have a greater durability than conventional circular-knit fabrics." *Id.* at Abstract, ¶ [0007]. Stewart also states that the fabrics may include functional properties, such as "an antimicrobial finish [or] flame-retardant finish." Stewart at ¶ [0020].

177. Stewart does not expressly state that its circular-knit performance fabrics are circularly knit at 17 gauges or more. However, it would have been obvious to a POSITA to use a circular knitting machine of 17 gauges or more to construct the circular knit fabrics in Stewart. Stewart states that "a tube of non-pile circular-knit fabric 12 is circular-knit in a conventional fashion with a plurality of series of loops." Stewart at ¶ [0015] (emphasis added). As I explain above, circular knitting machines that used 17 or more gauges (*i.e.*, "high gauge" circular knitting machines) were well-known and in widespread use long before the earliest possible filing date of the '580 patent. As I also explain above, a POSITA would have understood how to use these machines to construct the claimed performance fabric. A POSITA would have understood to use machines that are high-gauge. '695 patent at 9:59-67 (describing circular knitting of performance fabrics using 24

and 28 gauge circular knitting machines). A POSITA would have understood that these machines could be used because Stewart states that its fabrics can be constructed with customary machines and methods. This is consistent with my understanding, which is that it was well known to use such high gauge circular knit machines to construct performance fabrics, for example to use in athletic apparel. Further, a POSITA would have understood that to create a circular knit bed sheet suitable for comfortable sleep and wide enough for use as a fitted sheet on a mattress, the fabric would be knit at a high gauge. As I describe above, POSITA would have understood that increasing the gauge of circular knit machines increases the width and fineness of the fabric (which in turn enhances the comfortable feel of the fabric).

4. Stewart with Fleissner teaches the performance fabric having an elasticity such that it has a tendency to sag by an amount greater than a threshold amount of sag determined by a finishing process

178. A POSITA would have understood that the circular knit fabric in Stewart has an elasticity. Stewart states that circular knit fabrics were increasingly popular because of their ability to be used as fitted or contour sheets, and because of their ability to be used across different sizes of mattresses. Stewart at ¶ [0004]. A POSITA would have understood that this refers to the elastic property of circular knit fabrics, because the elasticity allows them to be fitted and conform to the contours of the bed.

179. Stewart also states that its fabrics may include "spandex elastomeric yarn." Stewart at ¶ [0005] (emphasis added). A POSITA would have understood that such a fabric has elasticity because spandex is elastomeric, which inherently exhibits high elasticity. '580 patent at 4:21-29. ("Spandex—or elastane—is a synthetic fiber known for its exceptional elasticity"). Stewart explains that its circular-knit performance fabrics may have an "elongation" of about 50%. Stewart at [0007], [0015]. A POSITA would have understood that this means that the circular knit fabric has the ability to stretch in size by 50%.

180. Stewart also describes finishing the circularly knit fabric with various finishing processes. Specifically, Stewart states that the fabrics can be finished using customary finishing methods and equipment. Stewart at [0020]. "Examples of finishing treatments include the application of an antimicrobial finish, a flame-retardent [sic] finish, a no-iron finish, a no-stain finish, an optical brightener, and/or a color." *Id.* A POSITA would have also understood that other well-known finishing processes, such as heat-setting, could be used to finish the circular knit fabrics.

181. Stewart does not explicitly state that its circular-knit performance fabrics tend to sag "by an amount that is greater than a threshold amount determined by a finishing process." However, as I explain above, a circular-knit performance fabric including elastic fiber would have inherently sagged.

182. Further, as I explain above, Fleissner expressly describes this "sag" property. Specifically, Fleissner states that at large widths of "sensitive knit fabric[s]", sagging occurs, and causes distortions in the fabric during the finishing process. Fleissner at 1:52-61. A POSITA would have considered Stewart's high-gauge circular knit performance fabrics to be an example of "sensitive knit fabrics".

