

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

TOP GLORY TRADING GROUP INC. and

DP DREAM PAIRS INC.,

Petitioners,

v.

COLE HAAN LLC,

Patent Owner.

Case IPR2025-01394

Patent No. 11,041,262

**DECLARATION OF DR. SABIT ADANUR IN SUPPORT
OF PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 11,041,262**

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LIST OF CHALLENGED CLAIMS

[1.pre] A method of manufacturing an article of footwear having a knit upper and a sole, the method comprising:

[1.a.i] knitting with a knitting machine to form a knitted element of the knit upper such that the knitted element is of a unitary one-piece construction comprising

[1.a.ii] a knitted upper heel region, a knitted upper lateral midfoot region, a knitted upper medial midfoot region, a knitted upper metatarsal region including an upper lateral metatarsal region and an upper medial metatarsal region, a knitted upper lateral ball region, a knitted upper medial ball region, a knitted upper toe region,

[1.a.iii] a knitted upper lateral side region including the knitted upper lateral midfoot region, the knitted upper lateral metatarsal region, and the knitted upper lateral ball region, a knitted upper medial side region including the knitted upper medial midfoot region, the knitted upper medial metatarsal region, and the knitted upper medial ball region,

[1.a.iv] a first area of a jersey stitch knit being at least in the knitted upper toe region, and a second area of a pointelle stitch knit being at least in the knitted upper lateral and medial metatarsal regions,

[1.a.v] the first area having a rear boundary, the second area having a forward boundary, the rear boundary of the first area and the forward boundary of the second area being coincident and coextensive with each other and defining a boundary line between the first and second areas,

[1.a.vi] and a line of broguing adjacent the boundary line; and

[1.a.vii] attaching the sole to the knit upper;

[1.b] the knitted upper toe region being seamlessly knitted with the knitted upper medial and lateral ball regions during the knitting step, the knitted upper medial and lateral ball regions being seamlessly knitted with the knitted upper metatarsal region during the knitting step, the knitted upper metatarsal region being seamlessly knitted with the knitted upper lateral and medial midfoot regions during the knitting step, and

[1.c] the first and second areas being knitted during the knitting step.

[2] A method as set forth in claim 1, further comprising a medial boundary line and a lateral boundary line of the boundary line being formed during the knitting step; and a medial line of broguing and a lateral line of broguing of the line of broguing being formed during the knitting step; the medial line of broguing being adjacent the

medial boundary line, the lateral line of broguing being adjacent the lateral boundary line, the medial line of broguing comprising a curved line of holes, and the lateral line of broguing comprising a curved line of holes.

[3] A method as set forth in claim 1, wherein the knit upper is knitted during the knitting step with at least first and second yarns, the first yarn being of a hot melt yarn, the second yarn being of a yarn other than a hot melt yarn.

[4.pre] A method as set forth in claim 3, further comprising:

[4.a] placing the knit upper around a last;

[4.b] applying heat to the knit upper while the knit upper is around the last to cause the hot melt yarn to affix to the second yarn.

[5.pre] A method as set forth in claim 1, wherein

[5.a] the knitted element further includes a knitted lateral eyestay area and a knitted medial eyestay area, each knitted during the knitting step;

[5.b] the knitted upper lateral midfoot region includes a knitted lateral midfoot area knitted during the knitting step;

[5.c] the knitted upper medial midfoot region includes a knitted medial midfoot area knitted during the knitting step; and

[5.d] the knitted element includes additional lines of broguing between the lateral midfoot area and the lateral eyestay area and between the medial midfoot area and the medial eyestay area, the additional lines of broguing being formed during the knitting step.

[6.pre] A method as set forth in claim 1, wherein

[6.a] the knitted upper lateral midfoot region includes a knitted lateral midfoot area knitted during the knitting step;

[6.b] the knitted upper medial midfoot region includes a knitted medial midfoot area knitted during the knitting step; and

[6.c] the knitted element includes additional lines of broguing between the lateral midfoot area and the second area and between the medial midfoot area and the second area, the additional lines of broguing being formed during the knitting step.

[7.pre] A shoe comprising:

[7.a] a knit upper;

[7.b] a sole secured to the knit upper;

[7.c.i] the knit upper having a knitted element, the knitted element being formed of a unitary one-piece construction during a knitting process on a knitting machine,

[7.c.ii] the knitted element comprising a knitted upper lateral midfoot region, a knitted upper medial midfoot region, a knitted upper metatarsal region, a knitted upper lateral ball region, a knitted upper medial ball region, a knitted upper toe region

[7.c.iii] and a line of broguing;

[7.d] the knitted upper metatarsal region including a knitted upper lateral metatarsal region and a knitted upper medial metatarsal region,

[7.e] the knitted element having a knitted upper lateral side region and a knitted upper medial side region, the knitted upper lateral side region including the knitted upper lateral midfoot region, the knitted upper lateral metatarsal region, and the knitted upper lateral ball region, the knitted upper medial side region including the knitted upper medial midfoot region, the knitted upper medial metatarsal region, and the knitted upper medial ball region,

[7.f.i] the knitted element comprising a first area of a jersey stitch knit and a second area of a pointelle stitch knit, the first area being at least in the knitted upper toe region, the second area being at least in the knitted upper lateral and medial metatarsal regions,

[7.f.ii] the first area having a rear boundary, the second area having a forward boundary, the rear boundary of the first area and the forward boundary of the second area being coincident and coextensive with each other and defining a boundary line between the first and second areas,

[7.f.iii] the boundary line being adjacent the line of broguing; and

[7.g] the knitted upper toe region being seamlessly knitted with the knitted upper medial and lateral ball regions during the knitting process, the knitted upper medial and lateral ball regions being seamlessly knitted with the knitted upper metatarsal region during the knitting process, the knitted upper metatarsal region being seamlessly knitted with the knitted upper lateral and medial midfoot regions during the knitting process, and

[7.h] the first and second areas being knitted during the knitting process.

[8] A shoe as set forth in claim 7, wherein the boundary line comprises a medial boundary line and a lateral boundary line, and wherein the line of broguing includes a medial line of broguing and a lateral line of broguing, the medial line of broguing

being adjacent the medial boundary line, the lateral line of broguing being adjacent the lateral boundary line, the medial line of broguing comprising a curved line of holes, and the lateral line of broguing comprising a curved line of holes.

[9] A shoe as set forth in claim 7, wherein the knit upper is knitted during the knitting process with at least first and second yarns, the first yarn being of a hot melt yarn, the second yarn being of a yarn other than a hot melt yarn.

[10] A shoe set forth in claim 9, further comprising the hot melt yarn being affixed to the second yarn by heat applied to the knit upper while the knit upper is positioned around a last.

[11.pre] A shoe as set forth in claim 7, wherein

[11.a] the knitted element further includes a knitted lateral eyestay area and a knitted medial eyestay area,

[11.b] the knitted upper lateral midfoot region including a knitted lateral midfoot area,

[11.c] the knitted upper medial midfoot region including a knitted medial midfoot area, and

[11.d] wherein broguing holes forming additional lines of broguing are between the lateral midfoot area and the lateral eyestay area and between the medial midfoot area and the medial eyestay area, wherein the knitted element is knitted with the broguing holes during the knitting process.

[12.pre] A shoe as set forth in claim 7, wherein

[12.a] the knitted upper lateral midfoot region includes a knitted lateral midfoot area and

[12.b] the knitted upper medial midfoot region includes a knitted medial midfoot area, and

[12.c] wherein broguing holes forming additional lines of broguing are between the lateral midfoot area and the second area and between the medial midfoot area and the second area, wherein the knitted element is knitted with the broguing holes during the knitting process.

[13] A shoe as set forth in claim 7, wherein the knitted element further includes a knitted upper heel region formed during the knitting process.

I. INTRODUCTION

1. My name is Sabit Adanur and I am currently a professor of Mechanical Engineering at Auburn University. I have been retained on behalf of Top Glory Trading Group Inc. and DP Dream Pairs Inc. (“Petitioners” or “Top Glory”), to provide my opinions on certain issues related to U.S. Patent No. 11,041,262 (“the ’262 patent”) in connection with the above-captioned *inter partes* review (“IPR”) proceeding. In particular, I have been asked to provide my insights, analysis, and opinions regarding whether claims 1–13 of the ’262 patent (“Challenged Claims”) are obvious over the prior art references identified below.

2. I understand that the ’262 patent is titled “Shoe having knit wingtip upper”; names as inventors Jack Boys, Ann Bono, Aubert Shepherd, and Mattias Verfl; and is currently assigned to Cole Haan LLC according to the USPTO. I have considered the ’262 patent. I understand that the ’262 patent has been provided as Ex. 1001.

3. I understand that the file history of the ’262 patent has been provided as Ex. 1002. I have considered this file history, and I will refer to it as “the ’262 File History.”

4. I understand that the ’262 patent is a continuation of U.S. Patent Application No. 15/205,672 (“’672 Application”), now U.S. Patent No. 10,327,511 (“’511 patent”). I understand that the ’511 patent has been provided as Ex. 1011.

5. I understand that the file history of the '511 patent has been provided as Ex. 1012. I have considered this file history, and I will refer to it as “the '511 patent File History.”

6. I understand that the '262 patent claims a priority date of July 8, 2016, the filing date of the '672 Application. For the purposes of rendering my opinions in this declaration, I have been asked to consider the Challenged Claims assuming they are entitled to the July 8, 2016 filing date of the '672 Application.

7. My analysis and conclusions set forth in this declaration are based on my educational background and experiences in the field (*see* Section II). I am qualified to opine concerning what a person of ordinary skill in the art would have known and understood during that time. Before July 8, 2016, my level of skill in the art was at least that of a person of ordinary skill. I am qualified to opine concerning what a person of ordinary skill in the art would have known and understood at the time of the '262 patent's purported invention. My analysis and conclusions herein are from the perspective of a person of ordinary skill in the art as of July 8, 2016.

8. As part of my independent analysis for this declaration, I have considered the following: the background knowledge/technologies that were commonly known to persons of ordinary skill in this art during the time before the earliest claimed priority date for the '262 patent; my own knowledge and experiences gained from my work experience in the field of the '262 patent and

related disciplines; and my experience in working with others involved in this field and related disciplines.

9. I have considered the following non-exhaustive list of references in preparing my declaration. I have been instructed to assume that each of these references qualifies as prior art as of the respective priority dates of the respective grounds in which they are used as discussed below.

- **U.S. Patent Publication No. 2010/0154256 (“Dua”)** to Bhupesh Dua titled “Article Of Footwear Having An Upper Incorporating A Knitted Component,” filed on December 18, 2008, and published on June 24, 2010. I understand that a copy of this reference has been designated as Exhibit 1004. Throughout my declaration, references to Dua are to Exhibit 1004.
- **U.S. Patent No. 6,931,762 (the ’762 patent”)** to Bhupesh Dua, titled “Footwear With Knit Upper And Method Of Manufacturing The Footwear,” filed on December 18, 2002, and published on August 23, 2005. I understand that a copy of this reference has been designated as Exhibit 1005. Throughout my declaration, references to the ’762 patent are to Exhibit 1005.
- **U.S. Patent No. 6,910,288 (the ’288 patent”)** to Bhupesh Dua, titled “Footwear Incorporating A Textile With Fusible Filaments And Fibers,” filed on December 18, 2002, and published on June 28, 2005. I understand that a copy of this reference has been designated as Exhibit 1006. Throughout my declaration, references to the ’288 patent are to Exhibit 1006.
- **Alan J. Flusser, *Clothes and the Man: The Principles of Fine Men’s Dress* (1985) (“Flusser”)**, published in 1985. I understand that a copy of this reference has been designated as Exhibit 1007. Throughout my declaration, references to Flusser are to Exhibit 1007.
- **U.S. Patent No. 7,949,570 (“Litke”)** to Kenneth S. Litke, Michael Redwood, and Saunders N. Whittlesey, titled “Computerized Article Customization System And Method For Use Thereof,” filed on August 14,

2009, and published on May 24, 2011. I understand that a copy of this reference has been designated as Exhibit 1008. Throughout my declaration, references to Litke are to Exhibit 1008.

10. I understand that there is a pending district court litigation between Petitioners and Patent Owner (“New Jersey Case”) involving the ’262 patent.

11. I am being compensated by Top Glory at my standard hourly consulting rate of \$350 per hour for my time on this matter. My compensation is not dependent on the outcome of this proceeding or any other proceeding between the parties.

12. In forming my opinions, I relied on the documents cited in this declaration and the documents identified in the attached Appendix B. These documents comprise patents, file histories, printed publications, and other related documents. As discussed below, each document is a type that experts in my field would have reasonably relied upon when forming their opinions. Further, experts in my field would have had access to each document either through the applicable patent offices and/or well-known libraries, conferences, or publications in the field. My opinions are also based upon my personal and professional experience.

II. BACKGROUND AND QUALIFICATIONS

13. A summary of my background and qualifications as a technical expert for this case is provided below. A complete listing of my qualifications and background are detailed in my curriculum vitae (“CV”), which is attached hereto as Appendix A. The ’262 patent is in the field of polymers, knitting, knitting machines

and textiles. As demonstrated by my CV and the below summary of my relevant experience, I would be considered by others to be an expert in the field of polymer processing, knitting, knitting machinery and textiles.

14. I received a Bachelor of Science (BS) degree in Mechanical Engineering from Istanbul Technical University, Istanbul, Turkey, in 1982, and a Master of Science (M.S.) degree in Textile Engineering and Science and a Doctor of Philosophy (Ph.D.) degree in Fiber and Polymer Science, both from North Carolina State University in 1985 and 1989, respectively. During my M.S. and Ph.D. education, I worked as Research/Teaching assistant as well.

15. After graduation, I worked at Asten Forming Fabrics, Inc., in Appleton, WI as process development engineer and product and process development manager between 1989 – 1992.

16. In 1992, I joined the faculty of Auburn University in Auburn, Alabama, and have since been a Professor in the Departments of Textile Engineering, Polymer and Fiber Engineering and Mechanical Engineering.

17. Over the past 35 years, my work has focused on research in fibers, yarns, polymers, fabrics, fabric design, manufacturing, testing and analysis, fabric structures including knitted socks and shoes, and textile machinery and equipment.

18. During my tenure at Auburn University, I have taught undergraduate and graduate courses relating to knitting technology and textile materials and

machinery, including Kinematics and Dynamics (MECH 2140), Engineered Flexible Structures (MECH 5320/6320), and Manufacturing of Polymeric Structures (MECH5520/6520-PFEN 6200). For other courses, see Appendix A.

19. To date, at least 15 individuals have received their Ph.D. degree in Mechanical Engineering, Polymer & Fiber Engineering (PFEN), and Textile Engineering under my supervision.

20. I have authored or co-authored 85 peer-reviewed scientific publications. I have published 6 invited feature articles, 60 conference proceedings and 6 non-refereed journal articles. I have made 125 technical presentations alone or with my students/colleagues and presented 80 poster sessions. I have supervised 72 senior design projects.

21. I have also authored several books, including:

- Wellington Sears Handbook of Industrial Textiles (Technomic, 1995)
(covering polymers, fibers, knitting, knitted fabrics, testing and analysis)
- Handbook of Weaving (Technomic Publishing Co., Inc., 2001)
- Paper Machine Clothing (2d ed.) (Asten Johnson, 2017)

22. Throughout my career, I have been involved with numerous professional organizations, including American Society of Mechanical Engineers (ASME), Fiber Society, Technical Association for the Pulp and Paper Industry (TAPPI), Manufacture Alabama, and Phi Psi Textile Fraternity (Honorary member).

23. I have also been a member of the Editorial Board for various journals in the textile industry, including Journal of Industrial Textiles, Electronic Journal of Textiles, POLITEKNIK, Journal of Coated Fabrics, and Textile and Technique.

24. My research areas include fiber, yarn, fabric design, manufacturing (weaving, knitting, braiding, tufting and nonwovens) and testing, textile machinery, polymer processing and machinery, composites, additive manufacturing, and computer aided design. I have concluded 42 research projects totaling several million dollars. I have submitted 11 inventions and patent disclosures.

25. I have received numerous honors and awards. I was ranked among the world's top 2% of all independently cited researchers by Stanford University in 2023 and 2024. I received Auburn Author Award in 2018. I have received outstanding faculty award in Textile and Polymer and Fiber Engineering 6 times. I received Auburn Alumni Professor Award between 1999-2004, Birdsong Merit Teaching Award in 2000 and Engineering Council Senior Faculty Award in 1999. I received National Science Foundation Early Career Development Award between 1996 – 2000. I was awarded George Goldfinger Award for best Ph.D. dissertation in 1991.

26. I have experience developing yarns and fabrics, and textile machinery for making the same, for a wide variety of garments and apparel including knitted socks and shoes. For example, I have served as a consultant for National Apparel, Inc. and as a member of a joint PhD program at Auburn University between the in

Integrated Textiles and Apparel Departments. I have given technical presentations on apparel fabrics. And I have served as an expert witness in several cases involving footwear with textile or knit uppers, including *Adidas AG v. Nike, Inc.*, IPR2013-00067 (filed Nov. 28, 2012).

27. A current curriculum vitae is attached as Appendix A and includes the above listed credentials, additional background and information, and my experience as an expert witness.

28. Based on my experience and education, I believe that I am qualified to opine as to the knowledge and level of skill of one of ordinary skill in the art at the time of the alleged invention of the '262 patent (which I further describe below) and what such a person would have understood at that time, and the state of the art during that time. Based on my above-described experience in polymer processing, fibers, yarns, fabrics, knitting and knitting machinery, and the application of such technology to various commercial goods including footwear, and the acceptance of my publications and professional recognition by societies in my field as listed above and in my CV, I believe that I am qualified to be an expert with respect to the above-described area of the '262 patent.

III. LEGAL STANDARDS

29. I am not an attorney and offer no legal opinions, but in the course of my work, I have had experience studying and analyzing patents and patent claims from the perspective of a person skilled in the art.

30. I have been informed of certain legal understandings relevant to my opinions. In formulating my opinions, I have relied on the legal understandings I have been provided with as set forth in this declaration.

31. I have been informed that in inter partes review proceedings, invalidity must be shown under a preponderance of the evidence standard.

A. MY UNDERSTANDING OF CLAIM CONSTRUCTION

32. I have been informed that patent claims are construed from the viewpoint of a person of ordinary skill in the art of the patent at the time of the alleged invention. I have been informed that patent claims generally should be interpreted consistent with their plain and ordinary meaning as understood by a person of ordinary skill in the art in the relevant time period (*i.e.*, at the time of the purported invention, or the so called “effective filing date” of the patent application), after reviewing the patent claim language, the specification, and the prosecution history (*i.e.*, the intrinsic record).

33. I have further been informed that a person of ordinary skill in the art must read the claim terms in the context of the claim itself, as well as in the context

of the entire patent specification. I understand that in the specification and prosecution history, the patentee may specifically define a claim term in a way that differs from the plain and ordinary meaning. I understand that the prosecution history of the patent is a record of the proceedings before the U.S. Patent and Trademark Office and may contain explicit representations or definitions made during prosecution that affect the scope of the patent claims. I understand that an applicant may, during the course of prosecuting the patent application, limit the scope of the claims to overcome prior art or to overcome an examiner's rejection, by clearly and unambiguously arguing to overcome or distinguish a prior art reference, or clearly and unambiguously disavowing claim coverage.

34. In interpreting the meaning of the claim language, I understand that a person of ordinary skill in the art may also consider "extrinsic" evidence, including expert testimony, inventor testimony, dictionaries, technical treatises, other patents, and scholarly publications. I understand this evidence is considered to ensure that a claim is construed in a way that is consistent with the understanding of those of ordinary skill in the art at the time of the claimed invention. For example, this can be useful for a technical term whose meaning may differ from its ordinary English meaning. I understand that extrinsic evidence may not be relied on if it contradicts or varies the meaning of claim language provided by the intrinsic evidence, particularly if the applicant has explicitly defined a term in the intrinsic record.

B. MY UNDERSTANDING OF ANTICIPATION

35. I understand that a patent claim is invalid as “anticipated” if all the limitations of the claim are present, either expressly or inherently, in a single prior art publication or patent.

36. I also understand that a prior art reference can disclose a claimed feature because the feature is expressly described or because the feature is inherent in the disclosure. I understand that something is inherent in a prior art reference if the missing descriptive matter must necessarily be present, not merely probably or possibly present, and it would be so recognized by a person of ordinary skill in the art as of the priority date of the patent. I understand that it is acceptable to examine evidence outside of the prior art reference (i.e., extrinsic evidence) in determining whether a feature, while not expressly discussed in the reference, is necessarily present in it.

37. I have further been informed that where a reference discloses multiple embodiments, the reference should not be limited to a preferred embodiment. Instead, each disclosed embodiment may anticipate.

38. Moreover, I have been informed that as part of an anticipation analysis, it is proper to take into account not only specific teachings of the reference, but also the inferences that one skilled in the art would reasonably be expected to draw therefrom. A reference can anticipate a claim even if it does not expressly spell out

all the limitations arranged or combined as in the claim, if a person of skill in the art, reading the reference, would at once envisage the claimed arrangement or combination.

C. MY UNDERSTANDING OF OBVIOUSNESS

39. I understand that a claim may be invalid if the subject matter described by the claim as a whole would have been obvious to a hypothetical person of ordinary skill in the art in view of a prior art reference or in view of a combination of references at the time the claimed invention was made. Therefore, I understand that obviousness is determined from the perspective of a hypothetical person of ordinary skill in the art and that the asserted claims of the patent should be read from the point of view of such a person at the time the claimed invention was made. I further understand that a hypothetical person of ordinary skill in the art is assumed to know and to have all relevant prior art in the field of endeavor covered by the patent in suit.

40. I have been informed that there are two criteria for determining whether prior art is analogous and thus can be considered prior art: (1) whether the art is from the same field of endeavor, regardless of the problem addressed, and (2) if the reference is not within the field of the patentee's endeavor, whether the reference still is reasonably pertinent to the particular problem with which the patentee is involved. I have also been informed that the field of endeavor of a patent is not

limited to the specific point of novelty, the narrowest possible conception of the field, or the particular focus within a given field. I have also been informed that a reference is reasonably pertinent if, even though it may be in a different field from that of the patentee's endeavor, it is one which, because of the matter with which it deals, logically would have commended itself to a patentee's attention in considering their problem.

41. I have also been advised that an analysis of whether a claimed invention would have been obvious should be considered in light of the scope and content of the prior art, the differences (if any) between the prior art and the claimed invention, and the level of ordinary skill in the pertinent art involved. I understand as well that a prior art reference should be viewed as a whole.

42. I have also been advised that in considering whether a claimed invention would have been obvious over a combination of prior art references, I may assess whether there are apparent reasons to combine known elements in the prior art in the manner claimed in view of interrelated teachings of multiple prior art references, the effects of demands known to the design community or present in the marketplace, and/or the background knowledge possessed by a person of ordinary skill in the art. I understand that other principles may be relied on in evaluating whether a claimed invention would have been obvious, and that these principles include the following:

- A combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results;
- When a device or technology is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or in a different one, so that if a person of ordinary skill can implement a predictable variation, the variation is likely obvious;
- If a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond their skill;
- An explicit or implicit teaching, suggestion, or motivation to combine two prior art references to form the claimed combination may demonstrate obviousness, but proof of obviousness does not depend on or require showing a teaching, suggestion, or motivation to combine;
- Market demand, rather than scientific literature, can drive design trends and may show obviousness;
- In determining whether the subject matter of a patent claim would have been obvious, neither the particular motivation nor the avowed purpose of the named inventor controls whether the claim is obvious;
- One of the ways in which a patent's subject can be proved obvious is by noting that there existed at the time of invention a known problem for which there was an obvious solution encompassed by the patent's claims;
- Any need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed;
- "Common sense" teaches that familiar items may have obvious uses beyond their primary purposes, and in many cases a person of ordinary skill will be able to fit the teachings of multiple patents together like pieces of a puzzle;
- A person of ordinary skill in the art is also a person of ordinary creativity, and is not an automaton;

- A patent claim can be proved obvious by showing that the claimed combination of elements was “obvious to try,” particularly when there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions such that a person of ordinary skill in the art would have had good reason to pursue the known options within his or her technical grasp; and
- One should be cautious of using hindsight in evaluating whether a claimed invention would have been obvious.

43. I further understand that, in making a determination as to whether the claimed invention would have been obvious to a person of ordinary skill, the Board may consider certain objective factors if they are present, such as: commercial success of products practicing the claimed invention; long-felt but unsolved need; teaching away; unexpected results; copying; and praise by others in the field. These factors are generally referred to as “secondary considerations” or “objective indicia” of nonobviousness. I understand, however, that for such objective evidence to be relevant to the obviousness of a claim, there must be a causal relationship (called a “nexus”) between the claim and the evidence, and that this nexus must be based on a novel element of the claim rather than something in the prior art. I also understand that even when they are present, secondary considerations may be unable to overcome primary evidence of obviousness (such as motivation to combine with predictable results) that is sufficiently strong.