183. As discussed above, it would have been obvious to combine the teachings of Fleissner and Stewart. In particular, Fleissner teaches that certain finishing processes could not be performed on fabrics that sagged above a certain (*i.e.*, threshold) amount and that this sagging was particularly problematic for wider, sensitive knit fabrics. It would have been obvious to a POSITA that the circular-knit performance fabrics taught by Stewart (which had exceptional elasticity) would tend to sag by a greater amount than the threshold amounts determined by these finishing processes as taught by Fleissner.

5. Stewart with Fleissner teaches the sag would interfere with the finishing process if the performance fabric were circularly knit at greater than a 72.5 inch circumference

184. Stewart does not explicitly state that the performance fabric's sag would interfere with the finishing process if its performance fabrics were circularly knit above a 72.5 inch circumference.

185. However, a POSITA would have understood this from Fleissner. Fleissner states that, when fabrics are knit above a particular width, the sagging interferes with finishing processes. Specifically, Fleissner explains that "in the case of sensitive knit fabric webs having a width of about 3 meters [(*i.e.*, 118 inches)] and more, a sagging of the material is disadvantageous." Fleissner at 2:60-66. Fleissner explains that the sagging is in part due to the loops and stitches at edges of the fabric becoming "stretched out of shape more readily and to a greater degree than those in the cent[er]" of the fabric. Fleissner at 2:60-66. Fleissner also explains that such sagging creates arcs and distortions during finishing processes. *Id.* at 1:49-66. Thus, a POSITA would have understood that sagging would cause distortions (interference) if the fabric were knit at certain widths.

186. A POSITA would have understood to combine the teachings of Fleissner and Stewart. Both references are directed to manufacturing finished fabrics, including knit fabrics. Stewart states that it may be made with customary methods, including finishing treatments. Stewart at ¶ [0020]. A POSITA would have then looked to Fleissner based on its disclosures related to finishing processes and machinery used to create finished fabrics. A POSITA would have been motivated to do so for any number of reasons, and in particular to obtain the dimensional stability provided by heat setting fabrics.

187. Based on the teachings in Fleissner, a POSITA would have then understood that the elasticity of the circular knit fabrics taught in Stewart would cause the fabrics to sag by amounts that interfered with the finishing processes if the fabrics were circularly knit above a particular width.

6. Stewart teaches the first and second fabric portions are discrete and are joined along respective edges to form the finished fabric

188. Stewart states that "[t]he sheet 36 may be made from the fabric 12 using … any desired finishing treatment(s), cutting, and sewing." Stewart at ¶ [0020] (emphasis added). For example, "one or more of the converting- or finishing-aspects may include cutting and removing a piece of fabric . . . and seaming the remaining corner fabric to form the various walls and edges of the sheet." *Id.* Stewart also states that binding strips may be sewn "to one or more of the edges" of the sheet, such as "the first and second elongated edges, 30, 32, of the fabric 12." *Id.*, *see also id*. ("as will be appreciated by one of ordinary skill, a binding strip or strips may be sewn to any of the exposed edges of a length of fabric during the formation of the fitted sheet . . . or any other bedding product made from the non-pile circular-knit fabric."). A POSITA would have understood from these discussions that two or more discrete portions of Stewart's circular-knit fabrics could be cut and removed and then joined together at their respective edges (*e.g.*, using customary cutting and sewing methods) in order to form a bed sheet or other finished fabric product.

189. Stewart states that doing so would have involved using customary methods and equipment. Stewart at ¶ [0020]. This is consistent with my understanding that techniques for creating and joining together multiple portions of fabric were well-known and routinely used to form finished fabrics, including bed sheets. For example, another patent filed by the same inventor describes techniques for forming bed sheets by stitching multiple, separate portions of circular knit spandex-based performance fabric to the edges of a main portion of a bed sheet. Stewart II at ¶ ¶ [0012]-[0017]; *see also*, Haggerty at Abstract, 1:28-38, 3:34-42, 4:41-46, FIG. 4; Seago at Abstract, 5:61-6:21, 7:30-8:21, FIGS. 3, 4; Ritacco at Abstract, 1:35-50, 2:5-7, 2:27-29, FIG. 1; MacDonald at Abstract, ¶¶ [0016], [0017], [0020], [0024], FIGS. 1, 7.

190. Accordingly, it would have been obvious to a POSITA to form two or more discrete portions of the circular knit fabrics taught by Stewart (*e.g.*, by cutting two portions of fabric from the roll of fabric 12 or forming two different rolls of fabric) and then joining them together (*e.g.*, by sewing or stitching the fabric portions along their edges) in order to form a finished fabric at least 90 inches wide. A POSITA would have been motivated to do so for a number of reasons. For example, a POSITA would have done so to construct a wide finished fabrics, or to create finished fabrics having portions of fabric with different properties or characteristics (*e.g.*, higher elasticity or warmer/cooler fabrics).

Deciding on a particular width, or which properties or characteristics the fabric portions had would have been a routine design choice for a POSITA. A POSITA would have also found this to be a simple combination of well-known elements. Specifically, a POSITA would have used well-known fabric materials and machinery in a customary and conventional manner to predictably yield a finished fabric at least 90 inches wide having at least two circular knit fabric portions joined together at their edges.

7. Stewart with Fleissner the finished fabric includes piping

191. Claim 2, which depends from claim 1, further requires piping. Neither Stewart nor Fleissner explicitly describe the use of "piping" in their finished fabrics. Piping, however, is merely a well-known aesthetic technique in which a decorative seam or narrow piece of material is sewn over the edge(s) in order to improve the appearance of the finished fabric.

192. Moreover, piping was well-known and used with various kinds of finished fabrics, including bed sheets, for decades before the '580 patent. *See*, *e.g.*, Allaire at Abstract, 4:1-20 ("in order to enhance the beauty of the sheet, a piping or a trim may also be employed about the edges of the sheet"). Thus, it would have been obvious to add piping to the finished fabrics taught by Stewart and Fleissner. A POSITA would have been motivated to do so for a number of reasons, such as to

enhance the beauty of the finished fabric. *Id.* For a POSITA, adding piping would have involved nothing more than a routine design choice. *Id.*

193. For at least the reasons above, it is my opinion that Stewart and Fleissner teach or suggest each and every limitation of claim 2.

8. Stewart with Fleissner teaches first and second fabrics having different fabric characteristics

194. Claim 3 depends from claim 1 and further requires the first and second fabrics have different fabric characteristics. As discussed above, Stewart teaches that its circular knit fabrics can have various characteristics, such as "an antimicrobial finish, a flame-retardant finish, a no-iron finish," or "any desired finishing treatments." Stewart at ¶ [0020]. To the extent Stewart does not explicitly teach using two fabrics with different characteristics in its bed sheet, a POSITA would have found this to be obvious. As discussed above, bed sheets with two fabric portions having different characteristics were well-known in the prior art. *Id.*; Haggerty at Abstract, 1:17-31, 4:16-33, FIG. 4. A POSITA would have been motivated to use fabrics with different characteristics for a number of reasons, including to provide different functional qualities in various portions of the bed sheets or other products. For a POSITA choosing the types of fabrics to join together would have been nothing more than a routine design choice. *Id*.

195. For at least the reasons above, it is my opinion that Stewart and Fleissner teach or suggest each and every limitation of claim 3.

9. Stewart with Fleissner teaches fabric characteristics including moisture management, UV protection, anti-microbial properties, thermo-regulation, wind resistance, and water resistance