D. MY UNDERSTANDING OF THE PRIORITY DATE OF A PATENT FOR PRIOR ART PURPOSES

44. I have been informed that for a claim in a later-filed application to be entitled to the benefit of the filing date of a prior application, the specification of the prior application must contain a written description of the invention and the manner and process of making and using the claimed invention, in such full, clear, concise, and exact terms to enable an ordinarily skilled artisan to practice the invention claimed in the later patent application. Additionally, the priority application must describe the later claimed invention in sufficient detail that a person having ordinary skill in the art can clearly conclude that the inventor invented the claimed invention as of the filing date sought. I understand this analysis is performed on a claim-by-claim basis.

IV. BACKGROUND OF THE TECHNOLOGY

45. As I explain in §V, the '262 patent's purported invention is directed to shoes having unitary, one-piece, seamless knit uppers that include areas with different knit structures (e.g., one is more tightly knit) and/or a wingtip pattern (e.g., formed at the boundary between different knit structures). '262 patent, 7:51-67, 8:1-67, 9:1-45, 10, 1-44.

46. But '262 does not purport to have identified any new techniques for seamless knitting, much less seamlessly knitting the claimed wingtip pattern or configuration of knit structures on the knitted upper, or a boundary line between two

knit areas or a line of broguing adjacent to the boundary line, or any advantageous structural or functional characteristics associated with these features. Instead, '262 seems to admit the knitting process used to generate such patterns and configurations of knit structures could be done on a generic “knitting machine, such as a CNC knitting machine.” '262, 6:10-13.

47. Techniques for seamlessly knitting shoe uppers with patterns and various configurations of different knit structures—and the wingtip pattern itself—were well-known prior to '262. For example, Dua disclosed a knitted upper, e.g., for a dress shoe, with various sections formed as a “unitary knit construction” with varied “knit types,” “knitted structures,” “yarn types,” “knit densit[ies],” and “apertures” in separate areas of the upper, e.g., forming patterns. Dua, [0015], [0022]-[0023], [0040]. It would have been obvious to try a wingtip pattern as one of Dua’s patterns for a dress shoe knitted in the upper because there were a finite number of standard, well-known dress shoe styles—including the wingtip pattern.

A. Knitting Techniques

48. Knitting involves interlooping yarn to create a textile. *See* David Spencer, *Knitting Technology – A Comprehensive Handbook and Practical Guide*, at 2 (2001) (Ex. 1023) (“Knitting is the most common method of interlooping and is second only to weaving as a method of manufacturing textile products.”). “Interlooping (Fig. 1.3) consists of forming yarn(s) into loops, each of which is

typically only released after a succeeding loop has been formed and intermeshed with it so that a secure ground loop structure is achieved. The loops are also held together by the yarn passing from one to the next.” Ex. 1023, 2

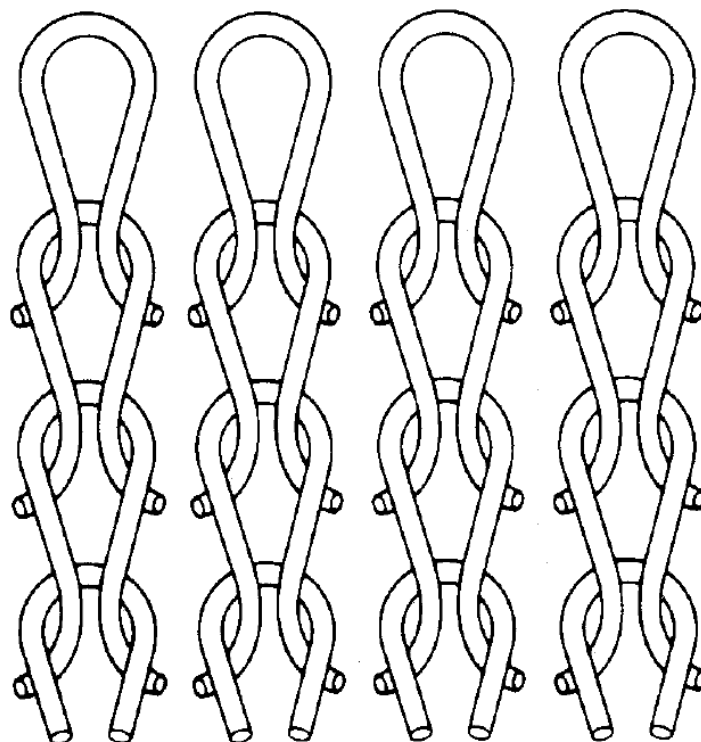


Fig. 1.3 Interlooping.

Ex. 1023, 2.

49. The knitting techniques disclosed and claimed in the '262 patent were well-known before the priority date of the '262 patent. For example, the concept of manufacturing textiles with a unitary, one-piece, knit construction was known for decades prior to the '262 patent. For example:

Shima Seiki launched their patented WholeGarment technique at ITMA'95 with two different V-bed models, each having unique features. These involve integrally and seamlessly knitting a complete tubular garment on a V-bed rib machine. A new feature of this technique is the ability to knit tubular rib with

a high wale density and therefore improved extensibility and appearance...The key concept of WholeGarment knitting is the facility to knit seamless body and sleeve tubes of virtually any type of plain, rib or purl construction, plus the ability to increase or decrease the sizes of the tubes and to move or merge them together as and when required during the garment knitting sequence.

Ex. 1023, at 237-238 (2001).

50. Several other knitting methods and machines for producing seamless one piece knitted structures were well-known prior to the '262 patent. Wonseok Choi, *Three Dimensional Seamless Garment Knitting on V-Bed Flat Knitting Machines*, 4 J. Textile and Apparel, Tech. and Mgmt., 1-33 (2005) (Ex. 1024). For example, Hong et al., summarized the single piece knitted fabric techniques on flat knitting machines. Hong et al., *The Development of 3D Shaped Knitted Fabrics For Technical Purposes on a Flat Knitting Machine*, 19 Indian Journal of Fibre & Textile Research, 189-94 (September 1994) (Ex. 1026).

51. Before the priority date of the '262 patent, it was well-known to apply these techniques for producing seamless one piece knitted structures to produce a single textile with multiple characteristics, such as different yarns, textures, colors, or patterns, in order to avoid having to stitch together multiple textiles. Ex. 1023, 57, 102-104, 111-14, 137-38, 154-55.

B. Knitted Footwear

52. Knitting, by hand or by machine, has been used to make footwear since at least the 1930s. *See, e.g.*, U.S. Patent Nos. 1,803,554 (Ex. 1029), 1,841,518 (Ex.

1030) (method to make knitted article formed as a single foot cover), 2,675,631 (Ex. 1031) (method to make a knitted structure to be joined with a sole), 5,345,638 (Ex. 1032) (method to produce knitted shoe shaped parts), 2,440,393 (Ex. 1033) (process to produce knitted fabric uppers for shoes), 2,147,197 (Ex. 1034) (method to make shoes with knitted uppers), 2,400,692 (Ex. 1035) (seamless knitted fabric for foot covering), European Patent No. 1338690B1(Ex. 1037) (process to make a knitted fabric for shoes).

C. Knit Structures

53. There are four primary or “base structures from which all weft knitted fabrics and garments are derived.” Ex. 1023, 60. These include “plain, rib, interlock and purl,” each of which “is composed of a different combination of face and reverse meshed stitches, knitted on a particular arrangement of needle beds.” Ex. 1023, 60. Each of these base structures may be used “in combination with another primary structure in a garment-length sequence.” Ex. 1023, 60. “Other types of stitch may be produced on each of the four needle arrangement base structures by varying the timing of the intermeshing sequence of the old and new loops.” Ex. 1023, 90. In addition, “[i]ndividual element movement (particularly of latch needles) enables weft knitting machines to produce designs and structures based upon needle selection for loop intermeshing and transfer. This also facilitates the production of garment parts shaped on the knitting machine.” Ex. 1023.

54. Jersey (also known as plain or single knit) and pointelle knit structures have been used in the textile industry for decades. *See* Ex. 1024, 5, 12, 24; Phyllis G. Tortora, *Understanding Textiles*, 344 (4th ed. 1992) (Ex. 1042); *Complete Textile Glossary*, at 87 (Celanese Acetate 2001) (Ex. 1028); Ex. 1023, 107-08, 111; A. W. Koester, *Fashion Terms: Apparel Fabric Glossary*, 6 (1992), (Ex. 1038); H. Stoll GmbH & Co, *Stoll Training: Manual Flat Knitting Machine*, 71-73 (2013) (Ex. 1021) (pointelle is formed, e.g., by a tuck stitch, which results in a hole at given positions); Jess Power, *Functional to Fashionable: Knitwear's Evolution Throughout the Last Century and into the Millennium*, 5 J. Textile and Apparel, Tech. and Mgmt., 1-16, 7 (2006) (Ex. 1043) (pointelle knits saw a spike in popularity in 2005).

55. As noted above, jersey is a “base structure[]” of knitting. Ex. 1023, 60. Jersey is known as “the simplest and most economical weft knitted structure to produce and has the maximum covering power.” Ex. 1023, 63. “It normally has a

potential recovery of 40% in width after stretching.” Ex. 1023, 63.

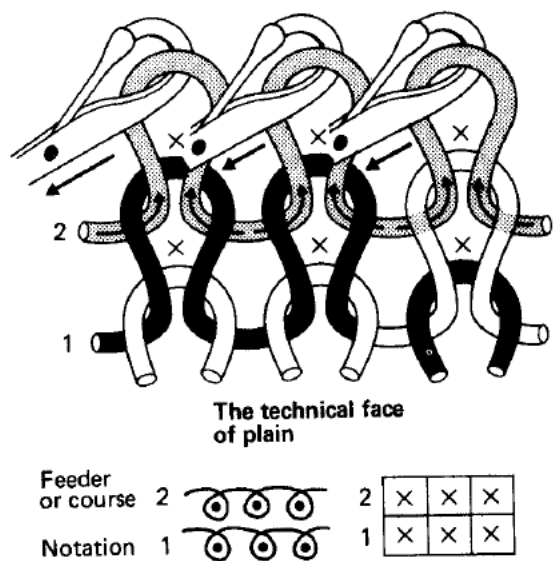


Fig. 7.1 The technical face of plain weft knitted fabric.

Ex. 1023, 61.

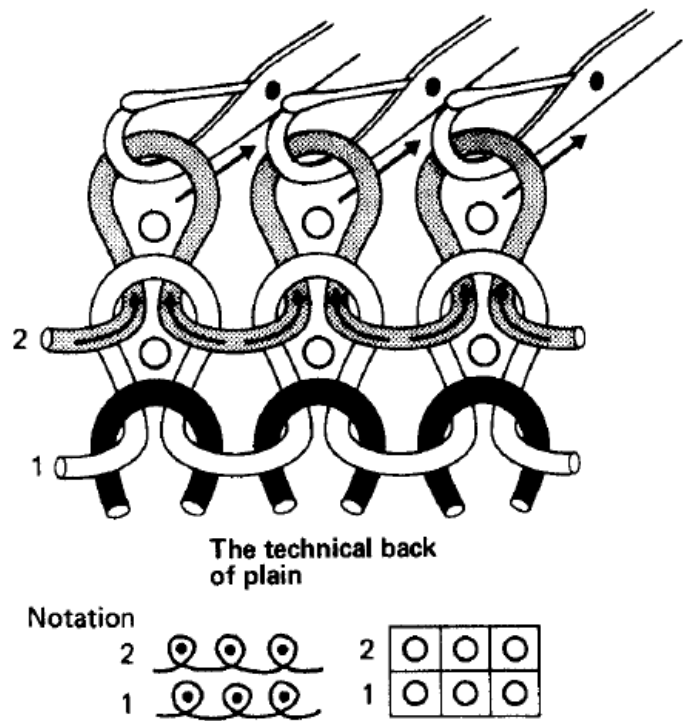


Fig. 7.2 The technical back of plain weft knitted fabric.

Ex. 1023, 62.

56. Pointelle is recognized as a type of openwork knit structure, but is described inconsistently in the field. An openwork knit structure is a knit structure having “normal securely intermeshed loops” as well as “areas where certain adjacent wales are not as directly joined” to “produc[e] apertures at these points.” Ex. 1023, 57-58 (describing open-work knit structures and contrasting with “close structure” knits in which “the stitches provide a uniform cover across the fabric and hold the wales securely together”), 99 (“The tuck stitch may also be employed to produce open-work effects.”). Some references define pointelle as a type of openwork structure in which individual stitches are transferred, such that needles are free, and then picked up again in subsequent knitting, i.e., a tuck stitch, such that a hole results and that position. Ex. 1021, 71-73. Other references define “pointelle” as “an open work design (as in knitted fabric) typically in the shape of chevrons.” Pointelle, *Meriam-Webster’s Collegiate Dictionary* (10th ed. 2001) (Ex. 1052). Other references define “pointelle” as “a type of knitwear or woolen fabric with small eyelet holes that create a lacy effect.” Pointelle, *The Oxford American College Dictionary* (2002) (Ex. 1053). And others say “pointelle” is a “rib-knit fabric that uses transfer stitches to create an openwork design.” Ex. 1038, 6. While a pointelle is known to have an openwork structure, it is unclear what—if anything—is needed beyond that for a knit structure to be considered a pointelle.

57. Prior to the '262 patent, commercially available knitting machines could produce jersey, jacquard, lace, intarsia, openwork/pointelle, and other knit patterns in a single, unitary knit element. Lewis et al., *A Machine Knitter's Guide To Creating Fabrics*, 12 (1986) (Ex. 1027); Ex. 1021, 71-73.

58. The use of different knit structures in the same item, whether that item is an article of footwear or a garment worn on the body, is a long-standing and integral part of fashion design. This includes the use of visually contrasting or complementary knit structures, the shapes of the different knit structures, and the locations of such knit structures relative to one another, among other examples. This is also the case for using different patterns or colors in the same knit element. For example, flat knitting also allows for intarsia designs to integrate “coloured areas into a cohesively-knitted structure.” Ex. 1023, 102-104.



Fig. 10.3 Examples of intarsia designs knitted on an electronic V-bed machine [Shima Seiki].

Ex. 1023, 103 (illustrating knitted elements with areas having varied colors, patterns, and textures).

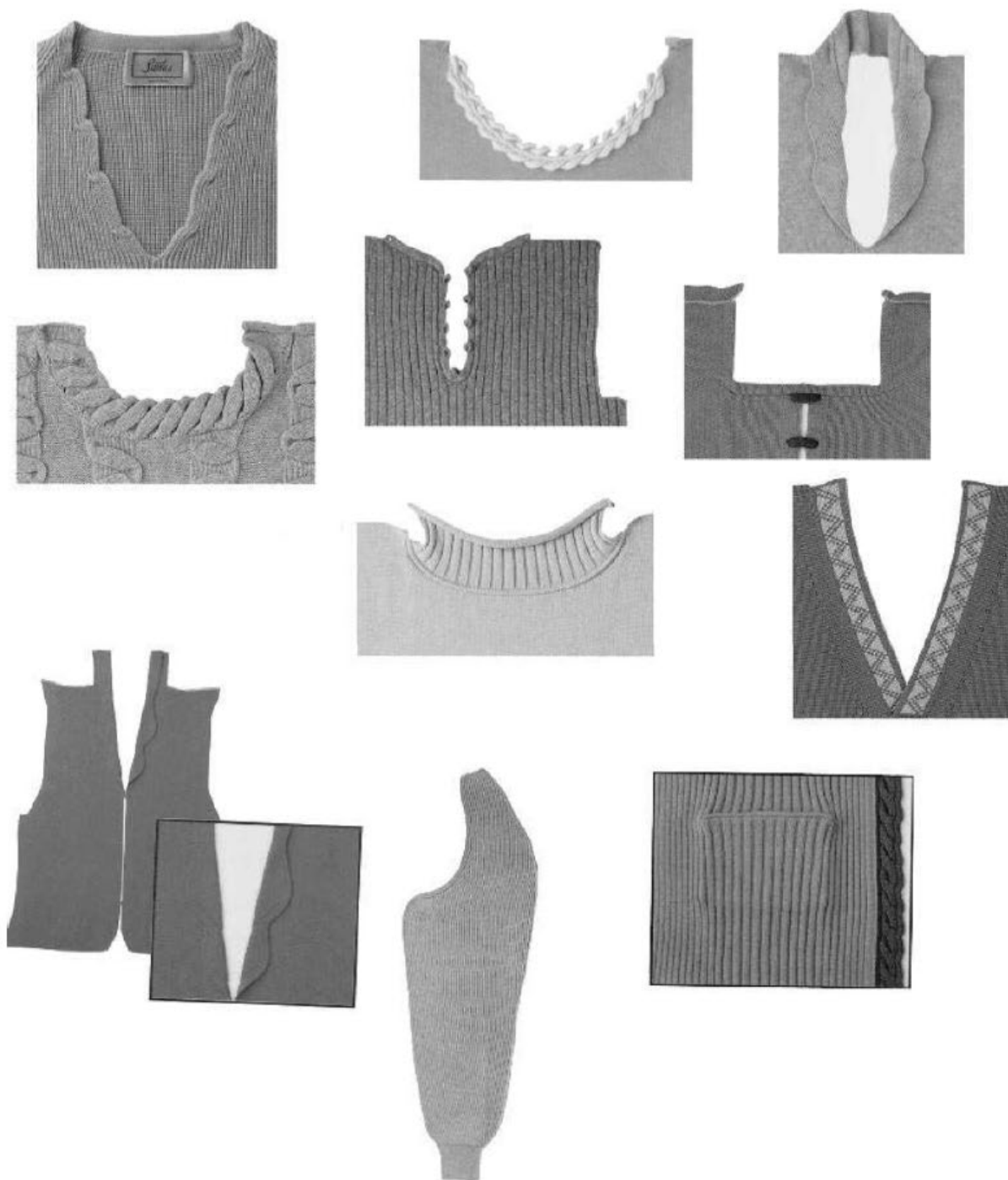


Fig. 16.9 Integrally shaped rib garment pieces. The machine has an additional bed containing the transfer points [Shima Seiki].

Ex. 1023, 185 (illustrating knitted elements with areas having varied knit structures and textures).

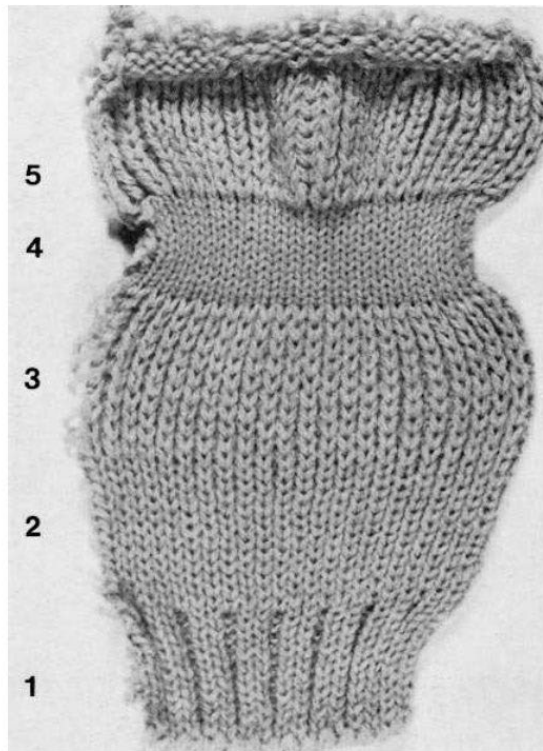
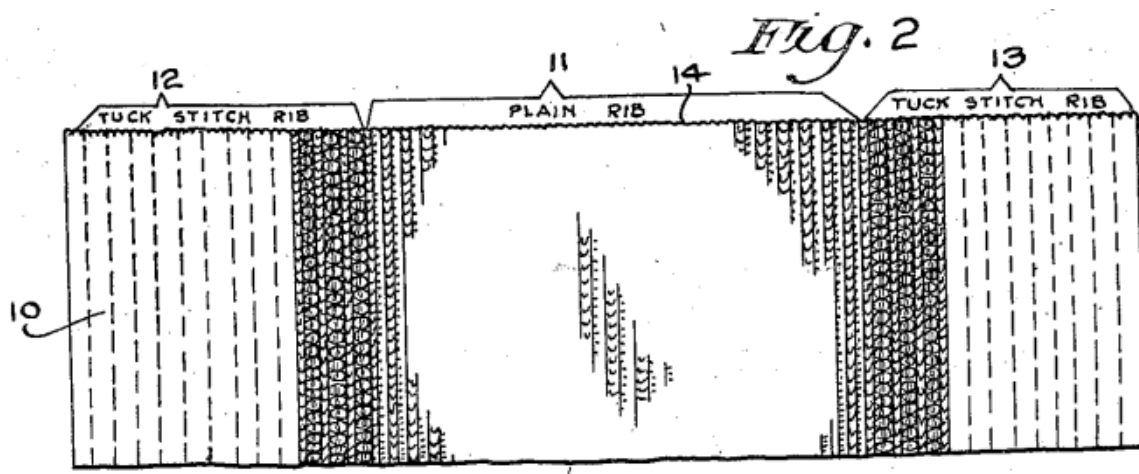


Fig. 16.13 Stitch shaping (1 = 2×2 rib; 2 = 1×1 rib; 3 = half-cardigan; 4 = tubular courses; 5 = full cardigan).

Ex. 1023, 195 (illustrating knitted element with areas having different textures, knit structures, and elasticity).

59. Prior to the '262 patent, commercially available knitting machines could produce jersey, jacquard, lace, intarsia, openwork/pointelle, and other knit patterns in a single, unitary knit element. Lewis et al., *A Machine Knitter's Guide To Creating Fabrics*, 12 (1986) (Ex. 1027); Ex. 1021, 71-73.



Ex. 1035, Fig. 2.

60. The consideration and possible use of patterns, including the location and configuration of such patterns (including elements of the patterns), among other things, is a long-standing and integral part of fashion design and would have been obvious or obvious to try from the perspective of a person of ordinary skill in the art familiar with either footwear or textiles. Indeed, a wingtip pattern was (and continues to be) one of a finite number of dress shoe styles—perhaps even the most common and recognizable style. Such a wingtip pattern, e.g., comprised of a border between two areas of containing different knit structures and/or includes a line of holes or “broguing,” would have been simple to implement in knit fabrics, and its use and success would have been predictable.

61. Because different knit structures and combinations of structures have different properties, a wide variety of characteristics can be imparted to different parts of a textile element by changing the type(s) of knit structures used throughout the fabric. For example, fabrics with jersey knit structures “have a smooth face” and

“stretch equally in both the lengthwise and crosswise directions.” Ex. 1042, 344. Pointelle knit structures have an “openwork design” which provides aesthetic appeal and is more breathable. *See* Ex. 1038, 6.

D. Yarn Types

62. Various properties can also be imparted to areas of a textile element by changing the type of yarns (which are made up of fibers) used in the knitting process. Different types of fibers have varying levels of tensile strength, stiffness, toughness, elasticity, recovery, friction, abrasion resistance, moisture absorption, and thermoplasticity, among many other properties. *See* Sabit Adanur, Wellington Sears Handbook of Industrial Textiles, at 565-68, 575, 581, 586-97 (Johnston Industries Group 1995) (Ex. 1039). These characteristics in turn affect the properties of the textile elements in which the yarns are used.

63. Hot melt yarns (i.e., yarns containing thermoplastic materials) have also been used for decades. *E.g.*, Debbie Ann Gioello, *Understanding Fabrics: From Fiber to Finished Cloth*, 208 (1982) (Ex.1040). Hot melt yarn effect can be achieved in different ways. Yarns with different melting temperatures can be used in the same structure. Upon heating, the yarn with low melting temperature melts and bonds the other yarns together. *See* Ex. 1040 (discussing using thermoplastic effects for “molding shapes” and “dimensional stability/shrinkage control”). Also, the yarn can be a sheath-core structure (bicomponent yarn) with sheath having a low melting

temperature and core having a higher melting temperature. Upon heating, the low melting temperature sheath melts and binds the core yarns together. These are common methods of bonding in textiles that have been practiced for decades. *See* Ex. 1039, at 149-51; Ex. 1040, 208 (“Thermoplasticity” describes “the properties of a fiber or fabric to become *plastic* or to *soften* under heat and ability to *retain* a predetermined shape, size, or design when cooled.”).