196. Claims 4-9 each depend from claim 3 and further require that "at least one of the fabric characteristics" includes "moisture management" (claim 4), "UV protection" (claim 5), "anti-microbial properties" (claim 6), "thermo-regulation" (claim 7), "wind resistance" (claim 8), and "water resistance" (claim 9). As discussed directly above, Stewart teaches that "any desired finishing treatment(s)" can be used with its fabrics, including "an antimicrobial finish" or "flame-retardant finish." To the extent Stewart does not explicitly teach fabrics having the other characteristics specified in these claims, this would have been obvious. Indeed, as acknowledged by the '580 patent, "[p]erformance fabrics are made for a variety of end-use applications, and can provide multiple functional qualities, such as moisture management, UV protection, anti-microbial [properties], thermo-regulation, and wind/water resistance." 580 patent at 1:65-66 (explaining that such fabrics "would include beneficial wicking among other properties), 2:44-56 (describing the '380 patent as disclosing a "moisture wicking" elastic performance fabric); *see also* Haggerty at Abstract, 1:17-31 (describing the use of fabrics with varying heating characteristics); US Pat. Nos. 6,782,590, 6,779,368, 2004/0132367, 6,412,540, WELLINGTON 361-362 .

197. Further, it was well known that fabrics with these characteristics could be constructed at larger sizes, such as for example, with the creation of tents, ship sails, stadium covers, and geotextiles used in civil engineering applications are performance fabrics. WELLINGTON at 208.

198. For at least the reasons above, it is my opinion that Stewart and Fleissner teach or suggest each and every limitation of claims 4-9.

10. Stewart with Fleissner teach performance fabric portion including man-made fibers having higher breathability, higher heat transfer, and higher moisture wicking characteristics than a cotton fabric

199. Claims 10-12 each depend from claim 1 and further require that the performance fabric portion includes "a man-made fiber" that has "higher breathability than a cotton fabric" (claim 10), "higher heat transfer than a cotton fabric" (claim 11), and "higher moisture wicking characteristics than a cotton fabric" (claim 12).

200. As I discuss above, spandex is a form of a man-made fiber. As I also discuss above, it was well known that spandex-based performance fabrics outperform cotton fabrics in several respects. Specifically, it was well-known at the time of the '580 patent that such fabrics provided higher breathability, heat transfer, and moisture wicking characteristics than cotton fabrics. For the same reasons I discuss above, it would have been obvious to a POSITA that the claimed performance fabric described in the APA, which includes man-made fiber, exhibits

characteristics superior to cotton, including higher breathability, heat transfer and moisture wicking.

201. For at least the reasons above, it is my opinion that Stewart and Fleissner teach or suggest each and every limitation of claims 10-12.

11. Stewart with Fleissner teaches a gauge of at least 17 gauges

Claim 13 depends from claim 1 and further requires the finished fabric having a gauge of at least 17. As I discuss above, high-gauge circular knitting machines having at least 17 gauges were well known in the art. As I also discuss above, it would have been obvious to a POSITA to use high-gauge circular knit machines that were well-known and used in the prior art to construct the claimed finished performance fabric as taught by Stewart. Circular knitting machines that used 17 or more gauges (*i.e.*, "high gauge") were commonplace. Additionally, a POSITA would have known that high gauge circular knitting was customarily used when knitting the type of spandex-based and other performance fabrics described in Stewart. Thus, a POSITA would have understood that Stewart's circular-knit performance fabrics could be 17 or more gauges. The operation of the high gauge circular knit machine would have not changed, allowing a POSITA to predictably construct a fabric with a high gauge. For example, a POSITA would have fed the fabric materials to the 24 and 28 gauge machines described in the '695 patent to form a circularly knit performance fabric as taught by Stewart. Further, a POSITA would have understood that to create a circular knit bed sheet suitable for comfortable sleep and wide enough for use as a fitted sheet on a mattress, the fabric would be knit at a high gauge. A POSITA would have understood that increasing the gauge of circular knit machines increases the width and fineness of the fabric (which in turn enhances the comfortable feel of the fabric).

202. For at least the reasons above, it is my opinion that Stewart and Fleissner teach or suggest each and every limitation of claim 13.

12. Stewart with Fleissner teaches a finished fabric comprising a bed sheet

203. Claim 14 depends from claim 1 and further requires that the finished fabric comprises "a bed sheet". As I discuss above, Stewart in view of Fleissner teaches a finished fabric with two or more discrete circular knit fabric portions joined together. It would have been obvious to a POSITA that this finished fabric can be in the form of a bed sheet, such as a fitted and/or flat bed sheet. *See*, *e.g.*, Haggerty at Title, Abstract, 1:28-49, 2:44-46, FIGS. 1-5. Specifically, Stewart teaches that its finished fabrics can be used to make bed sheets. Stewart at Title, ¶ [0020].

204. For at least the reasons above, it is my opinion that Stewart and Fleissner teach or suggest each and every limitation of claim 14.

13. Stewart with Fleissner teaches a knit fabric that includes polyurethanepolyurea copolymer fiber

205. As I discuss above, Stewart explains that its circularly knit bed sheet can be constructed with yarns that include spandex. I also discuss above that the '580 patent acknowledges, it was well-known that spandex "is a polyurethane-polyurea copolymer that was invented by DuPont." '580 patent at 4:21-29; *see also* '695 patent at 1:44-52. A POSITA would have understood from Stewart's description of spandex-based yarns that the circular knit bed sheet could be constructed using "polyurethane-polyurea copolymer" fiber in the same way that it is constructed with spandex. Specifically, a POSITA would have understood that after forming a yarn with "polyurethane-polyurea copolymer" fiber, the yarn would have been fed to the conventional and customary circular knitting machines disclosed in Stewart in a conventional manner to predictably yield the knit bed sheet.

206. For at least the reasons above, it is my opinion that Stewart and Fleissner teach or suggest each and every limitation of claim 18.

14. Stewart with Fleissner teaches the polyurethane-polyurea copolymer fiber included in the knit fabric in such a proportion that, if circularly knit at a high gauge, the knit fabric could be knit at no more than a 72.5 inch circumference without losing the integrity of the polyurethanepolyurea copolymer fiber

207. Claim 19 depends from claim 18 and further requires the polyurethane-polyurea copolymer fiber is included in the knit fabric in such a

proportion that, if circularly knit at a high gauge, the knit fabric could be knit at no more than a 72.5 inch circumference without losing the integrity of the polyurethanepolyurea copolymer fiber. As I discuss above, a POSITA would have understood from Stewart that the circular knit bed sheets could be manufactured using customary and conventional high-gauge circular knitting machines, materials, and techniques, including performance fabrics containing polyurethane-polyurea copolymer fibers. Stewart at ¶ [0020]. Thus, a POSITA would have understood that spandex had exceptionally high elasticity and compression properties and, therefore, a POSITA would have understood that circularly knitting these spandex-based performance fabrics above certain widths would affect the integrity of the spandex fibers or stitches in the fabric. ‘695 patent at 6:43-57, 8:16-64.

208. A POSITA would have readily appreciated that, when a particular proportion of spandex (*e.g.*, 4%) was included in the performance fabrics, as taught by Stewart, these fabrics could only be circularly knit at high-gauge up to a maximum circumference (*e.g.*, 72.5 inches), otherwise the spandex (*i.e.*, polyurethane-polyurea copolymer) fibers would lose their integrity.

209. Additionally, as I explain above, a POSITA would have understood that this claimed characteristic is merely an inherent property of circularly knit spandex-based performance fabrics. ‘580 patent at 7:29-32 (acknowledging that,

when using then-available "circular knitting machine[s], the high gauge performance fabrics can only be made to a maximum size of 72.5 inches without losing the integrity of the spandex in the fabric."). Indeed, as discussed above, this was confirmed during prosecution of the related '977 application. Accordingly, because the APA teaches the same fabric materials manufactured using the same machinery, the APA fabrics necessarily have this same 72.5 inch integrity restriction recited in claim 19.

210. For at least the reasons above, it is my opinion that Stewart and Fleissner teach or suggest each and every limitation of claim 19.

Conclusion

In signing this declaration, I recognize that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross-examination in the case, and that cross-examination will take place within the United States. If cross-examination is required of me, I will appear for cross-examination within the United States during the time allotted for cross-examination.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Executed on the _2nd__ day of March, 2016.

Dr. Sabit Adanur