64. All the yarns mentioned in '262 patent, i.e., polyester, nylon, spandex, cotton, covered spandex, polyester covered spandex, and hot melt yarn, were well-known and have been used in knitting for decades. Ex. 1023, 107-08, 111; Ex.1040, 96-97 (“Fibers for stretch fabrics include...spandex” and “[h]eat-set thermoplastic fibers”; “Yarns for stretch fabrics include...[c]ore-spun yarns with spandex”; “Lycra® power stretch” fabric; spandex fibers and yarn provide “power stretch” (i.e., 10-200% extensibility whereas textured or stretch polyester and core-spun or covered spandex yarns provide “comfort stretch” (i.e., 15-50% extensibility)), 208 (“Man-made thermoplastic fibers include acetate, acrylic, anidex, modacrylic, rylon, olefin, polyester, rubber, saran, triacetate, vinyl, and vinyon.”); *Advances in Knitting Technology*, 3-4 (K.F. Au ed. 2011) (Ex. 1044) (classifications of yarn include those based on processing (conventional/traditional staple, filament, and cord, and modified or textured yarns), production of textured yarns (elastic, fluffy/bulky),

composition (natural fibers vs. chemical/synthetic fibers) and filament (non-textured, textured, high elastic, bulk)).

E. Knitting Machines

65. Long before the priority date of the '262 patent, knitting machines had been used to commercially manufacture knitted textiles. Such machines can be hand or power controlled to “convert yarn into knitted loop structures,” and can be easily customized. Ex. 1023, 18-19. Users of knitting machines can therefore manufacture textiles with a wide variety of characteristics, including patterns and textures. *See, e.g.,* Ex. 1023, 134-135 (Electronic control “provides greater versatility as regards design parameters, simplifies the modification of repeat sequences and size, style and pattern-changing operations, and, in some cases, enables changes to occur whilst the machine is knitting[.]”), Fig. 12.2.



Fig. 12.2 Knitting patterns and programmes are quickly generated using automatic routines. These are checked and can be transmitted on-line to the CMS knitting machine. Simultaneous monitoring of production can also be achieved [Stoll SIRIX].

Ex. 1023, 137.

66. Before the priority date of the '262 patent, machine manufactures including Shima Seiki, Santoni, Simplex, Milanese, Stoll, and Karl Meyer had a variety of commercially available knitting machines on the market. Ex. 1023, 174.

67. Prior to July 8, 2016, the knitting technology described could be used, and indeed was commonly used, to manufacture unitary knit elements having different textures, stitches, yarns, or other properties. Ex. 1024, 6, 25, 18, 32; Ex. 1023, 94, 100, 141, 148, 172, 177, 191, 192. These types of designs were ubiquitous in textiles generally and in footwear. Indeed, variations in knit structures and/or yarns on a single fabric are among the oldest and simplest of all machine-knitted

designs. These variations could be used to form strips with different textures, patterns, or other characteristics like elasticity, thickness, or strength, among other characteristics.

68. Relatedly, there were many known techniques to form holes in a knitted element during the knitting process in a specific pattern (e.g., skipping stitches at predetermined locations to form lines of holes) rather than punching, cutting, or otherwise removing material in a manufacturing step distinct from the knitting process.

69. Therefore, in my opinion, and as further discussed below, the '262 patent recites claims that were well-known in the art.

V. THE '262 PATENT

A. Overview of the '262 Patent

70. As I previewed above, the purported invention of the '262 relates to a “shoe comprising a knit upper” having “a knitted element” that “includes a wingtip pattern” and “a first area of a first type of knit structure and a second area of a second type of knit structure” that is “different from the first type.” '262, 1:29-31, 1:54-55, 2:24-28. Along with the shoe itself, the invention relates to the “method of manufacturing” the shoe by knitting the upper using a “knitting machine” and attaching the upper to a sole. '262, 2:34-42.

71. The “knitted element 20 is formed of a unitary one-piece construction during a knitting process on a knitting machine.” ’262, 4:3-5. The knitted element comprises “a knitted upper heel region 24”; a “knitted upper toe region 32”; “knitted upper lateral ball region 30a,” “knitted upper medial ball region 30b”; “knitted upper lateral metatarsal region 28a,” “knitted upper medial metatarsal region 28b”; and “knitted upper lateral midfoot regions 26a,” and “knitted upper medial midfoot region 26b.” ’262, 4:3-26. Each region is “seamlessly knitted” with adjacent regions. *Id.* at 26.

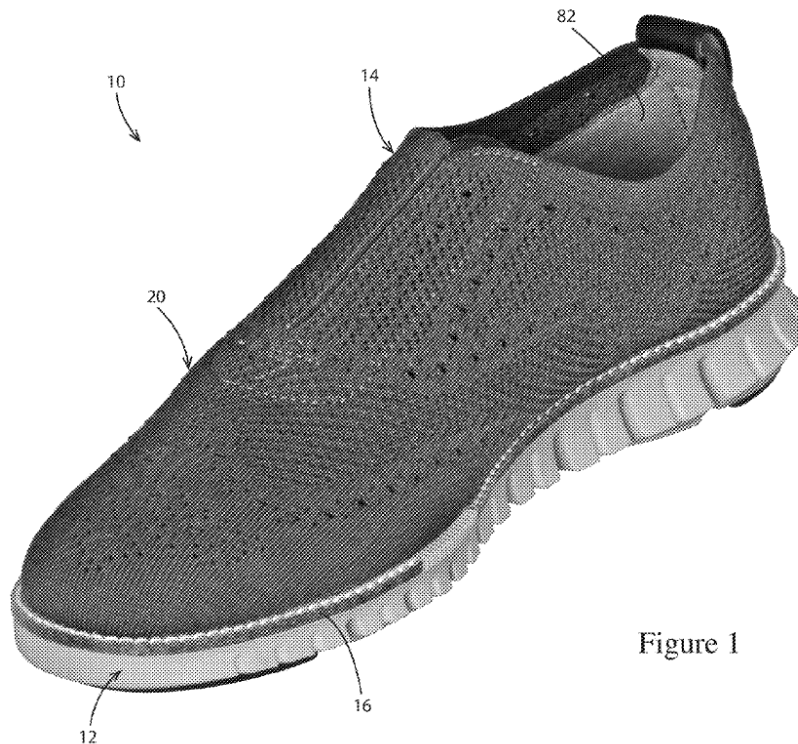


Figure 1

’262 patent, Fig. 1

72. The knitted element also includes “first and second wingtip patterns 36, 38.” ’262 patent, 4:41-45. Each wingtip pattern “comprises portions of at least the

upper toe region 32, the upper lateral and medial ball regions 30a, 30b, and the upper lateral and medial metatarsal regions 28a, 28b.” ’262 patent, 4:37-41. The first wingtip pattern is comprised of a “lateral” and “medial” line of broguing. ’262 patent, 4:35-37. Both the lateral line of broguing and medial line of broguing comprise a “wing-shaped curved line of holes.” ’262 patent, 4:52-61. The holes of the wingtip pattern are preferably formed through the “knitting process as opposed to being formed by removal of material.” ’262 patent, 5:6-9.

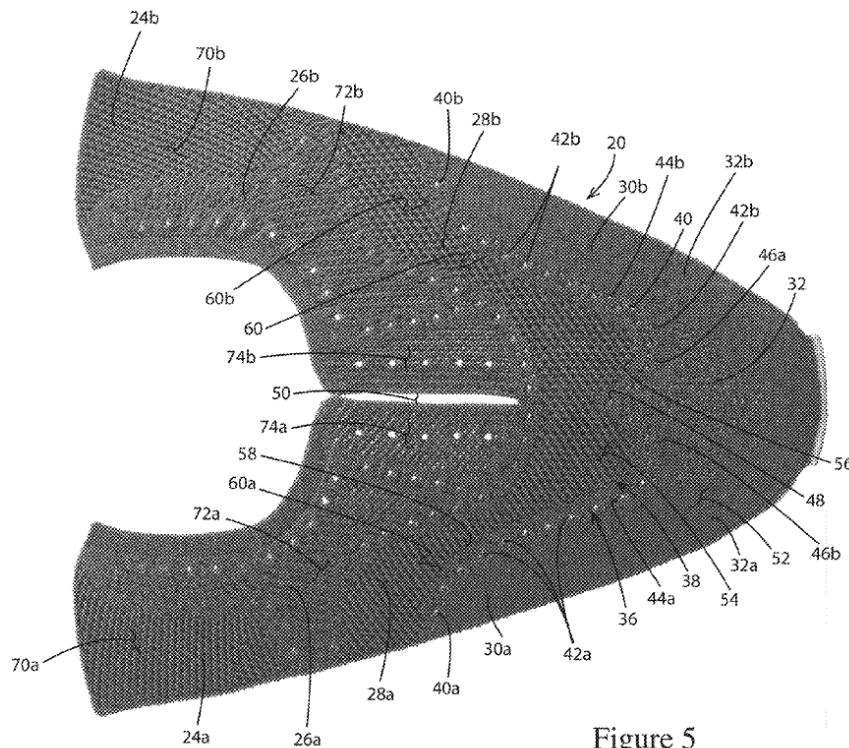


Figure 5

’262 patent, Fig. 5.

73. The knitted element also comprises a “first area” of a “first type of knit structure” and a “second area” of a “second type of knit structure” that is different from the first. ’262 patent, 5:10-13. For example, the first knit type of knit structure

may be more tightly knit than the second type of knit structure (e.g., the first knit structure may be a jersey stitch knit and the second type of knit structure may be a pointelle stitch knit). '262 patent, 6:34-39. The first area of a first type of knit structure and second area of a second type of knit structure also share a “coincident and coextensive” boundary. '262 patent, 5:17-20. The second wingtip pattern “comprises the boundary line” and the first wingtip pattern is “adjacent [to] the second wingtip pattern.” '262 patent, 5:20-23.

74. The '262 patent does not identify any unconventional techniques that are used to manufacture the knitted upper of the claimed invention. For example, the '262 patent does not disclose the use of any unconventional knitting techniques to form the claimed knitted uppers seamlessly with different knit structures and/or the wingtip pattern. In other words, '262 patent describes conventional techniques used to manufacture a knitted upper of a shoe. Instead, the '262 patent explains the entire process can be done on a generic “knitting machine, such as a CNC knitting machine.” '262 patent, 6:11-13. Again, in other words, the '262 patent discloses the use of any conventional knitting techniques to form the claimed knitted uppers seamlessly with different knit structures and/or the wingtip pattern. Similarly, the '262 patent does not identify any advantages associated with the claimed invention. For example, the '262 patent does not purport to identify any structural

or functional characteristics associated with the claimed configuration of knit structures or the wingtip pattern.

B. Prosecution History of the '262 Patent

75. In formulating my opinions, I considered the contents of the prosecution history of the '262 File History.

76. The '262 patent issued from U.S. Pat. App. 16/577,697 ("697-App."), filed 9/20/2019. Other than a double patenting rejection over the claims of the '511 patent (of which the '262 patent is a continuation of a continuation), no other rejections were issued. '262 patent FH, 66-70 (10/15/2020 Office Action). The Examiner thereafter issued a Notice of Allowance and the '262 patent issued on 06/22/2021. '262 patent FH, 98-102, 125.

C. Prosecution History of the '511 Patent

77. In formulating my opinions, I also considered the contents of the prosecution history of the '511 File History.

78. During the '511 patent's prosecution, the pending claims were rejected as obvious over U.S. Patent No. 7,347,011 ("the '011 patent") alone or in view of U.S. Patent No. 2,312,078 ("the '078 patent"). The '511 patent FH, 107-113. In doing so, Examiner relied upon the '011 patent's teaching of a shoe 10 with an upper 30 that is formed from a seamlessly knitted textile element 40" having a knitted design pattern 46", 47", 48" created using "various stitches . . . for different areas,"

e.g., to create “broguing (perforations, 48”),” but conceded the ’011 patent did not (1) disclose “the specific design pattern,” i.e., “wingtip design” recited in claim 2 or (2) specifically identify using the “jersey stitch knit and a pointelle stitch knit” recited in claim 22. ’511 File History, 108-109 (citing ’011, Fig. 11). However, the Examiner explained that it would have been “an obvious matter of design choice...to provide the broguing [in ’011]” or the wingtip configuration disclosed in the ’078 patent “to optimize the aesthetic appeal of [] [’011]’s shoes.” ’511 File History, 109-110. And because the ’011 patent disclosed that “various stitches may be used for different areas (46, 47, 48) of the knitted element,” the Examiner found it would have been obvious “to choose from different knit stitches including jersey and pointelle in order to vary the texture, physical properties, or aesthetics of footwear within a single, unitary element of material.” ’511 File History, 109-110.

79. In response, while Applicant conceded that the ’011 patent disclosed “knitted design patterns [46”, 47”, 48”],” Applicant argued those patterns “are isolated and segmented rather than...extend[ing] from the lateral metatarsal region into the toe region and into the medial metatarsal region” as claimed. ’511 File History, 134. Therefore, according to Applicant, the ’011 patent “fails to disclose [] a wingtip pattern” including “lines of broguing that extend throughout multiple regions of the shoe.” ’511 File History, 134. Applicant also admitted the ’011 patent disclosed “different types of knit structures,” but argued that the ’011 patent failed

to specifically mention “jersey and pointelle stitches” or arranging those knit structures in the “claimed configuration.” ’511 File History, 139-40. As for the ’078 patent, Applicant argued (1) the reference did not cure the ’011 patent’s deficiencies—despite disclosing “a leather upper” with “perforation[s]” or “broguing” in a wingtip pattern—because the ’078 patent did not disclose “a knitted line of broguing,” (’511 File History, 135), and it would not have been obvious to apply that design to the ’011 patent because Applicant was “the first to recognize the desirability of a knit upper with the claimed pattern” (’511 File History, 137). Applicant also argued the claims were not an obvious “aesthetic design change” because “the claimed knit pattern inherently has mechanical function.” *Id.*, 138. That response was followed by a Notice of Allowance. ’511 File History, 148-150.

VI. LEVEL OF ORDINARY SKILL IN THE ART

80. In rendering the opinions set forth in this declaration, I was asked to consider the patent claims and the prior art through the eyes of a person having ordinary skill in the art at the time of the alleged invention. I understand that the factors considered in determining the ordinary level of skill in a field of art include the level of education and experience of persons working in the field; the types of problems encountered in the field, the teachings of the prior art, and the sophistication of the technology at the time of the alleged invention. I understand that a person having ordinary skill in the art is not a specific real individual, but

rather is a hypothetical individual having the qualities reflected by the factors above. I understand that a person having ordinary skill in the art would also have knowledge from the teachings of the prior art including the art cited below.

81. I have been asked to assume the Challenged Claims are entitled to the July 8, 2016 priority date for the purposes of this declaration only. Upon consideration of the relevant factors listed above, in my opinion, on or before the priority date, a person of ordinary skill in the art, at the time the application that matured into the '511 patent was filed, would have at least a bachelor's degree in textile-related sciences, engineering, or industrial product design, or the equivalent thereof, and two years of work experience in footwear design. Additional graduate education could substitute for professional experience, and significant academic/work experience could substitute for formal education.

82. Well before July 8, 2016, my level of skill in the art was at least that of a person having ordinary skill. I am qualified to opine concerning what a person having ordinary skill in the art would have known and understood at the time of the '262 patent's purported invention. My analysis and conclusions herein are from the perspective of a person having ordinary skill in the art as of July 8, 2016. A different priority date would not change my opinions as long as the identified prior art were still prior art.

VII. CLAIM CONSTRUCTION

83. I have been instructed that the Challenged Claims of the '262 patent are to be given their ordinary and customary meaning as understood by one of ordinary skill in the art at the time of the alleged invention in light of the specification and the prosecution history pertaining to the patent, except as provided below. I have followed these principles in my analysis set forth in this document. I reserve the right to supplement my opinions in this declaration to the extent that any parties later propose claim constructions for any claim terms in the '262 patent.

84. I have been informed certain claim terms, including at least “pointelle stitch knit” (all Claims), “heel region” (claim 13), “midfoot region” (claims 1, 5-7, 11-12), “metatarsal region” (claims 1 and 7), “toe region” (claims 1 and 7), and “hot melt yarn” (claims 3, 4, 9, and 10), may not have clear outer bounds and may be indefinite. For the purposes of this Declaration, I do not take a position on whether these terms are indefinite. And, regardless of the outer bounds of these terms, for the reasons discussed below in Section IX, these limitations are still disclosed or rendered obvious by the prior art because the prior art discloses or renders obvious embodiments within the indisputable scope of these limitations.

A. The Aesthetic/Ornamental Limitations

85. For purposes of this Declaration, I was asked to consider whether the claim limitations listed below were purely aesthetic/ornamental (e.g., recite the

shape and arrangement of a claim element) or whether the limitations are structural or mechanical (e.g., have a shape that results in a different product distinct from the prior art and could not have been produced following the teachings of the prior art). Those limitations include: the entirety of limitations or additional limitations (for dependent claims) recited in [1.a.iv] and [7.f.i], which recite knit area design, and [1.a.vi], [2], [5.d], [6.c], [7.c.iii], [7.f.iii], [8], [11], [12], which recite line of broguing design. In more detail, the claims that recite ornamental features that are not entitled to patentable weight include at least the following groups of features:

- Knit area limitations:
 - [1.a.iv]: “a first area of a jersey stitch knit being at least in the knitted upper toe region, and a second area of a pointelle stitch knit being at least in the knitted upper lateral and medial metatarsal regions,”
 - [7.f.i]: “a first area of a jersey stitch knit and a second area of a pointelle stitch knit, the first area being at least in the knitted upper toe region, the second area being at least in the knitted upper lateral and medial metatarsal regions,”
- Line of broguing” limitations
 - [1.a.vi] “a line of broguing adjacent the boundary line”
 - [2] “a medial line of broguing and a lateral line of broguing of the line of broguing being formed during the knitting step; the medial line of

- broguing being adjacent the medial boundary line, the lateral line of broguing being adjacent the lateral boundary line, the medial line of broguing comprising a curved line of holes, and the lateral line of broguing comprising a curved line of holes”
- [5.d] “additional lines of broguing between the lateral midfoot area and the lateral eyestay area and between the medial midfoot area and the medial eyestay area, the additional lines of broguing being formed during the knitting step”
 - [6.c] “additional lines of broguing between the lateral midfoot area and the second area and between the medial midfoot area and the second area, the additional lines of broguing being formed during the knitting step”
 - [7.c.iii], [7.f.iii] “line of broguing”
 - [8] “the line of broguing includes a medial line of broguing and a lateral line of broguing, the medial line of broguing being adjacent the medial boundary line, the lateral line of broguing being adjacent the lateral boundary line, the medial line of broguing comprising a curved line of holes, and the lateral line of broguing comprising a curved line of holes”

- [11] “broguing holes forming additional lines of broguing are between the lateral midfoot area and the lateral eyestay area and between the medial midfoot area and the medial eyestay area, wherein the knitted element is knitted with the broguing holes during the knitting process”
- [12] “broguing holes forming additional lines of broguing are between the lateral midfoot area and the second area and between the medial midfoot area and the second area, wherein the knitted element is knitted with the broguing holes during the knitting process”

86. In my opinion, the first group of features identified above relates to ornamentation because the features recite the shape and arrangement of the jersey knit and pointelle knit pattern. More specifically, the first group ultimately recites (1) “a jersey” and “a pointelle” “stitch knit” and (2) the location of the knits. *See also* '262, Fig. 5. The jersey and pointelle knit patterns and arrangement of the patterns, have no structural or mechanical relationship to the claims—instead varying from the jersey to the pointelle knit patterns presents different designs on the shoe, as depicted below.

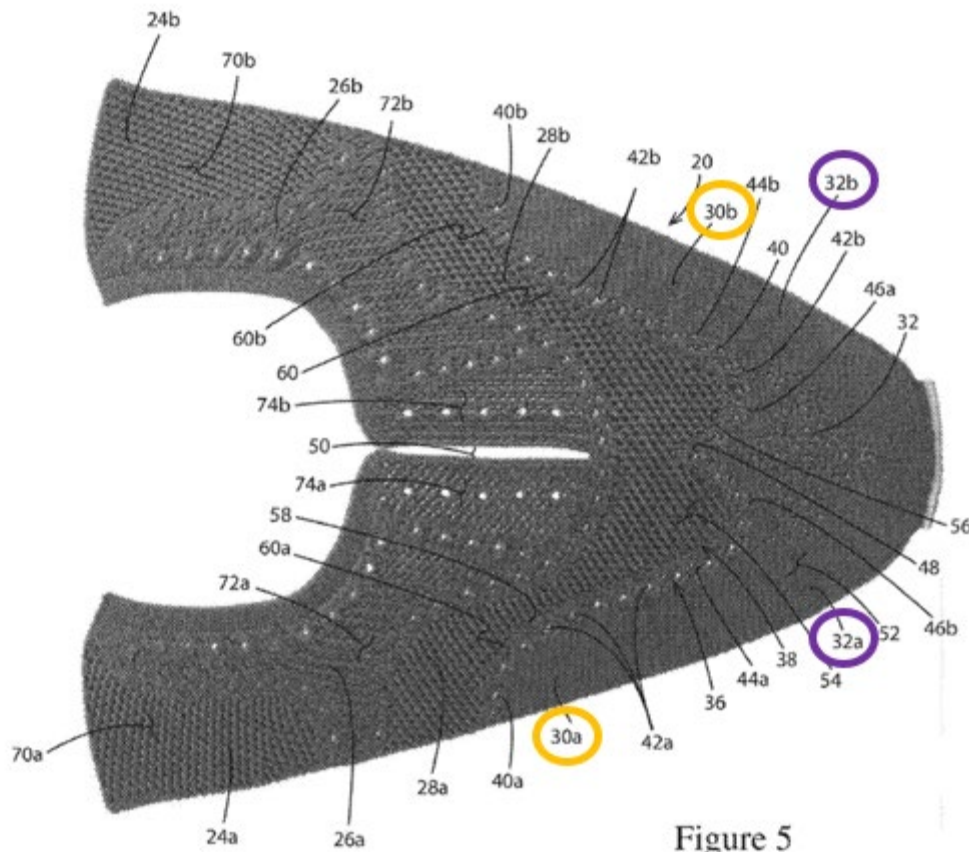


Figure 5

Fig. 5 (annotated to highlight locations of jersey knit (**upper toe region**) and pointelle knit (**upper lateral and medial metatarsal region**)).

87. In my opinion, the second group identified above relates to ornamentation because the line of broguing is disclosed and claimed in the '262 as a line of holes in a particular shape or arrangement. '262, 4:34-61 ("wingtip pattern 36 comprises a line of broguing," which includes "a wing-shaped curved line of holes" 42a, 42b). There is no mechanical or structural relationship of the broguing discussed in the '262 patent.

88. For purposes of this Declaration, I was asked to consider a construction in which each claim term above, in whole or in part, was not given patentable weight

(i.e., could not be relied upon to distinguish over the prior art), and whether that construction would affect my opinions. Regardless of whether the terms, or any portion of these terms, is not given patentable weight, the prior art disclosed herein meets each limitation.

VIII. GROUNDS OF UNPATENTABILITY

89. An article of footwear including a knit upper formed of a unitary one-piece construction and having a wingtip pattern and an arrangement of two different knit structures relative to one another was well-known in the art.

90. In this section, I will explain why the teachings or combinations of teachings from the following references render obvious each of the Challenged Claims:

Name	Exhibit	Publication	Filed	Published/ Issued
Dua	1004	U.S. Pat. Pub. No. 2010/0154256	12/18/2008	06/24/2010
'762	1005	U.S. Pat. No. 6,931,762	12/18/2002	08/23/2005
'288	1006	U.S. Pat. No. 6,910,288	12/18/2002	06/28/2005
Flusser	1007	Alan J. Flusser, <i>Clothes and the Man: The Principles of Fine Men's Dress</i> (1985)	N/A	1985

Litke	1008	U.S. Pat. No. 7,949,570	08/14/2009	05/24/2011
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I have been instructed to assume that each of these references qualifies as prior art.

91. As I explain below, the Challenged Claims are invalid based upon the following prior art grounds:

Grounds 1 and 2: Dua alone and in view of the '762 and the '288 patents (Claims 1-13)

Grounds 3 and 4: Dua in view of Flusser or Dua in view of the '762 and the '288 patents, and Flusser (Claims 1-8, 11-12)

Grounds 5 and 6: Dua in view of Litke or Dua in view of the '762 and the '288 patents, and Litke (Claims 1-8, 11-12)

IX. SPECIFIC GROUNDS FOR CHALLENGE

92. It is my opinion that the Challenged Claims of the '262 patent are unpatentable as explained below. As I explain above in Section VII, although the '262 patent purports to have invented a shoe including a unitary one-piece knit upper including a seamlessly knit pattern and/or configuration of two different knit structures, such a shoe was already known. For example, Dua and the '762 patent describe a dress shoe that includes an upper formed of a seamless, unitary knit construction with patterns and specific knit types located in desired areas of the knitted component, e.g., for structural or aesthetic reasons. In addition, Flusser discloses the wingtip pattern is one of seven common designs for men's dress shoes,

and Litke discloses shoes having a wingtip pattern. As demonstrated below, the prior art renders the Challenged Claims unpatentable.

93. I note that, in this discussion, I may focus on the particular language in specific claims, but it should be understood that my analysis applies to the corresponding limitations of all claims containing identical or substantially identical language.

A. Grounds 1 and 2: Dua alone and in view of the '762 patent and the '288 patent (Claims 1-13)

94. In this section, I explain why claims 1-13 of the '262 patent are rendered obvious by the teachings of Dua or Dua in view of the '762 patent and the '288 patent.

95. I understand that Dua incorporates the teachings of U.S. Patent No. 6,931,762 (“the '762 patent”) and U.S. Patent No. 6,910,288 (“the '288 patent”). Dua, [0022] (“Additional examples of knitted components for footwear uppers that have areas with different knit types to impart different properties may be found in U.S. Pat. No. 6,931,762 to Dua . . . which [is] entirely incorporated herein by reference.”), [0043] (“Examples of footwear uppers having fused regions may be found U.S. Pat. No. 6,910,288 to Dua, which is incorporated herein by reference.”). Thus, while the '762 patent and the '288 patent are cited separately herein, those disclosures form a part of Dua’s disclosure, and I discuss them as Dua’s teachings.

96. To the extent these references do not form a part of Dua's disclosure, it is my opinion that, at minimum, it would have been obvious to apply the teachings of the '762 and the '288 patents to Dua for the same reason.

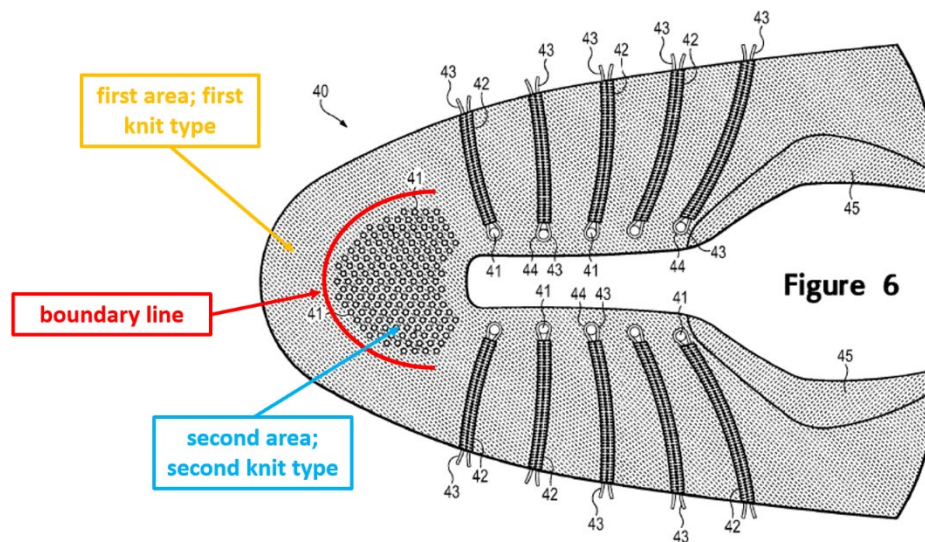
1. Overview of Dua

97. Dua discloses an "article of footwear," such as a "dress shoe," including a "a sole structure and an upper 30," where the upper is "formed of a knitted component 40...manufactured through a flat knitting process." Dua, [0015], [0017], [0020]. Sections of the knitted component are formed as a "unitary knit construction" in which "the features and structures are formed...through the flat knitting process, rather than other processes (e.g., stitching, bonding, shaping) that are performed after the flat knitting process." Dua, [0037].

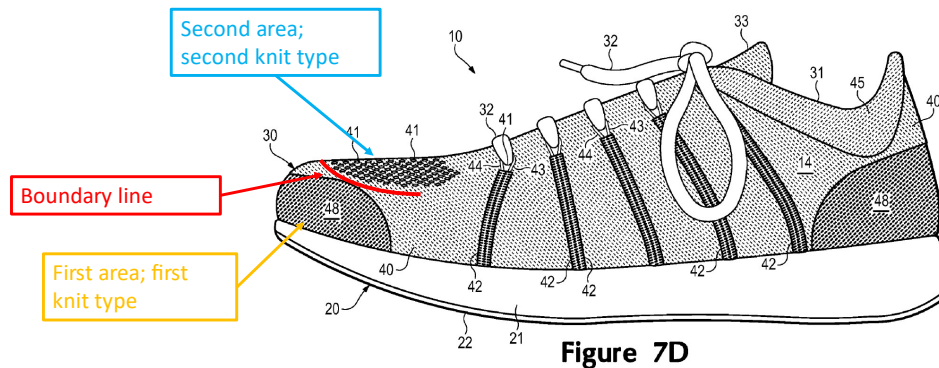
98. Furthermore, Dua discloses using a knitting machine to create a shoe upper with "specific knit types [located] in desired areas of the knitted component" to provide "desired features" such as "advantageous structural attributes." Dua, [0040]. For example, the knitted component may form "various apertures 41...in forefoot region 11, whereas many other areas of upper 30 have a more continuous or less-apertured configuration." Dua, [0022]. In addition, "the density of the knit" (Dua, [0022]), or "knitted structures" (Dua, [0040]), or "yarn types" (Dua, [0023]) may be varied in areas of the upper. For example, an area having "increase[d] [] knit

density” may be provided “in the forefoot region 11.” Dua, [0044], Fig. 7D (dense area 48).

99. As shown in Figs. 6 and 7D (including my annotations), Dua discloses a first area and a second area of the upper, each with different knit types, separated by a boundary line.



Dua, Fig. 6 (including my annotations).



Dua, Fig. 7 (including my annotations).

2. Overview of the '762 patent

100. The '762 patent discloses footwear including “an upper that is formed as a unitary knit structure with various sections having different physical properties” that are “joined in a generally seamless manner.” ’762, 2:66-3:9; see also ’762, 6:50-65 (“tuck stitches are [] utilized to seamlessly join the various sections”). For example, “various types of yarn,” including covered LYCRA and stretch yarn, and “various knit structures,” including a “jersey knit,” are utilized to form “different patterns and textures” in the different sections. ’762, 4:17-38, 6:30-38, 8:29-59. ’762 further explains that the conventional knitting machines used to form the upper could create “complex patterns.” ’762, 7:63-8:5.

3. Overview of the '288 patent

101. The '288 patent discloses “articles of footwear,” including dress shoes, formed of a textile including fusible yarns, e.g., yarns including strands formed of thermoplastic polymer materials such as polyurethane, nylon, polyester, or polyolefin. '288, 3:56-4:11, 7:4-22, 8:9-57. Varying proportions of fusible yarns and non-fusible or “neutral” yarns (e.g., yarns comprised of “thermoset polymers”) may be used in the upper. '288, 8:9-57, 10:50-65 (fusible yarns may be used in all areas or only select areas). Before applying heat to melt/fuse the yarns, “a last may be inserted into the upper 120 to provide support.” '288, 9:58-10:50.

4. Motivation to Apply the '762 and the '288 Patents' Teachings to Dua

102. As noted above, Dua expressly incorporates the '762 patent and the '288 patent by reference in their entirety such that the disclosures of the '762 patent and the '288 patent are the disclosures of Dua. Dua, [0022], [0043]. To the extent those disclosures are not expressly part of Dua, a person of ordinary skill in the art would have been motivated to combine the teachings of the '762 patent and the '288 patent, and Dua. Dua explains that the disclosed features of the knitted component “may be mixed and matched within a knitted component to form specific properties or structural attributes for a footwear upper.” Dua, [0040]. And Dua, the '762 patent, and the '288 patent share at least one common inventor (Bhupesh Dua), and are each assigned to Nike, Inc. In addition, Dua, the '762 patent, and

the '288 patent are analogous art, in the same field as the '262 patent, which includes footwear, and are reasonably pertinent to purported problems addressed by the named inventors of the '262 involving the improvement of the design and manufacture of knitted or textile footwear uppers. '262, 1:29-33, 3:39-41, 5:4-9; Dua, [0001]-[0004]; '762, 1:8-12; '288, 1:7-11.

103. In regards to the '762 patent, Dua and the '762 patent each disclose that a wide variety of knitting processes could be used to implement their teachings in regards to knit uppers, including warp knitting techniques like tricot, raschel, and double needle-bar raschel, and weft knitting techniques including various types of circular knitting and flat knitting. Dua, [0034]; '762 patent, 7:41-8:4. A person of ordinary skill in the art would have been motivated to apply the teachings of the '762 patent with respect to the textile elements and uppers disclosed therein to Dua's textile element/upper as such a combination is expressly contemplated by Dua. Dua, [0040].

104. For example, a person of ordinary skill in the art would have been motivated to apply the '762 patent's teachings of a shoe upper having "a unitary knit structure with various sections having different physical properties" formed by, e.g., varying the yarn types and knit structures used in each section, and disposed in "complex patterns" (the '762 patent, 2:66-3:9, 3:66-4:16, 7:63-8:4) to Dua's textile element. For example, Dua explains that "specific knit types [located] in desired

areas of the knitted component” may provide “desired features” such as “advantageous structural attributes.” Dua, [0040].

105. A person of ordinary skill in the art would have been motivated to apply the ‘762 patent’s teachings of a shoe upper in which various sections including varied yarn types and knit structures are “seamlessly join[ed]” (the ‘762 patent, 2:66-3:9, 6:50-65) to Dua’s textile element because, as taught by the ‘762 patent, doing so would advantageously prevent “the ends of yarns” from being “exposed, thereby decreasing the possibility of unraveling between sections” and “the amount of material waste is reduced.” ‘762 patent, 6:50-65, 8:29-42. In addition, seamlessly joining the various sections of varied yarn types and knit structures of the knit upper would advantageously eliminate thickness variations in the upper due to the presence of a seam, which would make the shoe upper more comfortable.

106. In regard to the ‘288 patent, Dua and the ‘288 patent each disclose the use of thermoplastic polymer yarns for use in a textile shoe upper in which those yarns are heated to fuse yarns in the upper. Dua, [0043]; ‘288 patent, 2:38-49. A person of ordinary skill in the art would have been motivated to apply the teachings of the ‘288 patent with respect to knitting an upper with various proportions of thermoplastic polymer yarns to neutral yarns to Dua’s textile element/upper including thermoplastic polymer yarns because (1) Dua expressly contemplated such a combination, and (2) doing so would advantageously provide the ability to create

areas of the upper with desired properties like the abrasion resistance of fused textiles or stretch of an unfused textile. Dua, [0043]; '288, 5:30-41, 9:58-10:50.

107. In addition, a person of ordinary skill in the art would have been motivated to apply the teachings of the '288 patent with respect to placing the textile upper on a last when heating the upper disclosed therein to Dua's textile element/upper because (1) Dua expressly contemplated such a combination, and (2) the last would advantageously provide support to the upper when heating the upper to form fused areas and would reduce the risk of uneven/unwanted changes in the fabric structure/shape during the heating and cooling process that could result in abnormalities in the upper. Dua, [0043]; '288, 5:30-41, 9:58-10:50. Indeed, Litke discloses patterns of holes, including the wingtip pattern of Fig. 3, can be applied to shoes with fabric uppers. Litke, 5:29-6:20.

108. Accordingly, a person of ordinary skill in the art would have had a reasonable expectation of success applying the '762 patent and the '288 patent's teachings to Dua's knit upper, and a person of ordinary skill in the art would have known that the combination (yielding the claimed limitations) would predictably work and provide the expected results.

5. Analysis of Claims 1-6

109. The Petition addresses claims 1-6 first as the remainder of the claims generally recite limitations similar to or the same as claims 1-6.

a. **[1.pre] A method of manufacturing an article of footwear having a knit upper and a sole, the method comprising**

110. This limitation is met by Dua.

111. To the extent the preamble is limiting, **Dua discloses a method of manufacturing an article of footwear having a knit upper and a sole** (e.g., “knitting processes...to form a knitted component for an upper of an article of footwear” that “has an upper that includes a knitted component and a sole structure secured to the upper”). Dua, Abstract, [0004].

Abstract: An article of footwear has an upper that includes a knitted component and a sole structure secured to the upper....

[0004]: A flat knitting process or a variety of other knitting processes may be utilized to form a knitted component for an upper of an article of footwear. Various features may be incorporated into the knitted component. For example, the knitted component may define a tube formed of unitary knit construction, and a strand may extend through a length of the tube. As another example, the knitted component may have a pair of at least partially coextensive knitted layers formed of unitary knit construction, and a plurality of floating yarns may extend between the knitted layers. In some configurations, the knit type or yarn type may vary in different regions of the knitted component to impart different properties. Additionally, the knitted component may incorporate a thermoplastic yarn that is fused in different regions of the knitted component to impart different properties.

[0017]: An article of footwear 10 is depicted in FIGS. 1-5D as including a sole structure 20 and an upper 30. For reference purposes, footwear 10 may be divided into three general regions: a forefoot region 11, a midfoot region 12, and a heel region 13, as shown in FIGS. 2 and 3. Footwear 10 also includes a lateral side 14 and a medial side 15. Forefoot region 11 generally includes portions of footwear 10 corresponding with the toes and the joints connecting the metatarsals with the phalanges. Midfoot region 12 generally includes portions of footwear 10 corresponding with the arch area of the

foot, and heel region 13 corresponds with rear portions of the foot, including the calcaneus bone. Lateral side 14 and medial side 15 extend through each of regions 11-13 and correspond with opposite sides of footwear 10. Regions 11-13 and sides 14-15 are not intended to demarcate precise areas of footwear 10. Rather, regions 11-13 and sides 14-15 are intended to represent general areas of footwear 10 to aid in the following discussion. In addition to footwear 10, regions 11-13 and sides 14-15 may also be applied to sole structure 20, upper 30, and individual elements thereof.

[0020]: A majority of upper 30 is formed from a knitted component 40 that may, for example, be manufactured through a flat knitting process. Knitted component 40 extends through each of regions 11-13, along both lateral side 14 and medial side 15, over forefoot region 11, and around heel region 13. In addition, knitted component 40 forms both an interior surface and an opposite exterior surface of upper 30. As such, knitted component 40 defines at least a portion of the void within upper 30, and knitted component 40 also defines ankle opening 31 to provide access to the void. In some configurations, knitted component 40 may also extend under the foot. For purposes of example in the various figures, however, a strobil sock 34 is secured to knitted component 40 and forms a majority of the portion of upper 30 that extends under the foot. In this configuration, sockliner 23 extends over strobil sock 34 and forms a surface upon which the foot rests.

[0034]: A flat knitting process may be utilized to manufacture knitted component 40. Flat knitting is a method for producing a knitted material that is turned periodically (i.e., the material is knitted from alternating sides). The two sides (otherwise referred to as faces) of the material are conventionally designated as the right side (i.e., the side that faces outwards, towards the viewer) and the wrong side (i.e., the side that faces inwards, away from the viewer). Although flat knitting provides a suitable manner for forming knitted component 40, other knitting processes may also be utilized, depending upon the features that are incorporated into knitted component 40. Examples of other knitting processes that may be utilized include wide tube circular knitting, narrow tube circular knit jacquard, single knit circular knit jacquard, double knit circular knit jacquard, warp knit tricot, warp knit raschel, and double needle bar raschel.

112. Dua discloses an “article of footwear” (10 in Fig. 7D below) that includes “a sole structure and an upper” (20 and 30, respectively, in Fig. 7D), that

may, for example, “be manufactured through a flat knitting process” or other processes including “wide tube circular knitting, narrow tube circular knit jacquard, single knit circular knit jacquard, double knit circular knit jacquard, warp knit tricot, warp knit raschel, and double needle bar raschel.” Dua, [0017], [0020], [0034]. Once the upper is complete, it may be attached to the sole structure. Dua, [0052].

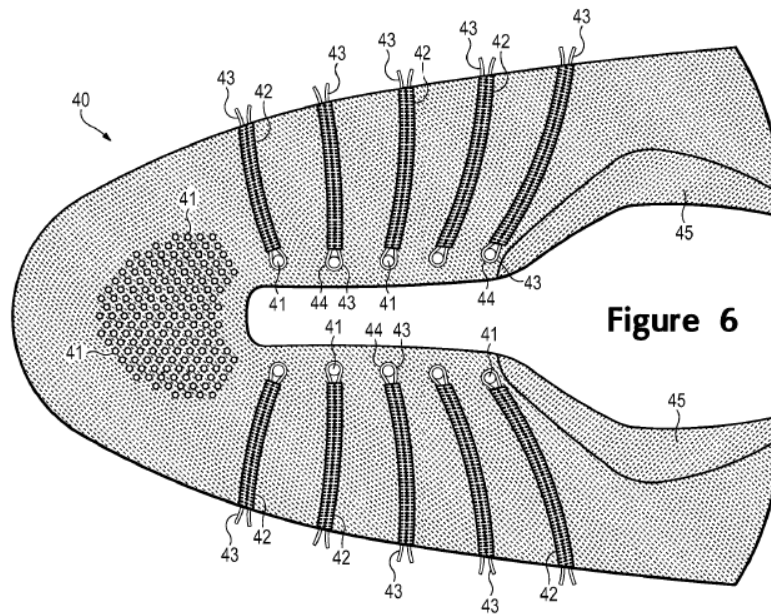


Figure 6

Dua, Fig. 6.

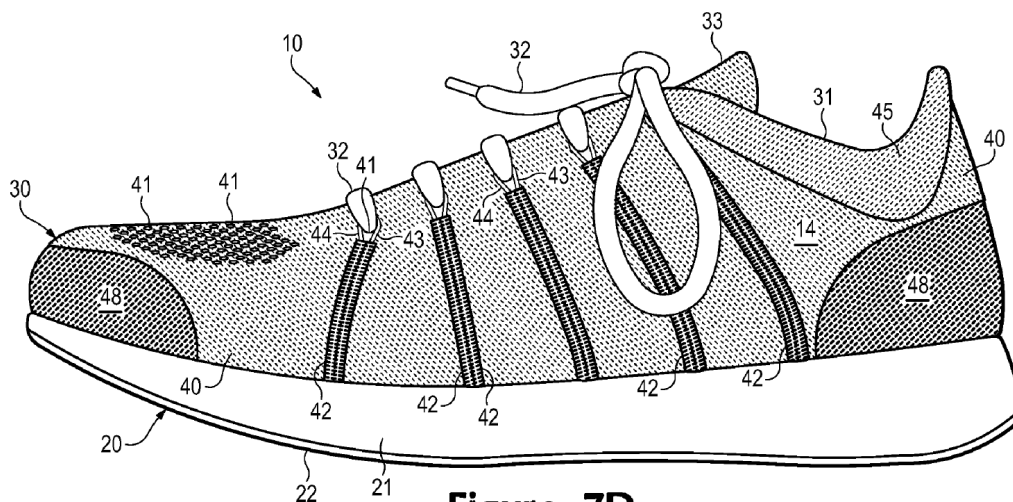


Figure 7D

Dua, Fig. 7D.

- b. [1.a.i] knitting with a knitting machine to form a knitted element of the knit upper such that the knitted element is of a unitary one-piece construction comprising**

113. This limitation is met by Dua.

114. **Dua discloses knitting with a knitting machine to form a knitted element of the knit upper** (*e.g.*, “knitting machines may [be used to] form[]...knitted components 40”) **such that the knitted element is of a unitary one-piece construction comprising** (*e.g.*, “[k]nitted component 40” is “formed of unitary knit construction”). Dua, [0036]-[0037]; *see also* [1.pre].

[0035]: An advantage to utilizing a flat knitting process to manufacture knitted component 40 is that each of the features discussed above may be imparted to knitted component 40 through the flat knitting process. That is, a flat knitting process may form knitted component 40 to have, for example, (a) various knit types that impart different properties to separate areas of upper 30, (b) various yarn types that impart different properties to separate areas of upper 30, (c) knitted components with the configuration of overlapping knitted layers in tubes 42, (d) a material such as strand 43 that is laid into tubes 42, (e) knitted components with the configuration of overlapping knitted layers in collar 45, and (f) floating yarns between layers of knitted material in collar 45. Moreover, each of these features, as well as other features, may be incorporated into knitted component 40 through a single flat knitting process. As such, a flat knitting process may be utilized to substantially form upper 30 to have various properties and structural features that are advantageous to footwear 10.

[0036]: Although one or more yarns may be mechanically-manipulated by an individual to form knitted component 40 (*i.e.*, knitted component 40 may be formed by hand), flat-knitting machines may provide an efficient manner of forming relatively large numbers of knitted component 40. The flat-knitting machines may also be utilized to vary the dimensions of knitted component

40 to form uppers 30 that are suitable for footwear with different sizes based on one or both of the length and width of a foot. Additionally, the flat-knitting machines may be utilized to vary the configuration of knitted component 40 to form uppers 30 that are suitable for both left and right feet. Various aspects of knitted component 40 may also be varied to provide a custom fit for individuals. Accordingly, the use of mechanical flat-knitting machines may provide an efficient manner of forming multiple knitted components 40 having different sizes and configurations.

[0037]: Knitted component 40 incorporates various features and structures formed of unitary knit construction. In general, the features and structures are formed of unitary knit construction when incorporated into knitted component 40 through the flat knitting process, rather than other processes (e.g., stitching, bonding, shaping) that are performed after the flat knitting process. As an example, tubes 42 and portions of collar 45 are formed from overlapping and at least partially coextensive layers of knitted material, and sides or edges of one layer may be secured to the other layer. The two layers of knitted material are generally formed during the flat knitting process and do not involve supplemental stitching, bonding, or shaping processes. The overlapping layers are, therefore, formed of unitary knit construction through the flat knitting process. As another example, the regions of knitted component 40 formed from knit types that define apertures 41 are formed of unitary knit construction through the flat knitting process. As yet another example, floating yarns 46 are formed of unitary knit construction.

115. See my analysis of [1.pre]. Dua discloses using “knitting machines” to form knitted components of the upper. Dua, [0036]-[0037]. The knitted components are “formed of unitary knit construction” through a “single [] knitting process.” Dua, [0035], [0037]. That is, each feature of the upper, including “various knit types,” “various yarn types,” and “knitted components,” is incorporated into the knitted component during the single knitting process without “other processes (e.g., stitching, bonding, shaping).” Dua, [0035], [0037]. A person of ordinary skill in the art would understand that Dua discloses forming a knitted element of a unitary one-

piece construction, because Dua states a “unitary knit construction,” and goes on to describe the single knitting process without other processes. *See also* §§IV.A-B, E.

- c. [1.a.ii] a knitted upper heel region, a knitted upper lateral midfoot region, a knitted upper medial midfoot region, a knitted upper metatarsal region, a knitted upper lateral ball region, a knitted upper medial ball region, and a knitted upper toe region

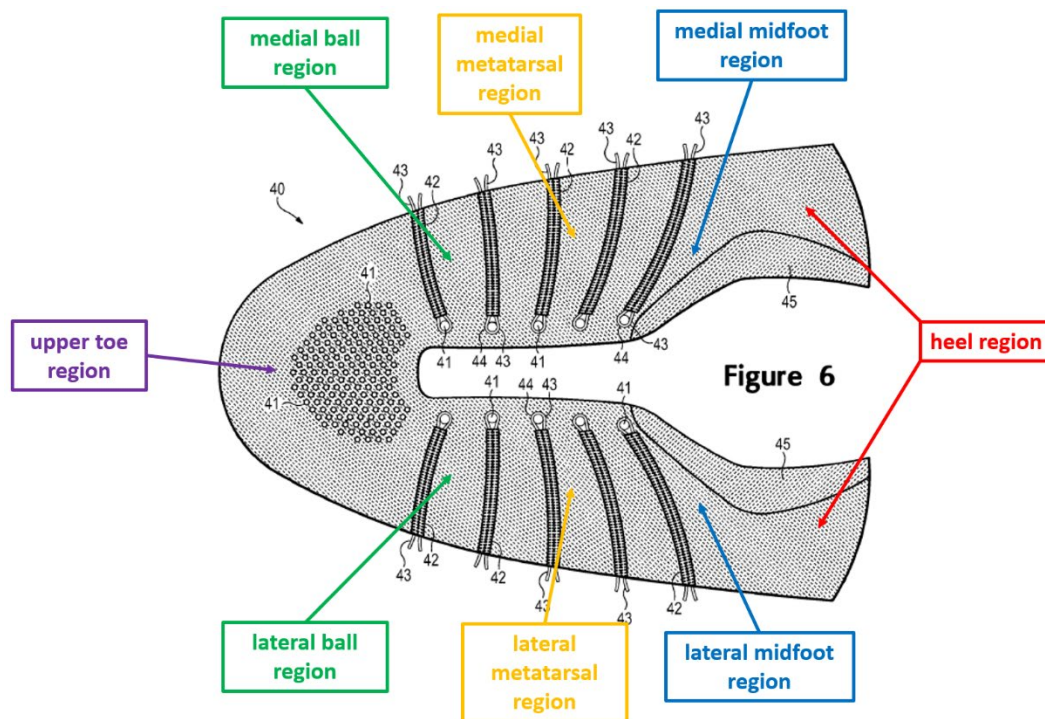
116. This limitation is met by Dua.

117. Dua discloses a knitted upper heel region, a knitted upper lateral midfoot region, a knitted upper medial midfoot region, a knitted upper metatarsal region, a knitted upper lateral ball region, a knitted upper medial ball region, and a knitted upper toe region (*e.g.*, annotated Fig. 6 below).

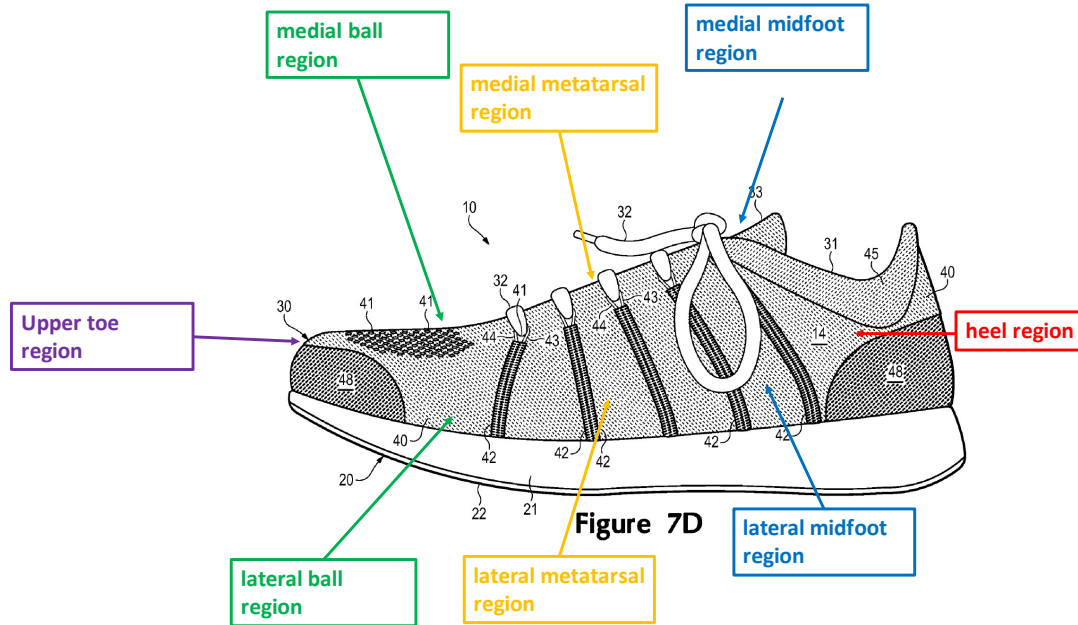
[0017]: An article of footwear 10 is depicted in FIGS. 1-5D as including a sole structure 20 and an upper 30. For reference purposes, footwear 10 may be divided into three general regions: a forefoot region 11, a midfoot region 12, and a heel region 13, as shown in FIGS. 2 and 3. Footwear 10 also includes a lateral side 14 and a medial side 15. Forefoot region 11 generally includes portions of footwear 10 corresponding with the toes and the joints connecting the metatarsals with the phalanges. Midfoot region 12 generally includes portions of footwear 10 corresponding with the arch area of the foot, and heel region 13 corresponds with rear portions of the foot, including the calcaneus bone. Lateral side 14 and medial side 15 extend through each of regions 11-13 and correspond with opposite sides of footwear 10. Regions 11-13 and sides 14-15 are not intended to demarcate precise areas of footwear 10. Rather, regions 11-13 and sides 14-15 are intended to represent general areas of footwear 10 to aid in the following discussion. In addition to footwear 10, regions 11-13 and sides 14-15 may also be applied to sole structure 20, upper 30, and individual elements thereof.

118. Dua discloses that “a forefoot region 11, a midfoot region 12, and a heel region 13” and “[l]ateral 14 and medial side 15 extend through each of regions 11-

13,” where the “[k]nitted component 40 extends through each of regions 11-13, along both lateral side 14 and medial side 15, over forefoot region 11, and around heel region 13.” Dua, [0017], Figs. 6 and 7D. As Dua explains, the forefoot region “generally includes portions of footwear 10 corresponding with the toes and the joints connecting the metatarsals with the phalanges,” i.e., a toe region, a ball region, and a metatarsal region. Dua, [0017]. Thus, the knitted element of Dua includes medial and lateral midfoot regions, medial and lateral metatarsal regions, and medial and lateral ball regions, and the upper toe region, as those regions correspond to the regions of a foot within the shoe.



Dua, Fig. 6



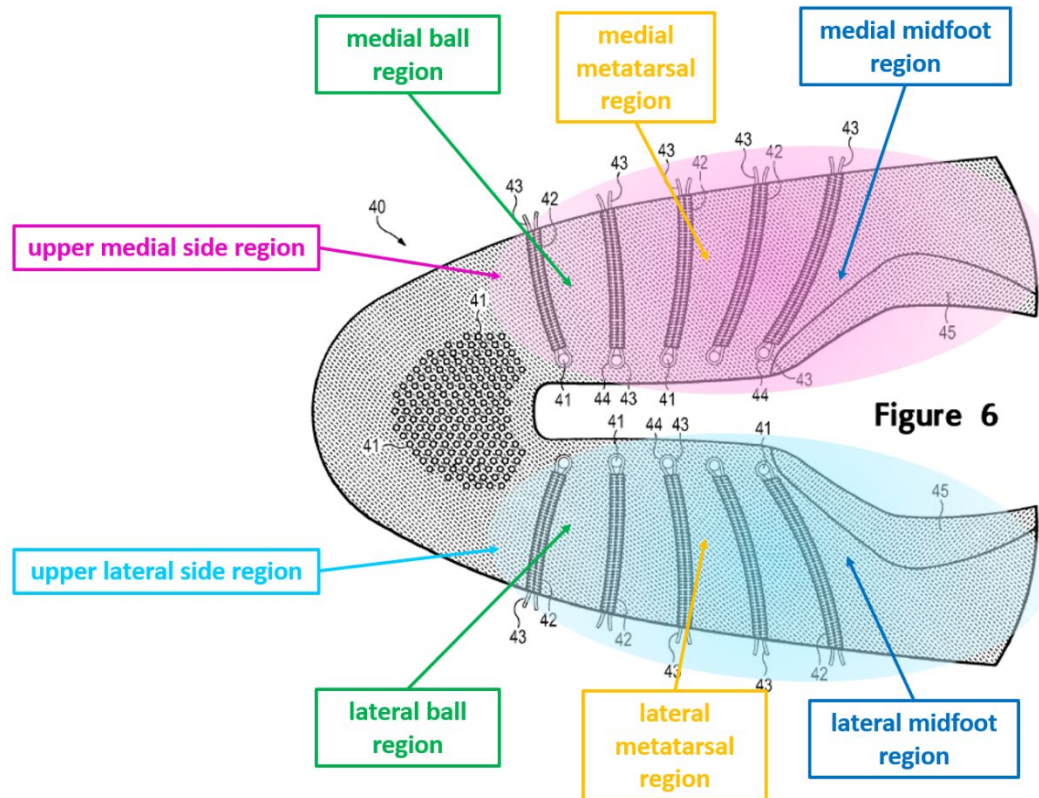
Dua, Fig. 7D.

- d. [1.a.iii] a knitted upper lateral side region including the knitted upper lateral midfoot region, the knitted upper lateral metatarsal region, and the knitted upper lateral ball region, a knitted upper medial side region including the knitted upper medial midfoot region, the knitted upper medial metatarsal region, and the knitted upper medial ball region

119. This limitation is met by Dua.

120. Dua discloses a knitted upper lateral side region including the knitted upper lateral midfoot region, the knitted upper lateral metatarsal region, and the knitted upper lateral ball region, a knitted upper medial side region the knitted upper medial midfoot region, the knitted upper medial metatarsal region, and the knitted upper medial ball region (e.g., annotated Fig. 6 of Dua). See also [1.a.ii].

121. See my analysis of [1.a.ii]. As shown in annotated Fig. 6 below, Dua's knitted component includes knitted upper lateral and medial metatarsal regions. Dua, Fig. 6. Dua further discloses that the knitted component includes "a lateral side 14 and a medial side 15." Dua, [0017]. As further shown in annotated Fig. 6 below, Dua's upper lateral and medial side regions include the upper lateral and medial midfoot regions, the upper lateral and medial metatarsal regions, and the upper lateral and medial ball regions. Dua, Fig. 6.



Dua, Fig. 6

- e. [1.a.iv] a first area of a jersey stitch knit being at least in the knitted upper toe region, and a second area of a

pointelle stitch knit being at least in the knitted upper lateral and medial metatarsal regions.

122. As I detailed above in §VIII.A, this limitation is ornamental/aesthetic and is not entitled to patentable weight.

123. To the extent any portion of this limitation is entitled to patentable weight, this limitation is met by Dua.

124. Dua discloses, or at minimum renders obvious, a **first area** of a jersey stitch knit being at least in the **knitted upper toe region**, and a **second area** of a pointelle stitch knit being at least in **the knitted upper lateral and medial metatarsal regions** (e.g., “areas of upper 30 hav[ing] a more continuous or less-apertured configuration” or higher “knit density,” “various knit types,” such as “jersey knit” and an “apertured configuration,” in “complex patterns”). Dua, [0022-0024], Figs. 6, 7D; ’762, 4:17-38, 7:63-8:5.

[0022]: Knitted component 40 incorporates various knit types that impart different properties to separate areas of upper 30. As an example that is depicted in FIGS. 1, 4, and 5A, knitted component 40 forms various apertures 41 that extend through upper 30 in forefoot region 11, whereas many other areas of upper 30 have a more continuous or less-apertured configuration. In addition to imparting greater permeability, which allows air to circulate within upper 30, apertures 41 may increase both the flexibility and stretch of upper 30 in forefoot region 11. As further examples, other properties that may be varied through selecting particular knit types for a particular area of knitted component 40 include permeability to liquids, the directions in which knitted component 40 stretches or resists stretch, the stiffness of knitted component 40, and the compressibility of knitted component 40. Additional examples of knitted components for footwear uppers that have areas with different knit types to impart different properties may be found in U.S. Pat. No. 6,931,762 to Dua and U.S. Pat. No. 7,347,011

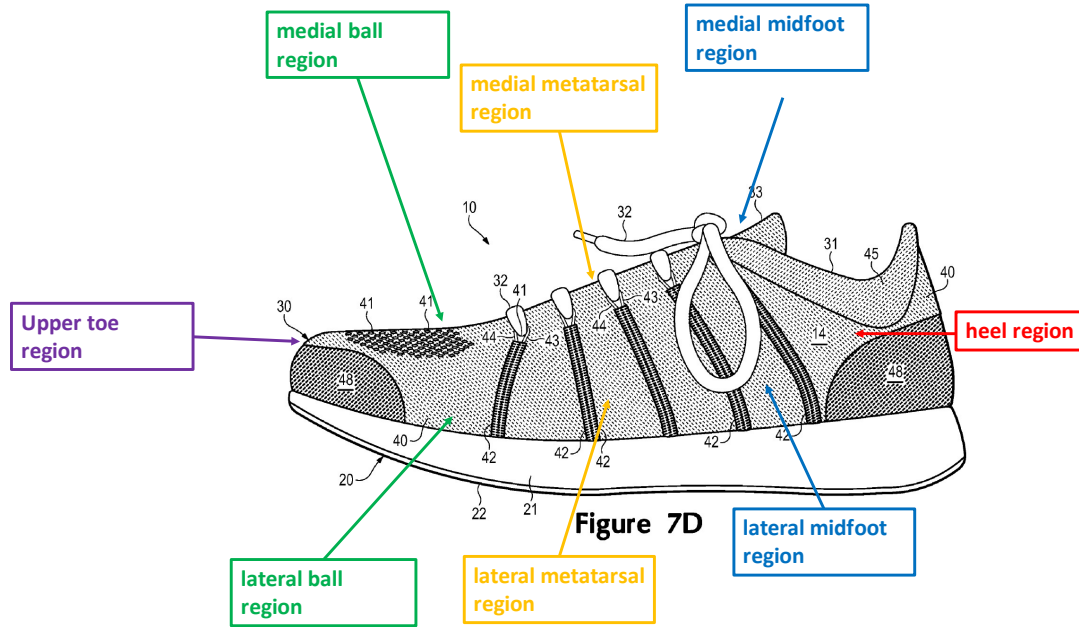
to Dua, et al., both of which are entirely incorporated herein by reference. As a related matter, the density of the knit within knitted component 40 may vary among separate areas of upper 30 to, for example, make less-permeable or stiffer portions. Accordingly, knitted component 40 may exhibit various properties in separate areas depending upon the particular knit type that is selected for the areas.

[0023]: Knitted component 40 may also incorporate various yarn types that impart different properties to separate areas of upper 30. Moreover, by combining various yarn types with various stitch types, knitted component 40 may impart a range of different properties to separate areas of upper 30. The properties that a particular type of yarn will impart to an area of knitted component 40 partially depend upon the materials that form the various filaments and fibers within the yarn. Cotton, for example, provides a soft hand, natural aesthetics, and biodegradability. Elastane and stretch polyester each provide substantial stretch and recoverability, with stretch polyester also providing recycleability. Rayon provides high luster and moisture absorption. Wool also provides high moisture absorption, in addition to insulating properties. Nylon is a durable and abrasion-resistant material with high strength. Polyester is a hydrophobic material that also provides relatively high durability. In addition to materials, other aspects relating to the yarn may affect the properties of upper 30. For example, the yarn may be a monofilament yarn or a multifilament yarn. The yarn may also include separate filaments that are each formed of different materials. The yarn may also include filaments that are each formed of two or more different materials, such as a bicomponent yarn with filaments having a sheath-core configuration or two halves formed of different materials. Different degrees of twist and crimping, as well as different deniers, may affect the properties of upper 30 where the yarn is located. Accordingly, both the materials forming the yarn and other aspects of the yarn may be selected to impart a variety of properties to separate areas of upper 30.

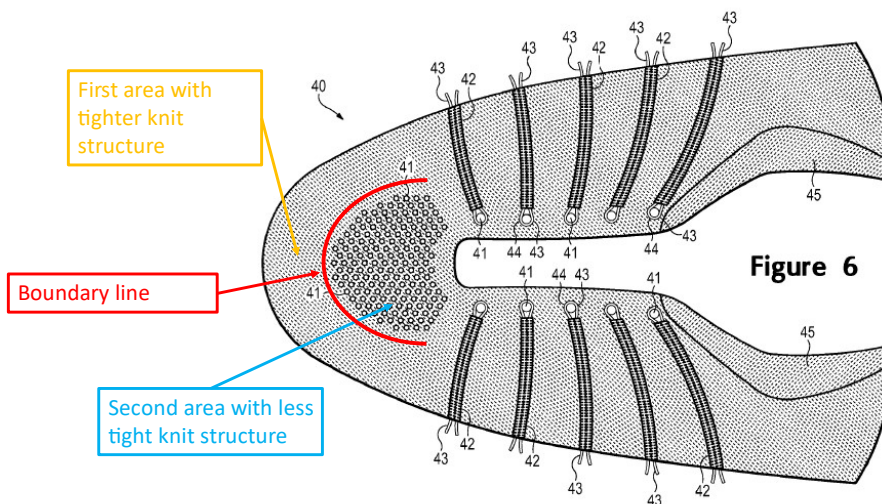
[0024]: In addition to knit types and yarn types, knitted component 40 may incorporate various knitted structures. Referring to FIGS. 2 and 3, for example, knitted component 40 includes various tubes 42 in which strands 43 are located. Tubes 42 are generally hollow structures formed by two overlapping and at least partially coextensive layers of knitted material, as depicted in FIGS. 5B and 5C. Although the sides or edges of one layer of the knitted material forming tubes 42 may be secured to the other layer, a central area is generally unsecured such that another

element (e.g., strands 43) may be located between the two layers of knitted material and pass through tubes 42. An additional example of knitted components for footwear uppers that have overlapping or at least partially coextensive layers may be found in U.S. Patent Application Publication 2008/0110048 to Dua, et al., which is incorporated herein by reference.

125. Dua discloses a dense area (48 in Fig. 7D) that has an increased “knit density” (such as a “jersey knit”) in the forefoot region 11 (including the toe region). Dua, [0022-0024]; ’762, 4:17-38. Dua discloses “increas[ing] the knit density in specific areas,” such as the forefoot region, to provide areas of greater and lesser knit density, i.e., areas having knit structures that are more tightly knit than other areas. Dua, [0022], [0044]. Knit density refers to “the total number of loops in a measured area of fabric.” Ex. 1023, 17. A person of ordinary skill in the art would have understood that an area having greater knit density would be an area that is more tightly knit than an area with lesser knit density.



Dua, Fig. 7D.



Dua, Fig. 6.

126. See Dua's dense area (48) in Fig. 7D, above, that has an increased "knit density" (such as a "jersey knit") in the forefoot region 11 (including the toe region).

Dua, [0022-0024]; '762, 4:17-38. Further, Dua discloses that portions of the upper may be formed using a “jersey knit” structure ('762, 4:17-38) and “various” other “knit types” such as a “more continuous or less-apertured configuration” or a more apertured region (Dua, [0022]). The “apertured configuration” seen in Figs. 6 and 7D is an example of the well-known “pointelle stitch knit structure” and at minimum it would have been obvious to use this knit structure for the aperture configuration because pointelle was well-known. As explained above in §V, there are a variety of inconsistent definitions for “pointelle” in the art. For example, while it is clear a person of ordinary skill in the art would have understood that a pointelle knit structure is an openwork knit structure, it is not clear what—if anything—is required beyond that. For example, some sources suggest pointelle is based on a rib structure, whereas other sources show a jersey structure. Ex. 1038, 6; Ex. 1021, 71-73. In addition, some definitions of pointelle suggest particular configurations may be what defines a pointelle over other openwork knit structures, while others suggest a wide range of shapes/configurations may be pointelles. Ex. 1052 (pointelle is “typically in the shape of chevrons); Ex. 1053 (pointelle has “small eyelet holes that create a lacy effect); Ex. 1021, 73 (illustrating varying configurations/patterns as pointelle, reproduced above in §V).

127. Regardless of the term’s scope, it is either disclosed or rendered obvious by Dua’s teachings of forming an “apertured configuration” formed during

the knitting process. Dua, [0022], [0037]. For example, Dua discloses that “openings are formed” by “not forming a [] stitch in specific locations” (’762 patent, 5:31-44) or by “omitting stitches at specific locations during the...knitting process” (’011 patent, 9:36-64 (incorporated by reference into Dua (Dua, [0022])))). In addition, Dua discloses using “tuck stitches,” and explains that the knitting machine used to form the knit element of the upper “can select groups or patterns of needles in either the knit, tuck, or float position” to form “different patterns and textures” such as apertured or other configurations in the various sections of the shoe. ’762 patent, 8:29-42; Ex. 1023, 99 (“The tuck stitch may also be employed to produce open-work effects.”). The prior art also explains that a pointelle knit structure may be formed by apertures resulting from individual stitches being transferred and then picked up again in specific locations (i.e., a tuck) in a knit element. Ex. 1021, 71-73; Ex. 1038 (explaining pointelle “uses transfer stitches to create an openwork design”); Ex. 1023, 99 (“The tuck stitch may also be employed to produce open-work effects.”). Thus, Dua’s teachings regarding creating apertures by omitting stitches or using tuck stitches meets this limitation.

128. To the extent “pointelle” requires something more, regardless of its scope, it would have been obvious to a person of ordinary skill in the art to include the well-known openwork pointelle stitch knit structure in Dua’s knitted upper because doing so would improve Dua’s knitted upper in the same way Dua’s

exemplary openwork knit structure (i.e., apertured configuration) improves Dua's knit upper, e.g., by providing "greater permeability, which allows air to circulate within the upper," increased "flexibility and stretch of the upper," and improved aesthetics. Dua, [0022]. For example, Dua and the '262 patent both disclose a knitted shoe upper and method of manufacturing the same. The '262 patent's alleged improvement over the prior art is providing an area with a pointelle stitch knit structure in the knitted upper. Dua, [0022]. As explained above in §IV, a pointelle knit structure is an example of an openwork knit structure, and Dua discloses that knit uppers can be improved by creating openwork knit structure (i.e., apertured configuration) in certain areas of the shoe to provide "greater permeability, which allows air to circulate within the upper," and increased "flexibility and stretch of the upper." Dua, [0022], [0037]. Dua further discloses that a knitting machine used to form the knit element of the upper "can select groups or patterns of needles in either the knit, tuck, or float position" to apply stitch variations (e.g., tuck stitches or omitted stitches) to create "different patterns and textures" such as apertured or other configurations in the various sections of the shoe. '762 patent, 8:29-42; *see also* '762 patent, 5:31-44; Dua, [0022], [0037]; '011 patent, 9:36-64. Using tuck stitches was a well-known technique for producing openwork knit structures generally and pointelle knit structures specifically. Ex. 1023, 99 ("The tuck stitch may also be employed to produce open-work effects."); Ex. 1021, 71-73. For example, it was

well-known that pointelle stitch knit structures could be created using conventional knitting machines, such as the knitting machines disclosed in Dua, by knitting tuck stitches (i.e., transferring individual stitches, such that needles are free and then picked up again in subsequent knitting) to create holes in certain positions of a knitted element. Ex. 1021, 71. Thus, a person of ordinary skill in the art would have applied the pointelle knit stitch structure to Dua's upper in the same way Dua contemplates for creating apertures, and the resulting improvements to the permeability and flexibility of the upper provided by other openwork knit structures such as Dua's apertures would have been predictably realized in the pointelle knit stitch structure. Dua, [0022]. And a person of ordinary skill in the art would have been motivated to apply the known pointelle structure using the same known knitting techniques disclosed in Dua to form apertures to achieve these improvements ('762, 5:31-44, 8:29-42; Dua, [0022], [0037]; '011, 9:36-64) in a predictable manner and with an expectation of success.

129. Further, the "apertured configuration" seen in Figs. 6 and 7D is an example of the well-known "pointelle stitch knit structure" and at minimum it would have been obvious to use this knit structure to for the aperture configuration because pointelle was well-known. *See e.g.* Ex. 1052 (Pointelle, Merriam-Webster's

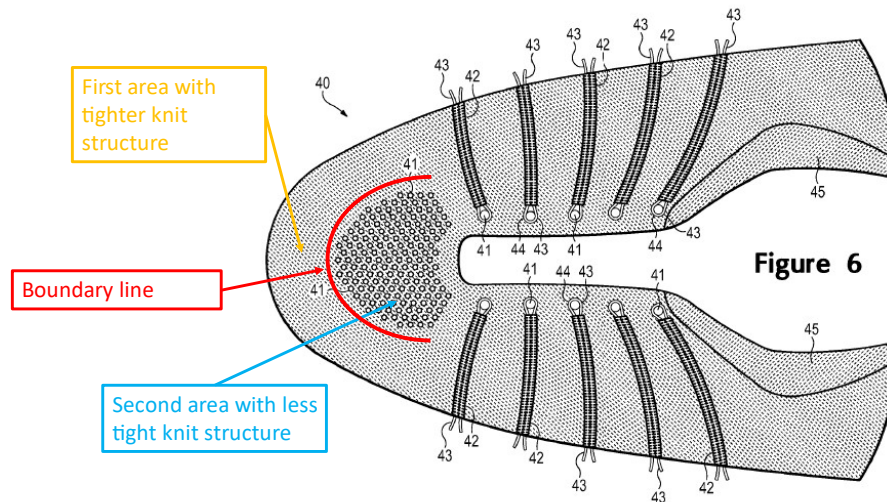
Collegiate Dictionary (10th ed. 2001)) pg 896 (“pointelle” “as in knitted fabric”).¹

While the apertured configuration is depicted in the toe region, a person of ordinary skill in the art would have understood from Dua’s disclosures (and at minimum found it obvious) to apply the apertured configuration in other areas of the shoe (including the lateral and medial metatarsal regions—appropriately sized to fit in these regions), because doing so would create aesthetic designs. Further, applying the apertured configuration to other areas of the shoe would advantageously provide more ventilation for the foot. *See* Dua, [0022] (forming “various apertures” in “many areas of the upper” causing “greater permeability, which allows air to circulate within upper 30, [and] increase both the flexibility and stretch,”), Fig. 6. As I have described earlier, a more breathable shoe may be more comfortable or appealing to an individual wearing the shoe. Indeed, **Dua** discloses using “complex patterns” (’762, 7:63-8:5), *e.g.*, patterns formed by “various knit types to impart different properties to separate areas of upper 30” such “areas of upper hav[ing] more or less apertured configuration” based on desired properties (Dua, [0022], [0035]). Those patterns can be portions of “many regions of the upper.” Dua, [0022], [0046].

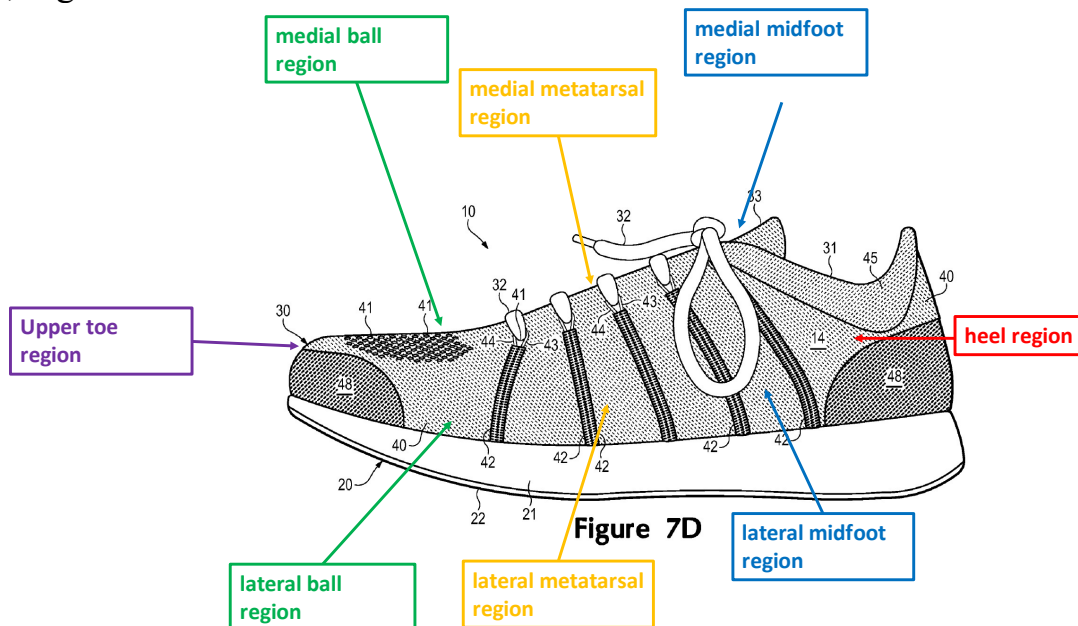
¹ Ex. 1021, at 71-73 (“Kitting technique pointelle: Transferring individual stitches, needles will be free, which then are picked-up again through the subsequent knitting (= tuck). *At this position results a hole = pointelle.*”)

130. And Dua further discloses that the first area is in the toe region. *See*

Dua, Fig. 6 below.



Dua, Fig. 6.



Dua, Fig. 7D.

131. Thus, Dua renders obvious [1.a.iv].

- f. **[1.a.v] the first area having a rear boundary, the second area having a forward boundary, the rear boundary of the first area and the forward boundary of the second area being coincident and coextensive with each other and defining a boundary line between the first and second areas**

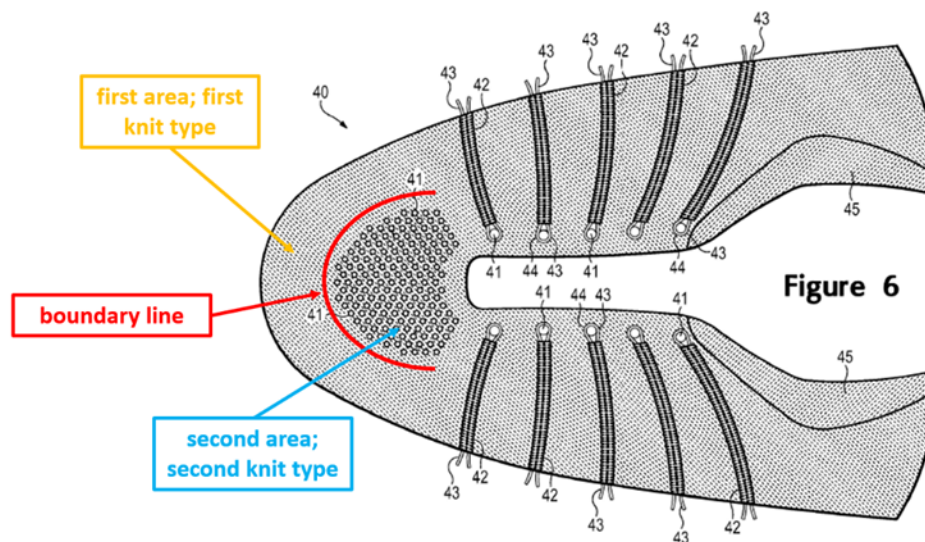
132. This limitation is met by Dua.

133. **Dua discloses the first area having a rear boundary, the second area having a forward boundary, the rear boundary of the first area and the forward boundary of the second area being coincident and coextensive with each other and defining a boundary line between the first and second areas** (*e.g.*, annotated Fig. 6 of Dua below). Dua, [0022]; *see also* [1.a.iv].

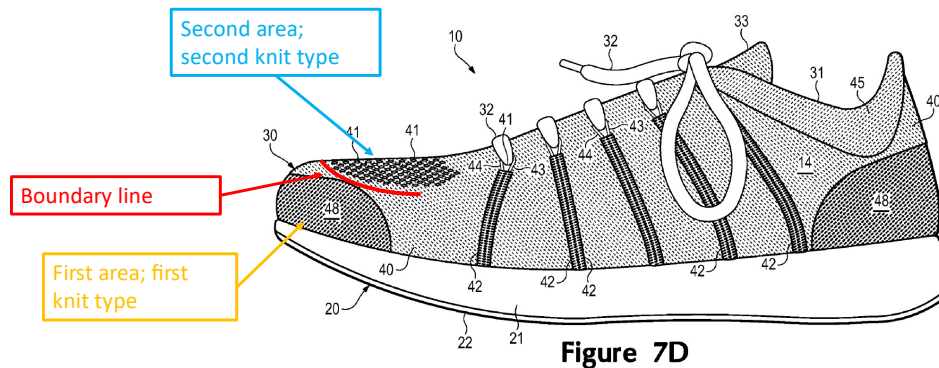
[0022]: Knitted component 40 incorporates various knit types that impart different properties to separate areas of upper 30. As an example that is depicted in FIGS. 1, 4, and 5A, knitted component 40 forms various apertures 41 that extend through upper 30 in forefoot region 11, whereas many other areas of upper 30 have a more continuous or less-**apertured** configuration. In addition to imparting greater permeability, which allows air to circulate within upper 30, apertures 41 may increase both the flexibility and stretch of upper 30 in forefoot region 11. As further examples, other properties that may be varied through selecting particular knit types for a particular area of knitted component 40 include permeability to liquids, the directions in which knitted component 40 stretches or resists stretch, the stiffness of knitted component 40, and the compressibility of knitted component 40. Additional examples of knitted components for footwear uppers that have areas with different knit types to impart different properties may be found in U.S. Pat. No. 6,931,762 to Dua and U.S. Pat. No. 7,347,011 to Dua, et al., both of which are entirely incorporated herein by reference. As a related matter, the density of the knit within knitted component 40 may vary among separate areas of upper 30 to, for example, make less-permeable or stiffer portions. Accordingly, knitted component 40 may exhibit various

properties in separate areas depending upon the particular knit type that is selected for the areas.

134. **Dua discloses a first area** (i.e., a less-apertured configuration) **and a second area** (i.e., apertures 41) **that are coincident and coextensive with each other and defining a boundary line between the first and second areas** as shown below. As explained in my discussion of [1.a.iv], a person of ordinary skill in the art would have understood from Dua (and at minimum found it obvious) for the pointelle stitching in the second area to be placed in the lateral and medial metatarsal regions where those regions would satisfy the boundary limitations for the same reasons, aesthetics and ventilation.



Dua, Fig. 6.



Dua, Fig. 7D.

g. [1.a.vi] and a line of broguing adjacent the boundary line; and

135. I understand that Petitioners argue all or part of this limitation is not entitled to patentable weight. Even if this limitation, or any portion of this limitation, is entitled to patentable weight, this limitation is met by Dua. As I explained above in Section §VII.A, this limitation is ornamental/aesthetic and is not entitled to patentable weight.

136. To the extent any portion of this limitation is entitled to patentable weight, this limitation is met by Dua.

137. This limitation is met by Dua.

138. Dua discloses **a line of broguing adjacent the boundary line** (e.g., “apertures 41” in various “areas of the upper”; annotated Fig. 6 below). Dua, [0022], Fig. 6; *see also* my discussion of [1.a.iv]-[1.a.v], above.

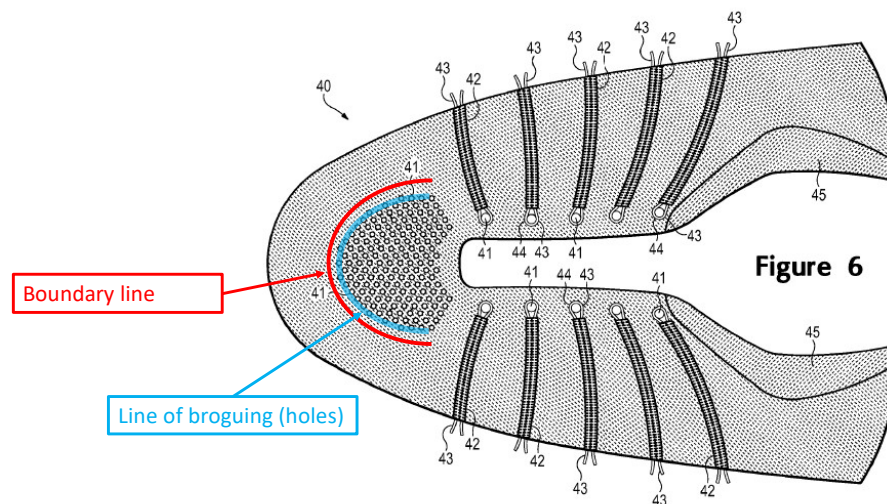
[0022]: Knitted component 40 incorporates various knit types that impart different properties to separate areas of upper 30. As an example that is depicted in FIGS. 1, 4, and 5A, knitted component 40 forms various apertures 41 that extend through upper 30 in forefoot region 11, whereas many other areas of upper 30 have a more continuous or less-apertured configuration. In addition to imparting greater permeability, which allows air to circulate within upper 30, apertures 41 may increase both the flexibility and stretch of upper 30 in forefoot region 11. As further examples, other properties that may be varied through selecting particular knit types for a particular area of knitted component 40 include permeability to liquids, the directions in which knitted component 40 stretches or resists stretch, the stiffness of knitted component 40, and the compressibility of knitted component 40. Additional examples of knitted components for footwear uppers that have areas with different knit types to impart different properties may be found in U.S. Pat. No. 6,931,762 to Dua and U.S. Pat. No. 7,347,011 to Dua, et al., both of which are entirely incorporated herein by reference. As a related matter, the density of the knit within knitted component 40 may vary among separate areas of upper 30 to, for example, make less-permeable or stiffer portions. Accordingly, knitted component 40 may exhibit various properties in separate areas depending upon the particular knit type that is selected for the areas.

'762, 5:31-43: Instep Section 33 extends along the instep from ankle section 31 and provides four-way stretch. Although the knit may be similar to ankle section 31, instep section 33 will generally be formed to have a single layer, rather than the overlapping layers of ankle Section 31. The same yarn utilized for ankle section 31 may be utilized for instep section 33. In addition, a plurality of openings 38 may be formed in instep Section 33 to enhance the Stretch properties of instep section 33. Instep section 33 may be formed by using three feeds of yarns, for example. When Switching between the feeds, a tuck Stitch is generally utilized. By not forming a tuck Stitch in **Specific locations, openings 37 are formed.**

'762, 7:63-8:5: Unlike conventional two feed circular knitting machines, knitting machine 50 has four feeds of yarn, with each feed containing up to ten different types of yarns in fingers. An example of a suitable, commercially available narrow-tube circular knitting machine that may be utilized as knitting machine 50 is sold by Sangiocomo S.p.A. of Italy under the X-MACHINE trademark. The X-MACHINE has been used to produce argyle-style socks where multiple colored yarns form argyle and other complex patterns.

139. Dua discloses forming “various apertures” in “many areas of the upper.”

Dua, [0022]. Those apertures are formed during the knitting process by, e.g., omitting “stitch[es] in specific locations” and can form “complex patterns.” ’762, 5:31-43, 7:63-8:5.



Dua, Fig. 6.

140. As I discussed above, applying a line of broguing adjacent the boundary line would be as simple as applying a pattern. This would be applying Dua’s

teachings regarding creating apertures by omitting “stitch[es] in specific locations” in a seamlessly knit, patterned upper for “dress shoes” to form a patterned dress shoe which includes a line of broguing (e.g., holes) to form the pattern. Dua, [0015]; ‘762 patent, 5:31-44, 7:63-8:5. As I explained in my discussions of [1.a.iv]-[1.a.vi], a person of ordinary skill in the art would have understood from Dua (and at minimum found it obvious) for the pointelle stitching in the second area to be placed in the lateral and medial metatarsal regions where those regions would include a line of broguing adjacent to the boundary line as shown in Fig. 6 above.

h. [1.a.vii] attaching the sole to the knit upper

141. This limitation is met by Dua.

142. **Dua discloses attaching the sole to the knit upper** (e.g., “article of footwear has an upper that includes a knitted component and a sole structure secured to the upper”). Dua, Abstract.

Abstract: An article of **footwear** has an upper that includes a knitted component and a sole structure secured to the upper....

[0001]: Conventional articles of footwear generally include two primary elements, an upper and a sole structure. The upper is secured to the sole structure and forms a void on the interior of the footwear for comfortably and securely receiving a foot. The sole structure is secured to a lower surface of the upper so as to be positioned between the upper and the ground. In some articles of athletic footwear, for example, the sole structure may include a midsole and an outsole. The midsole may be formed from a polymer foam material that attenuates ground reaction forces to lessen stresses upon the foot and leg during walking, running, and other ambulatory activities. The outsole is secured to a lower surface of the midsole and forms a ground-engaging portion of the sole structure that is formed from a durable

and wear-resistant material. The sole structure may also include a sockliner positioned within the void and proximal a lower surface of the foot to enhance footwear comfort.

[0018]: Sole structure 20 is secured to upper 30 and extends between the foot and the ground when footwear 10 is worn. The primary elements of sole structure 20 are a midsole 21, an outsole 22, and an sockliner 23. Midsole 21 is secured to a lower surface of upper 30 and may be formed from a compressible polymer foam element (e.g., a polyurethane or ethylvinylacetate foam) that attenuates ground reaction forces (i.e., provides cushioning) when compressed between the foot and the ground during walking, running, or other ambulatory activities. In further configurations, midsole 21 may incorporate a fluid-filled bladder that supplements the ground reaction force attenuation properties, or midsole 21 may be primarily formed from the fluid-filled bladder. Outsole 22 is secured to a lower surface of midsole 21 and may be formed from a wear-resistant rubber material that is textured to impart traction. Sockliner 23 is located within upper 30 and is positioned to extend under a lower surface of the foot. Although this configuration for sole structure 20 provides an example of a sole structure that may be used in connection with upper 30, a variety of other conventional or nonconventional configurations for sole structure 20 may also be utilized. Accordingly, the structure and features of sole structure 20 or any sole structure utilized with upper 30 may vary considerably.

[0019]: Upper 30 defines a void within footwear 10 for receiving and securing a foot relative to sole structure 20. The void is shaped to accommodate the foot and extends along the lateral side of the foot, along the medial side of the foot, over the foot, around the heel, and under the foot. Access to the void is provided by an ankle opening 31 located in at least heel region 13. A lace 32 extends through portions of upper 30, as described in greater detail below, and permits the wearer to modify dimensions of upper 30 to accommodate the proportions of the foot. More particularly, lace 32 permits the wearer to tighten upper 30 around the foot, and lace 32 permits the wearer to loosen upper 30 to facilitate entry and removal of the foot from the void (i.e., through ankle opening 31). In addition, upper 30 includes a tongue 33 that extends under lace 32.

143. For example, Dua discloses that an “article of footwear has an upper that includes a knitted component and a sole structure secured to the upper.” Dua, Abstract; *see also* Dua, [0018] (“[s]ole structure 20 is secured to upper 30”); [0001], [0019].

- i. **[1.b] the knitted upper toe region being seamlessly knitted with the knitted upper medial and lateral ball regions during the knitting step, the knitted upper medial and lateral ball regions being seamlessly knitted with the knitted upper metatarsal region during the knitting step, the knitted upper metatarsal region being seamlessly knitted with the knitted upper lateral and medial midfoot regions during the knitting step**

144. This limitation is met by Dua.

145. **Dua discloses the knitted upper toe region being seamlessly knitted with the knitted upper medial and lateral ball regions during the knitting step, the knitted upper medial and lateral ball regions being seamlessly knitted with the knitted upper metatarsal region during the knitting step, the knitted upper metatarsal region being seamlessly knitted with the knitted upper lateral and medial midfoot regions during the knitting step** (*e.g.*, “the features and structures are formed of unitary knit construction when incorporated into knitted component 40 through the flat knitting process, rather than other processes (*e.g.*, stitching, bonding, shaping) that are performed after the flat knitting process”; “section[s]” of

the “upper” with varied “physical propert[ies]” are “formed of knit materials” are “joined seamlessly”). Dua, [0035]; ’762, 2:23-28; *see also* [1.pre]-[1.a.iii].

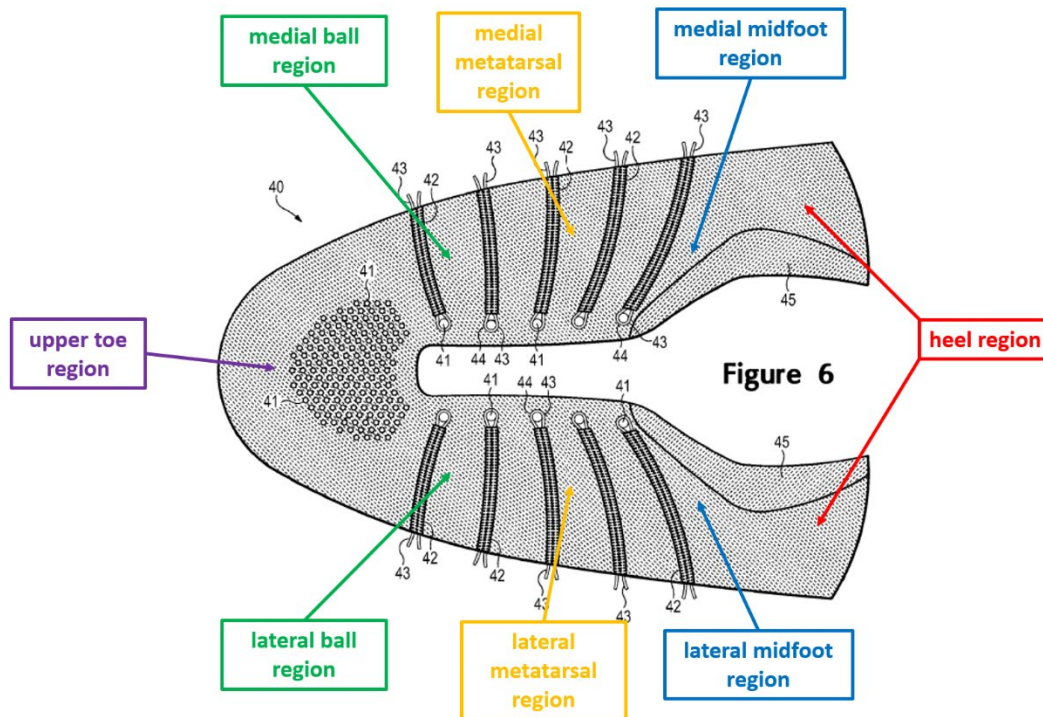
[0035]: An advantage to utilizing a flat knitting process to manufacture knitted component 40 is that each of the features discussed above may be imparted to knitted component 40 through the flat knitting process. That is, a flat knitting process may form knitted component 40 to have, for example, (a) various knit types that impart different properties to separate areas of upper 30, (b) various yarn types that impart different properties to separate areas of upper 30, (c) knitted components with the configuration of overlapping knitted layers in tubes 42, (d) a material such as strand 43 that is laid into tubes 42, (e) knitted components with the configuration of overlapping knitted layers in collar 45, and (f) floating yarns between layers of knitted material in collar 45. Moreover, each of these features, as well as other features, may be incorporated into knitted component 40 through a single flat knitting process. As such, a flat knitting process may be utilized to substantially form upper 30 to have various properties and structural features that are advantageous to footwear 10.

’762, 2:23-28: Other methods of joining the first section and the second section may form tails, or ends of yarns, that are exposed and may cause the area between the first and second sections to unravel. By utilizing a tuck stitch, however, tails are not formed and the first and second sections are joined seamlessly.

146. See my analysis of [1.pre]-[1.a.v.ii], above. Dua discloses that “the regions of knitted component 40 formed from knit types that define apertures 41 are formed of unitary knit construction through the flat knitting process,” i.e., without “supplemental stitching, bonding, or shaping processes.” Dua, [0022], [0035]. This type of unitary construction “without supplemental stitching” refers to seamlessly knitting the various regions of the shoe upper. A unitary knit construction means that the structure is made as an integrated one-piece during manufacturing, i.e., the

structure is not made of multiple pieces that are joined together with seams or other bonding techniques later. Ex. 1024, 5 (“Seamless knitting, or complete knitting, which produces one entire complete garment without a sewing or linking process....”). The knitted piece comes out of the machine as one integrated piece which is called seamless knitting. Ex. 1024, 5; see also Ex.1040, 60. Because Dua’s entire knitted component is formed of a unitary knit construction in a single knitting process without supplemental stitching, a person of ordinary skill in the art would understand that Dua discloses seamlessly knitting the various regions of the shoe. See my discussion in [1.a.i] describing how Dua describes a seamlessly knit shoe.

147. In addition to the above, Dua explicitly discloses that the knit component “is formed as a unitary knit structure with various sections having different physical properties” that are “joined in *a generally seamless manner.*” ’762, 3:2-9. For example, Dua discloses that each of an ankle section, an instep section, a primary section, and a toe section are “seamlessly join[ed].” ’762, 6:50-65. Thus, a person of ordinary skill in the art would understand Dua discloses seamlessly knitting the regions of the knitted element. See §§IV.A-B, E. See my annotations of Fig. 6, below, showing the upper toe region, the medial and lateral ball regions, medial and lateral midfoot regions, and medial and lateral metatarsal regions, and my discussion of [1.a.i].



Dua, Fig. 6 (annotated).

j. [1.c] the first and second areas being knitted during the knitting step

111. This limitation is met by Dua.

112. **Dua discloses the first and second areas being knitted during the knitting step** (e.g., “a flat knitting process may form knitted component 40 to have, for example, (a) various knit types that impart different properties to separate areas of upper 30” which “may be incorporated into knitted component 40 through a single flat knitting process”). Dua, [0035]; ‘762 patent, 3:2-9. See my discussions at [1.a.i]-[1.a.iv], [1.b].

[0035]: An advantage to utilizing a flat knitting process to manufacture knitted component 40 is that each of the features discussed above may be imparted to knitted component 40 through the flat knitting process. That is, a flat knitting process may form knitted component 40 to have, for example, (a)

various knit types that impart different properties to separate areas of upper 30, (b) various yarn types that impart different properties to separate areas of upper 30, (c) knitted components with the configuration of overlapping knitted layers in tubes 42, (d) a material such as strand 43 that is laid into tubes 42, (e) knitted components with the configuration of overlapping knitted layers in collar 45, and (f) floating yarns between layers of knitted material in collar 45. Moreover, each of these features, as well as other features, may be incorporated into knitted component 40 through a single flat knitting process. As such, a flat knitting process may be utilized to substantially form upper 30 to have various properties and structural features that are advantageous to footwear 10.

‘762, 3:2-9: Footwear 10 includes an upper that is formed as a unitary, knit structure with various sections having different physical properties. The various sections are joined in a generally seamless manner and may exhibit different degrees of strength, abrasion-resistance, stretch, support, stiffness, recovery, fit, and form, for example. In joining the various sections, tuck stitches are utilized to seamlessly-connect sections between wales.

113. For example, Dua discloses “a flat knitting process may form knitted component 40 to have, for example, [] various knit types that impart different properties to separate areas of upper 30” that are “incorporated into knitted component 40 through a single flat knitting process.” Dua, [0035].

- k. **[2] A method as set forth in claim 1, further comprising a medial boundary line and a lateral boundary line of the boundary line being formed during the knitting step; and a medial line of broguing and a lateral line of broguing of the line of broguing being formed during the knitting step; the medial line of broguing being adjacent the medial boundary line, the lateral line of broguing being adjacent the lateral boundary line, the medial line of broguing comprising a curved line of holes, and the**

lateral line of broguing comprising a curved line of holes.

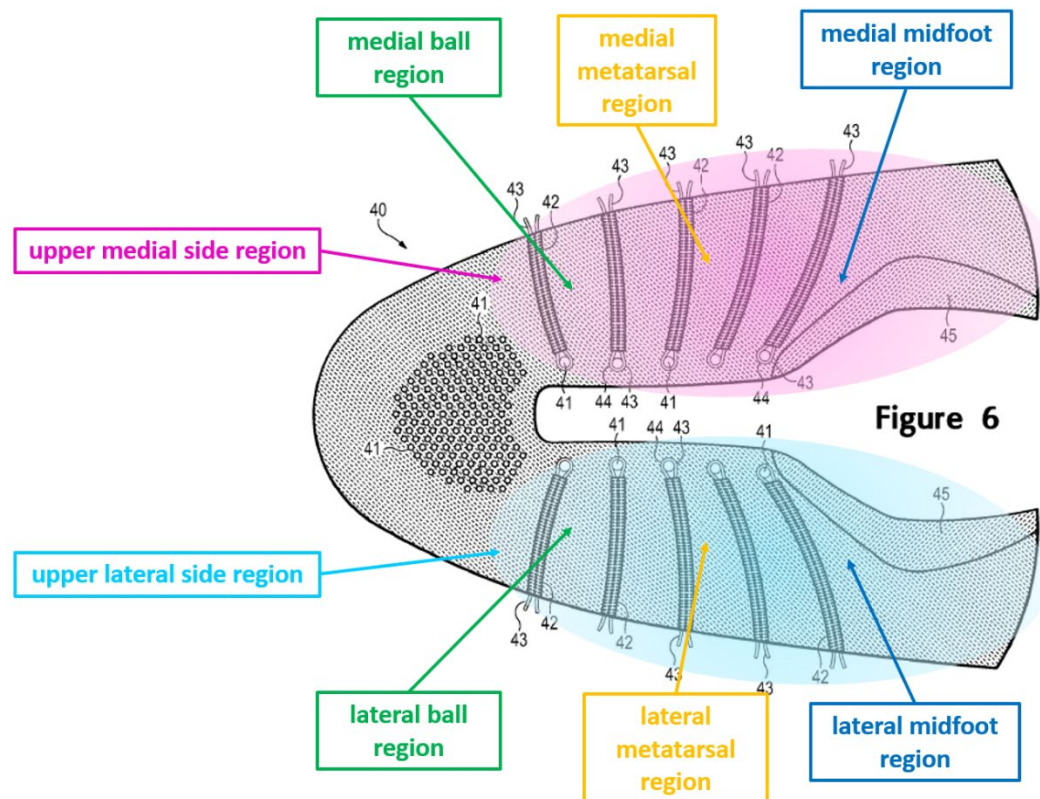
114. I understand that Petitioners argue all or part of this limitation is not entitled to patentable weight. Even if this limitation, or any portion of this limitation, is entitled to patentable weight, this limitation is met by Dua. As explained above in §VII.A, this limitation is ornamental/aesthetic and is not entitled to patentable weight.

115. This limitation is met by Dua.

116. See my explanation in claim [1]. **Dua discloses a medial boundary line and a lateral boundary line of the boundary line being formed during the knitting step (see my discussions of [1.a.v], and [1.c]); and a medial line of broguing and a lateral line of broguing of the line of broguing being formed during the knitting step; the medial line of broguing being adjacent the medial boundary line, the lateral line of broguing being adjacent the lateral boundary line (see my discussion of [1.a.vi]), the medial line of broguing comprising a curved line of holes, and the lateral line of broguing comprising a curved line of holes (see my discussion of [1.a.vi]).**

117. As shown in annotated Fig. 6 below, Dua's knitted component includes knitted upper lateral and medial metatarsal regions and "a lateral side 14 and a medial side 15." Dua, [0017], Fig. 6 (annotated). As further shown in annotated Fig. 6 below, Dua's upper **lateral side region** and **medial side region** include the

upper lateral and medial midfoot regions, the upper lateral and medial metatarsal regions, and the upper lateral and medial ball regions. Dua, Fig. 6.



Dua, Fig 6.

118. As I explained in my discussions of [1.a.iv]-[1.a.vi] and [1.c], a person of ordinary skill in the art would have understood that **Dua discloses or at minimum renders obvious for the pointelle stitching in the second area to be placed in the lateral and medial metatarsal regions** where those regions would satisfy the boundary limitations for the same reasons. Claim [2] is directed to the portions of the pointelle stitching in the medial and lateral areas and their respective boundary lines, lines of broguing, which are met for the reasons I have already explained in my discussions of [1.a.iv]-[1.a.vi] and [1.c]. Claim [2] specifies that the lines of

broguing are curved, which is disclosed by Dua as shown in Fig. 6 (see my discussion of [1.a.vi]) and would satisfy the claims when a similar area of pointelle stitch (and broguing) is used in each of the metatarsal regions for the reasons I explained in my discussion of [1.a.iv]. At a minimum, it would have been obvious to a person of ordinary skill in the art to use (or at least to try) curved broguing lines to advantageously accommodate the curved nature of the shoes, which in turn accommodates the curved nature of the foot wearing the shoe. Further, a curved line is often aesthetically appealing in footwear design, and was common in footwear, for example the wingtip shape. Indeed, Alan Flusser, a prominent, award-winning² men's clothing designer and influential style commentator for at least the past 40 years,³ identified these dress shoe styles in one of his many books as the "approximately seven [styles of shoes] that tradition and good taste dictate as appropriate" dress shoes. Flusser, 101. Thus, a person of ordinary skill in the art

² See, e.g., Michael Gross, *Dressing By The Books: Getting The Word To Men*, N.Y. Times, Oct. 19, 1985, at 52 (Ex. 1048) (describing Alan Flusser as a Coty Award winner (i.e., winner of an American Fashion Critics' Award)).

³ Cammy Sessa, "Clothes and the Man" by Flusser, *The Virginia-Pilot*, Sept. 7, 1995, at E3 (Ex. 1041).

would have found it obvious to try the curved broguing lines because it was a well-known wingtip dress shoe pattern.

- I. **[3] A method as set forth in claim 1, wherein the knit upper is knitted during the knitting step with at least first and second yarns, the first yarn being of a hot melt yarn, the second yarn being of a yarn other than a hot melt yarn.**

119. This limitation is met by Dua.

120. See my discussion of [1]. **Dua discloses the knit upper is knitted during the knitting step** (see my discussion of [1.c]), **with at least first and second yarns, the first yarn being of a hot melt yarn** (e.g., “yarns that incorporate thermoplastic polymer materials”), **the second yarn being of a yarn other than a hot melt yarn** (e.g., “knitted component 40 may incorporate various yarn types” including “polyester”; “the [] knitting machine may be programmed to place fusible strands in only selected areas of upper,” i.e., other areas may incorporate “yarns...formed entirely of neutral [i.e., non-fusible/thermoplastic] stands”). Dua, [0023], [0043]; '762, 4:17-38; '288, 8:49-57, 10:16-49.

[0023]: Knitted component 40 may also incorporate various yarn types that impart different properties to separate areas of upper 30. Moreover, by combining various yarn types with various stitch types, knitted component 40 may impart a range of different properties to separate areas of upper 30. The properties that a particular type of yarn will impart to an area of knitted component 40 partially depend upon the materials that form the various filaments and fibers within the yarn. Cotton, for example, provides a soft hand, natural aesthetics, and biodegradability. Elastane and stretch polyester each provide substantial stretch and recoverability, with stretch polyester also providing recycleability. Rayon provides high luster

and moisture absorption. Wool also provides high moisture absorption, in addition to insulating properties. Nylon is a durable and abrasion-resistant material with high strength. Polyester is a hydrophobic material that also provides relatively high durability. In addition to materials, other aspects relating to the yarn may affect the properties of upper 30. For example, the yarn may be a monofilament yarn or a multifilament yarn. The yarn may also include separate filaments that are each formed of different materials. The yarn may also include filaments that are each formed of two or more different materials, such as a bicomponent yarn with filaments having a sheath-core configuration or two halves formed of different materials. Different degrees of twist and crimping, as well as different deniers, may affect the properties of upper 30 where the yarn is located. Accordingly, both the materials forming the yarn and other aspects of the yarn may be selected to impart a variety of properties to separate areas of upper 30.

[0043]: As discussed above, separate areas of upper 30 may have different properties due to utilizing different knit types or yarn types in those areas. Another manner of modifying the properties of particular areas relates to fusing thermoplastic materials from the yarns in those areas. That is, particular areas may be formed from yarns that incorporate thermoplastic polymer materials. By heating the thermoplastic polymer materials, adjacent yarns, filaments, or fibers may fuse to each other in those areas to lock the knit loops together, thereby increasing stiffness or wear-resistance. In some configurations, individual layers of knitted component 40 (e.g., the exterior layer or the interior layer of tubes 42 or collar 45) or laid-in yarns within knitted component 40 (i.e., strands 43 or floating yarns 46) may be formed from yarns that incorporate thermoplastic polymer materials. As an alternative, the entirety of knitted component 40 may also be formed from yarns that incorporate thermoplastic polymer materials, and only portions corresponding with fused areas 47 may be heated to modify the properties. Referring to FIG. 7C, knitted component 40 includes two fused areas 47. One of fused areas 47 is in heel region 13 and may impart greater stiffness in order to effectively provide a heel counter to footwear 10. Examples of footwear uppers having fused regions may be found in U.S. Pat. No. 6,910,288 to Dua, which is incorporated herein by reference. Another of fused area 47 is in forefoot region 11 and may impart greater wear-resistance to the forefoot area. Fusing may also be utilized to reinforce apertures 41, provide areas of decreased flex, or decrease permeability.

'762, 4:17-38: The yarn and knit selected for ankle section 31 provides four-way stretch around the ankle opening. That is, ankle section 31 expands vertically and horizontally upon the application of a tensile force, thereby permitting the foot to enter upper 30. Once the foot is within upper 30, ankle section 31 contracts to recover the unstretched shape and comfortably conform to the shape of the ankle. Ankle section 31 includes an inner layer and an overlapping outer layer that are formed as a jersey knit by reversing the textile to create the two, overlapping layers. The inner layer of ankle section 31 is formed to include a slit 36. A semi-rigid element may be inserted through slit 36 to form a support positioned between the inner layer and the outer layer of ankle section 31. In order to provide the stretch and recovery properties of ankle section 31, a yarn that incorporates an elastane fiber may be utilized. Elastane fibers are available from E.I. duPont de Nemours Company under the LYCRA trademark. Such fibers may have the configuration of covered LYCRA, wherein the fiber includes a LYCRA core that is surrounded by a nylon sheath. Other fibers or filaments exhibiting elastic properties may also be utilized in ankle section 31.

'288, 8:49-57: Based upon the preceding discussion, textiles 130 b-130 d may incorporate various types of yarn 146, which may be similar in composition to yarns 151, 153, 155, and 156, for example. In addition, a portion of the yarns 146 that form textiles 130 b-130 d may be formed entirely of neutral strands. Accordingly, the textile configurations falling within the scope of the present invention may include varying types and proportions of fusible strands and neutral strands.

'288, 10:16-49: With regard to footwear 200, textile 230 may be formed with a circular knitting machine to have the structure generally described above. An example of a suitable, commercially available circular knitting machine that may be utilized to form textile 230 is sold by Sangiocomo S.p.A. of Italy under the X-MACHINE trademark. The X-MACHINE has been used to produce argyle-style socks where multiple colored yarns form argyle and other complex patterns. In manufacturing textile 230, for example, the X-MACHINE may be selected to have a 4 inch cylinder with 160 needles. Through proper programming of such a circular knitting machine, textile 230 may be formed to have a variety of configurations. For example, textile 230 may have fusible strands that are located throughout upper 220. That is, the fusible strands may be distributed in a substantially uniform manner in almost all portions of upper 220. In this configuration, select areas may be heated to form fused areas 232-235. A last may be

placed within upper 220 to provide support when the various areas are being fused. Alternately the circular knitting machine may be programmed to place fusible strands in only selected areas of upper 220. That is, the fusible strands may be located only in the areas of upper 220 that are intended to form fused areas 232-235. In this configuration, all of upper 220 may be heated uniformly, but only the areas having fusible strands will form fused areas 232-235. Following the manufacture of textile 230 using the circular knitting machine, textile 230 may be placed within a dyeing bath to impart color. The dyeing bath may be heated to a temperature that exceeds the melting temperature of the fusible strands. When the fusible strands are located only in select areas, the use of a heated dyeing bath may be an effective and efficient manner of forming fused areas 232-235. Alternately, textile 230 may be immersed in hot steam or air, for example, to form fused areas 232-235.

121. Dua discloses that a yarn incorporating thermoplastic polymer (i.e., hot melt yarn) can be one of the yarns that is used in “the entirety of the knitted component,” along with covered spandex yarn. Dua, [0043]; ’288, 8:49-57, 10:16-49. The “knitting machine may be programmed to place fusible strands in only selected areas of upper” so that other areas may incorporate “yarns...formed entirely of neutral [i.e., non-fusible/thermoplastic] strands.” ’288, 8:49-57, 10:16-49. See my discussion of technology in V.A for more information as to how to accomplish this.

- m. **[4] A method as set forth in claim 3, further comprising: placing the knit upper around a last; applying heat to the knit upper while the knit upper is around the last to cause the hot melt yarn to affix to the second yarn.**

122. This limitation is met by Dua.

123. See my discussion of [3]. **Dua discloses placing the knit upper around a last** (e.g., “a last may be placed within the upper”); **applying heat to the knit upper while the knit upper is around the last to cause the hot melt yarn to affix to the second yarn** (e.g., “yarns that incorporate thermoplastic polymer materials” are “heated to modify their properties”). Dua, [0043]; ’288 patent, 9:58-10:49.

[0043]: As discussed above, separate areas of upper 30 may have different properties due to utilizing different knit types or yarn types in those areas. Another manner of modifying the properties of particular areas relates to fusing thermoplastic materials from the yarns in those areas. That is, particular areas may be formed from yarns that incorporate thermoplastic polymer materials. By heating the thermoplastic polymer materials, adjacent yarns, filaments, or fibers may fuse to each other in those areas to lock the knit loops together, thereby increasing stiffness or wear-resistance. In some configurations, individual layers of knitted component 40 (e.g., the exterior layer or the interior layer of tubes 42 or collar 45) or laid-in yarns within knitted component 40 (i.e., strands 43 or floating yarns 46) may be formed from yarns that incorporate thermoplastic polymer materials. As an alternative, the entirety of knitted component 40 may also be formed from yarns that incorporate thermoplastic polymer materials, and only portions corresponding with fused areas 47 may be heated to modify the properties. Referring to FIG. 7C, knitted component 40 includes two fused areas 47. One of fused areas 47 is in heel region 13 and may impart greater stiffness in order to effectively provide a heel counter to footwear 10. Examples of footwear uppers having fused regions may be found in U.S. Pat. No. 6,910,288 to Dua, which is incorporated herein by reference. Another of fused area 47 is in forefoot region 11 and may impart greater wear-resistance to the forefoot area. Fusing may also be utilized to reinforce apertures 41, provide areas of decreased flex, or decrease permeability.

’288, 9:58-10:49. Footwear 100 and footwear 200 may be manufactured through a variety of procedures. With regard to footwear 100 specifically, textile 130 may be manufactured on any of a variety of conventional textile manufacturing machines. Fusible strands may

be incorporated into textile 130 by replacing one or more of the conventional neutral strands that characterize many conventional textiles. Following the manufacture of textile 130 in bulk form, three general procedures for forming fused areas 132-136 may be utilized. In the first procedure, fused areas 132-136 are formed with a hot die, steam, hot air, or radio frequency heating, for example, in specific portions of a relatively large section of textile 130. Individual elements of textile 130 may then be cut from the relatively large section and incorporated into upper 120. In the second procedure, the individual elements of textile 130 are cut and fused areas 132-136 are formed prior to incorporating the individual elements into upper 120. In the third procedure, the individual elements of textile 130 are cut and incorporated into upper 120, and fused areas 132-136 are subsequently formed. With regard to the third procedure, a last may be inserted into upper 120 to provide support and fused areas 132-136 may be formed with a hot die, for example, that contacts the exterior of upper 120. Accordingly, the manner in which individual strands are melted to form fused areas 132-136 may vary significantly within the scope of the present invention. With regard to footwear 200, textile 230 may be formed with a circular knitting machine to have the structure generally described above. An example of a suitable, commercially available circular knitting machine that may be utilized to form textile 230 is sold by Sangiocomo S.p.A. of Italy under the X-MACHINE trademark. The X-MACHINE has been used to produce argyle-style socks where multiple colored yarns form argyle and other complex patterns. In manufacturing textile 230, for example, the X-MACHINE may be selected to have a 4 inch cylinder with 160 needles. Through proper programming of such a circular knitting machine, textile 230 may be formed to have a variety of configurations. For example, textile 230 may have fusible strands that are located throughout upper 220. That is, the fusible strands may be distributed in a substantially uniform manner in almost all portions of upper 220. In this configuration, select areas may be heated to form fused areas 232-235. A last may be placed within upper 220 to provide support when the various areas are being fused. Alternately the circular knitting machine may be programmed to place fusible strands in only selected areas of upper 220. That is, the fusible strands may be located only in the areas of upper 220 that are intended to form fused areas 232-235. In this configuration, all of upper 220 may be heated uniformly, but only the areas having fusible strands will form fused areas 232-235. Following the manufacture of textile 230 using the circular knitting machine, textile 230 may be placed within a dying bath to impart color. The dying bath may be heated to a temperature that exceeds the melting temperature of the fusible

strands. When the fusible strands are located only in select areas, the use of a heated dying bath may be an effective and efficient manner of forming fused areas 232-235. Alternately, textile 230 may be immersed in hot steam or air, for example, to form fused areas 232-235.

124. Dua discloses that “a last may be placed within the upper to provide support when the various areas are being fused” (i.e., heated). ’288 patent, 10:28-33. Further, Dua further discloses that “heating” the “yarns that incorporate thermoplastic polymer materials” fuses those yarns to “adjacent yarns, filaments, or fibers.” Dua, [0043].

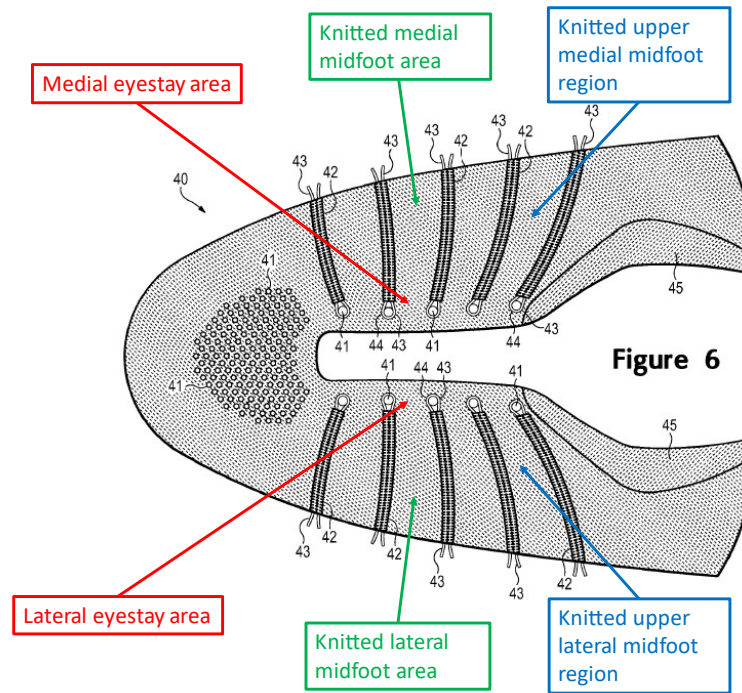
- n. **[5.pre]-[5a] A method as set forth in claim 1, wherein the knitted element further includes a knitted lateral eyestay area and a knitted medial eyestay area, each knitted during the knitting step.**

125. This limitation is met by Dua.

126. See my discussion of [1]. **Dua discloses the knitted element further includes a knitted lateral eyestay area and a knitted medial eyestay area** (see annotated Fig. 6 below), **each knitted during the knitting step** (see my discussion of [1.c]).

127. For example, **Dua** discloses apertures (41 in Fig. 6 below) that are formed in the knitted component for lace 32, which define lateral and medial eyestay areas. Dua, [0043]. For example, *Footwear Glossary: Shoe Construction Terminology* defines “eyelet” as a “hole through which a lace is threaded.” (page 4).

The knitting machine performs the eyestay knitting at the same time, in the knitting step. See Dua, [0035]; [1.b]-[1.c].



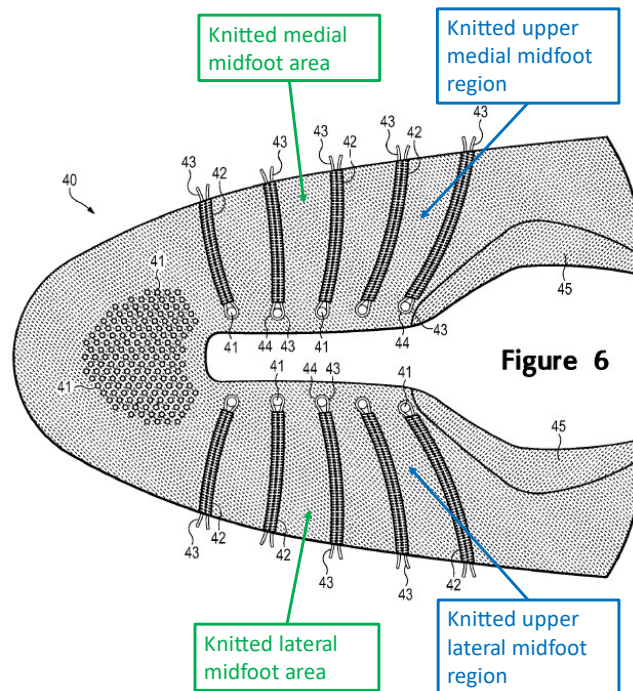
Dua, Fig. 6.

- o. [5.b]-[5.c] the knitted upper lateral midfoot region includes a knitted lateral midfoot area knitted during the knitting step; the knitted upper medial midfoot region includes a knitted medial midfoot area knitted during the knitting step;

128. This limitation is met by Dua.

129. Dua discloses the knitted upper lateral midfoot region including a knitted lateral midfoot area knitted during the knitting step; the knitted upper medial midfoot region including a knitted medial midfoot area knitted during

the knitting step (e.g., see annotated Fig. 6 below; [1.c]). Dua, Fig. 6.



Dua, Fig. 6 (annotated).

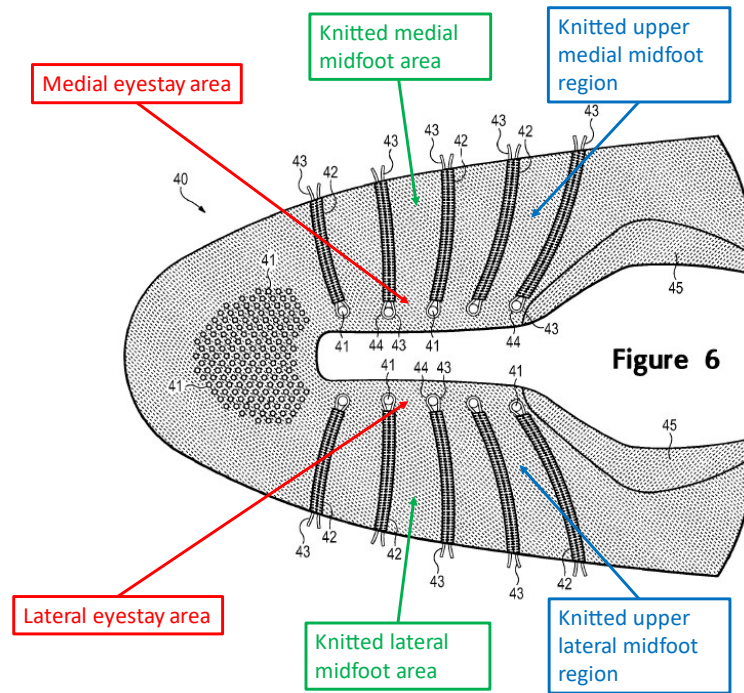
130. These are knitted at the same time (i.e. during the knitting step). See Dua, [0035]; [1.b]-1.c].

- p. **[5.d] the knitted element includes additional lines of broguing between the lateral midfoot area and the lateral eyestay area and between the medial midfoot area and the medial eyestay area, the additional lines of broguing being formed during the knitting step.**

131. This limitation is met by Dua.

132. As I explained above in §VII.A, and as I understand, Petitioners argue all or part of this limitation is not entitled to patentable weight. Even if this limitation,

or any portion of this limitation, is entitled to patentable weight, this limitation is met by Dua.



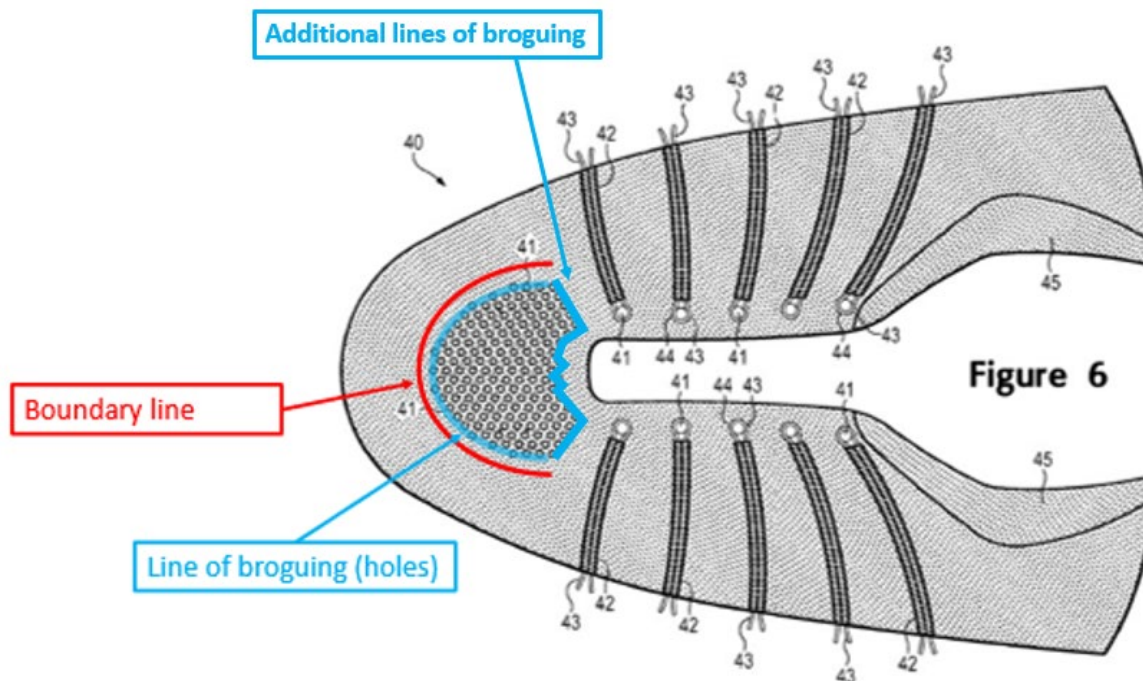
Dua, Fig. 6.

133. For example, as explained in my discussion of [1.a.iv]-[1.a.vi], [1.c], and [2], a person of ordinary skill in the art would have understood from Dua (and at minimum found it obvious) for the pointelle stitching in the second area to be placed in the lateral and medial metatarsal regions where those regions would satisfy the boundary and lines of brogue limitations for the same reasons. Claim [5.d] recites that there are additional lines of brogueing in these lateral and medial metatarsal areas (between the lateral midfoot area and the lateral eyestay area and between the medial midfoot area and the medial eyestay area). As shown in Figure 6 of Dua, there are already additional lines of brogueing included in the pointelle

stitching that satisfy these requirements for additional lines of broguing (*see* annotated Fig. 6 above).

134. And at minimum, it would have been obvious to use additional areas of pointelle stitching (that is appropriately sized to fit on the sides of the particular shoe) along the lateral and medial sides of the shoe similar to the apertures 41 shown in Figure 6 to provide additional ventilation for the shoe—each of these groups of apertures would form additional broguing lines as shown in Figure 6 below. Indeed, **Dua** discloses using “complex patterns” (’762, 7:63-8:5), *e.g.*, patterns formed by “various knit types to impart different properties to separate areas of upper 30” such “areas of upper hav[ing] more or less apertured configuration” based on desired properties (Dua, [0022], [0035]). Those patterns can be portions of “many regions of the upper.” Dua, [0022], [0046].

135. And consistent with Dua’s disclosures, a person of ordinary skill in the art would have had a reasonable expectation of success applying these teachings of increased apertures along the sides of the shoe for ventilation purposes because such stitching would have allowed more area to flow through the shoe. Dua [0022]. A person of ordinary skill in the art would have known that the combination (yielding the claimed limitations) would predictably work and provide the expected results, of a well-ventilating shoe. Dua [0022].



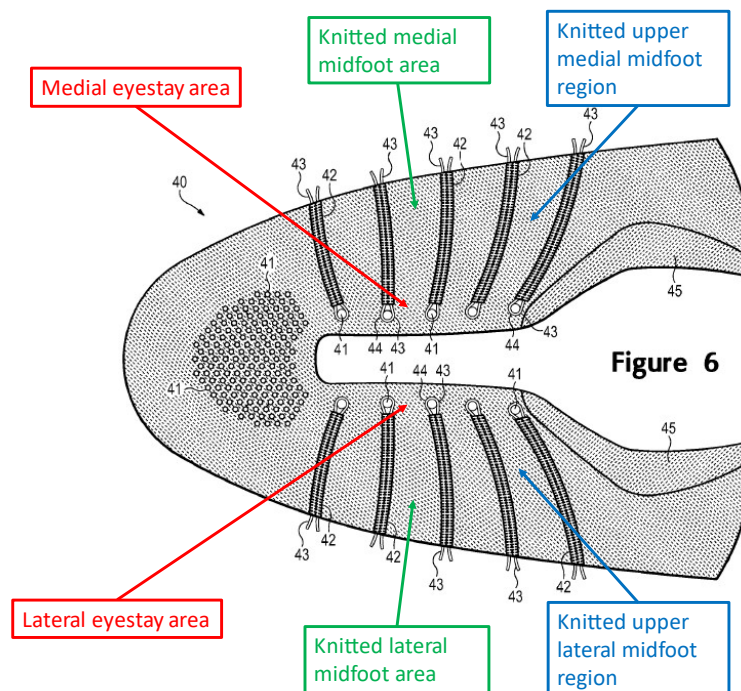
Dua, Fig. 6.

- q. [6.pre]-[6.b] A method as set forth in claim 1, wherein the knitted upper lateral midfoot region includes a knitted lateral midfoot area knitted during the knitting step; the knitted upper medial midfoot region includes a knitted medial midfoot area knitted during the knitting step;

136. See my discussion of [1]. **Dua discloses the knitted upper lateral midfoot region includes a knitted lateral midfoot area** (Dua, Fig. 6, annotated below) **knitted during the knitting step** (see my discussion of [1.c]); **the knitted upper medial midfoot region includes a knitted medial midfoot area** (Dua, Fig. 6, annotated below) **knitted during the knitting step** (see my discussion of [1.c]).

Dua, Fig. 6

Dua, [0035]: An advantage to utilizing a flat knitting process to manufacture knitted component 40 is that each of the features discussed above may be imparted to knitted component 40 through the flat knitting process. That is, a flat knitting process may form knitted component 40 to have, for example, (a) various knit types that impart different properties to separate areas of upper 30, (b) various yarn types that impart different properties to separate areas of upper 30, (c) knitted components with the configuration of overlapping knitted layers in tubes 42, (d) a material such as strand 43 that is laid into tubes 42, (e) knitted components with the configuration of overlapping knitted layers in collar 45, and (f) floating yarns between layers of knitted material in collar 45. Moreover, each of these features, as well as other features, may be incorporated into knitted component 40 through a single flat knitting process. As such, a flat knitting process may be utilized to substantially form upper 30 to have various properties and structural features that are advantageous to footwear 10.



Dua, Fig. 6.

137. Dua's knitted lateral midfoot regions and areas are illustrated above. Such areas are also knitted during the knitting step. Dua, [0035]. See my discussion of [1.b]-[1.c].

- r. [6.c] the knitted element includes additional lines of broguing between the lateral midfoot area and the second area and between the medial midfoot area and the second area, the additional lines of broguing being formed during the knitting step.**

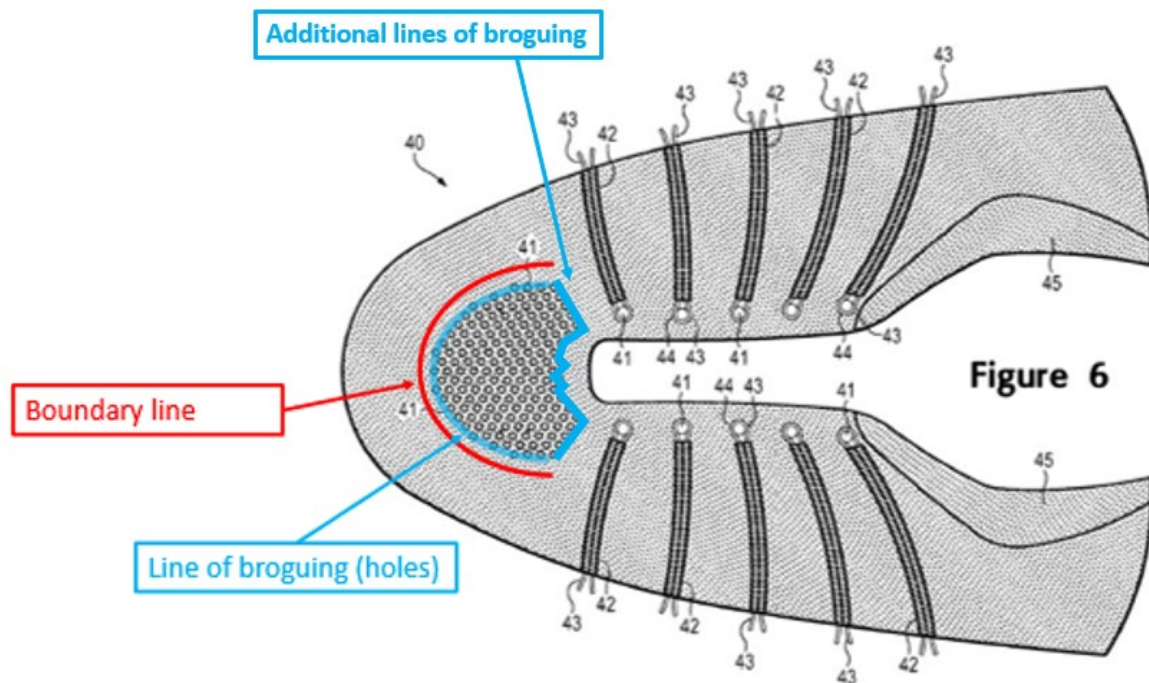
138. As I explained above in §VII.A, the broguing portions of the limitation recited in [6.c] are ornamental/aesthetic and not entitled to patentable weight.

139. As I explained above in §VII.A, and as I understand, Petitioners argue all or part of this limitation is not entitled to patentable weight. Even if this limitation, or any portion of this limitation, is entitled to patentable weight, this limitation is met by Dua.

140. Dua discloses this limitation (see my discussion of [5.d]). Dua, Fig. 6.

141. As I explained in my discussion of [5.d], at minimum, it would have been obvious to use additional areas of pointelle stitching (appropriately sized to fit on the sides of the shoe) along the lateral and medial sides of the shoe similar to the apertures 41 shown in Figure 6 to provide additional ventilation for the shoe—each of these groups of apertures would form additional broguing lines as shown in Figure 6 (see my discussion of [5.d]). Indeed, Dua discloses using “complex patterns” (’762, 7:63-8:5), e.g., patterns formed by “various knit types to impart different properties to separate areas of upper 30” such “areas of upper hav[ing] more or less apertured configuration” based on desired properties (Dua, [0022], [0035]). Those patterns

can be portions of “many regions of the upper,” knitted during a knitting step. Dua, [0022], [0046]; see my discussion of [1.b]-[1.c].



Dua, Fig. 6.

142. And consistent with Dua’s disclosures, a person of ordinary skill in the art would have had a reasonable expectation of success applying these teachings of increased apertures along the sides of the shoe for ventilation purposes, and a person of ordinary skill in the art would have known that the combination (yielding the claimed limitations) would predictably work and provide the expected results of a more well-ventilating shoe. Dua, [0022].

6. Analysis of Related Claims 7-13

143. Independent claims 7 and its dependent claims (8-13) addressed below recite limitations similar to or the same as claims 1-6, and thus are disclosed for the same reasons:

a. [7.pre]-[7.b]

144. [1.pre] is similar to [7.pre-7.b] except claim 7 recites “a shoe” including a “knit upper” and “a sole secured to the knit upper” rather than “a method of manufacturing an article of footwear having a knit upper and a sole.” **Dua** discloses that an “article of footwear has an upper that includes a knitted component and a sole structure secured to the upper.” **Dua**, Abstract. The article of footwear includes shoes such as “walking” and “dress shoes.” **Dua**, [0015]. Thus, **Dua** discloses and renders obvious these limitations.

[1.pre] A method of manufacturing an article of footwear having a knit upper and a sole, the method comprising	[7.pre] A shoe comprising: [7.a] a knit upper; [7.b] a sole secured to the knit upper;
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b. [7.c.i]

145. [1.a.i] and [7.c.i] recite the same substantive features (i.e., “a knitted element” of an “upper” that is “of a unitary one-piece construction” and knit on “a knitting machine”) with minor differences in phrasing and are met for the same reasons.

[1.a.i] knitting with a knitting machine to form a knitted element of the knit upper such that the knitted element is of a unitary one-piece construction comprising	[7.c.i] the knit upper having a knitted element, the knitted element being formed of a unitary one-piece construction during a knitting process on a knitting machine,
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c. [7.c.ii]

146. [7.c.ii] is substantively the same as [1.a.ii], except [1.a.ii] includes an additional limitation of “a knitted upper heel region.”

[1.a.ii] a knitted upper heel region, a knitted upper lateral midfoot region, a knitted upper medial midfoot region, a knitted upper metatarsal region including an upper lateral metatarsal region and an upper medial metatarsal region, a knitted upper lateral ball region, a knitted upper medial ball region, a knitted upper toe region,	[7.c.ii] the knitted element comprising a knitted upper lateral midfoot region, a knitted upper medial midfoot region, a knitted upper metatarsal region, a knitted upper lateral ball region, a knitted upper medial ball region, a knitted upper toe region
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d. [7.c.iii], [7.f.iii]

147. [1.a.vi] and [7.c.iii], [7.f.iii] recite the same substantive features (i.e., “a line of broguing” ([7.c.iii]) being adjacent “the boundary line” ([1.a.v.i], [7.c.iii])) and are met for the same reasons.

[1.a.vi] and a line of broguing adjacent the boundary line; and	[7.c.iii] and a line of broguing; [7.f.iii] the boundary line being adjacent the line of broguing; and
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e. [7.d], [13]

148. [7.d] is substantively the same as [1.a.ii], except [1.a.ii] includes additional limitations. [1.a.ii] and [13] recite the same substantive features (i.e., “a knitted upper heel region” knitted as part of the method ([1.a.ii]) or a part of “a shoe” ([13]) and are met for the same reasons.

[1.a.ii] a knitted upper heel region, a knitted upper lateral midfoot region, a knitted upper medial midfoot region, a knitted upper metatarsal region including an upper lateral metatarsal region and an upper medial metatarsal region, a knitted upper lateral ball region, a knitted upper medial ball region, a knitted upper toe region,	[7.d] the knitted upper metatarsal region including a knitted upper lateral metatarsal region and a knitted upper medial metatarsal region, [13] A shoe as set forth in claim 7, wherein the knitted element further includes a knitted upper heel region formed during the knitting process.
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f. [7.e]

149. [1.a.iii] recites substantively the same features in nearly identical language as [7.e], in different order. There is no substantive difference between these limitations for purposes of this analysis and they are met for the same reasons.

[1.a.iii] a knitted upper lateral side region including the knitted upper lateral midfoot region, the knitted upper lateral metatarsal region, and the knitted upper lateral ball region, a knitted upper medial side region including the knitted upper medial midfoot region, the knitted upper medial metatarsal region, and the knitted upper medial ball region,	[7.e] the knitted element having a knitted upper lateral side region and a knitted upper medial side region, the knitted upper lateral side region including the knitted upper lateral midfoot region, the knitted upper lateral metatarsal region, and the knitted upper lateral ball region, the knitted upper medial side region including the knitted upper medial midfoot region, the knitted
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	upper medial metatarsal region, and the knitted upper medial ball region,
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g. [7.f.i]

150. [1.a.iv] recites substantively the same features in nearly identical language as [7.f.i]. There is no substantive difference between these claims for purposes of this analysis and they are met for the same reasons.

[1.a.iv] a first area of a jersey stitch knit being at least in the knitted upper toe region, and a second area of a pointelle stitch knit being at least in the knitted upper lateral and medial metatarsal regions,	[7.f.i] the knitted element comprising a first area of a jersey stitch knit and a second area of a pointelle stitch knit, the first area being at least in the knitted upper toe region, the second area being at least in the knitted upper lateral and medial metatarsal regions,
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h. [7.f.ii]

151. [1.a.v] is identical to [7.f.ii].

[1.a.v] the first area having a rear boundary, the second area having a forward boundary, the rear boundary of the first area and the forward boundary of the second area being coincident and coextensive with each other and defining a boundary line between the first and second areas	[7.f.ii] the first area having a rear boundary, the second area having a forward boundary, the rear boundary of the first area and the forward boundary of the second area being coincident and coextensive with each other and defining a boundary line between the first and second areas,
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i. [7.g] and [7.h]

152. [1.b] is identical to [7.g], and [1.c] is identical to [7.h], except that the word “process” is used in place of “step.”

<p>[1.b] the knitted upper toe region being seamlessly knitted with the knitted upper medial and lateral ball regions during the knitting step, the knitted upper medial and lateral ball regions being seamlessly knitted with the knitted upper metatarsal region during the knitting step, the knitted upper metatarsal region being seamlessly knitted with the knitted upper lateral and medial midfoot regions during the knitting step, and</p>	<p>[7.g] the knitted upper toe region being seamlessly knitted with the knitted upper medial and lateral ball regions during the knitting process, the knitted upper medial and lateral ball regions being seamlessly knitted with the knitted upper metatarsal region during the knitting process, the knitted upper metatarsal region being seamlessly knitted with the knitted upper lateral and medial midfoot regions during the knitting process, and</p>
<p>[1.c] the first and second areas being knitted during the knitting step.</p>	<p>[7.h] the first and second areas being knitted during the knitting process.</p>

j. [8]

153. [2] and [8] are similar except [2] describes a method and [8] describes an apparatus (a shoe), and [8] does not recite “being formed during the knitting step.” [2] and [8] recite the same substantive features (i.e., “medial line of broguing and a lateral line of broguing” and “the medial line of broguing being adjacent the medial boundary line, the lateral line of broguing being adjacent the lateral boundary line” with “the medial line of broguing comprising a curved line of holes, and the lateral line of broguing comprising a curved line of holes”) with minor differences in ordering, but are met for the same reasons.

<p>[2] A method as set forth in claim 1, further comprising a medial boundary line and a lateral boundary line of the boundary line being formed during the knitting step; and a medial line of broguing and a lateral line of broguing</p>	<p>[8] A shoe as set forth in claim 7, wherein the boundary line comprises a medial boundary line and a lateral boundary line, and wherein the line of broguing includes a medial line of broguing and a lateral line of broguing,</p>
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of the line of broguing being formed during the knitting step; the medial line of broguing being adjacent the medial boundary line, the lateral line of broguing being adjacent the lateral boundary line, the medial line of broguing comprising a curved line of holes, and the lateral line of broguing comprising a curved line of holes.	the medial line of broguing being adjacent the medial boundary line, the lateral line of broguing being adjacent the lateral boundary line, the medial line of broguing comprising a curved line of holes, and the lateral line of broguing comprising a curved line of holes.
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k. [9]

154. [3] is identical to [9] except that [3] describes a method while [9] describes a shoe. Claim [3] begins with “A method as set forth in claim 1” while [9] begins with “A shoe as set forth in claim 7.” Otherwise, the claims recite the same additional limitation and are met for the same reasons.

[3] A method as set forth in claim 1, wherein the knit upper is knitted during the knitting step with at least first and second yarns, the first yarn being of a hot melt yarn, the second yarn being of a yarn other than a hot melt yarn.	[9] A shoe as set forth in claim 7, wherein the knit upper is knitted during the knitting process with at least first and second yarns, the first yarn being of a hot melt yarn, the second yarn being of a yarn other than a hot melt yarn.
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l. [10]

155. [4.pre-4.b] recite substantively the same features as [10] (i.e. applying “heat” to “the knit upper” that is “around a last” causing “the hot melt yarn” to affix to “the second yarn”) except that [4.pre-4.b] describe a method while [10] requires an apparatus, and there are minor differences in phrasing. Nevertheless, the additional limitations are met for the same reasons.

<p>[4.pre] A method as set forth in claim 3, further comprising:</p> <p>[4.a] placing the knit upper around a last;</p> <p>[4.b] applying heat to the knit upper while the knit upper is around the last to cause the hot melt yarn to affix to the second yarn.</p>	<p>[10] A shoe set forth in claim 9, further comprising the hot melt yarn being affixed to the second yarn by heat applied to the knit upper while the knit upper is positioned around a last.</p>
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m. [11.pre]-[11.c]

156. **[5.pre]-[5.c]** are similar to **[11.pre]-[11.c]** except that **[5.pre]-[5.c]** describe a method while **[11]** describes an apparatus. As such, **[5.a]-[5.c]** specify the steps occurring “during the knitting step,” while **[11]** does not contain such a limitation.

<p>[5.pre] A method as set forth in claim 1, wherein</p> <p>[5.a] the knitted element further includes a knitted lateral eyestay area and a knitted medial eyestay area, each knitted during the knitting step;</p> <p>[5.b] the knitted upper lateral midfoot region includes a knitted lateral midfoot area knitted during the knitting step;</p> <p>[5.c] the knitted upper medial midfoot region includes a knitted medial midfoot area knitted during the knitting step; and</p>	<p>[11.pre] A shoe as set forth in claim 7, wherein</p> <p>[11.a] the knitted element further includes a knitted lateral eyestay area and a knitted medial eyestay area,</p> <p>[11.b] the knitted upper lateral midfoot region including a knitted lateral midfoot area,</p> <p>[11.c] the knitted upper medial midfoot region including a knitted medial midfoot area, and</p>
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n. [11.d]

157. [11.d] is substantively the same to [5.d], counting for the fact that [11] describes an apparatus, while [5] describes a method. The differences are non-substantive: [11.d] describes broguing holes during the knitting “process,” while [5.d] describes broguing holes during the knitting “step,” and organization of limitations.

[5.d] the knitted element includes additional lines of broguing between the lateral midfoot area and the lateral eyestay area and between the medial midfoot area and the medial eyestay area, the additional lines of broguing being formed during the knitting step.	[11.d] wherein broguing holes forming additional lines of broguing are between the lateral midfoot area and the lateral eyestay area and between the medial midfoot area and the medial eyestay area, wherein the knitted element is knitted with the broguing holes during the knitting process.
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o. [12.pre]-[12.b]

158. [6.pre]-[6.b] are substantively similar to [12.pre]-[12.b] except that [6.pre]-[6.c] describe a method while [12] describes an apparatus.

159. [6.a]-[6.b] describe substantively the same features as [12.pre]-[12.b] (i.e. “the knitted upper lateral midfoot region includes a knitted lateral midfoot area” ([6.a]), “the knitted upper medial midfoot region includes a knitted medial midfoot area ([6.b]), except that [6.a]-[6.b] each require “knitted during the knitting step”.

[6.pre] A method as set forth in claim 1, wherein [6.a] the knitted upper lateral midfoot region includes a knitted	[12.pre] A shoe as set forth in claim 7, wherein
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lateral midfoot area knitted during the knitting step; [6.b] the knitted upper medial midfoot region includes a knitted medial midfoot area knitted during the knitting step; and	[12.a] the knitted upper lateral midfoot region includes a knitted lateral midfoot area and [12.b] the knitted upper medial midfoot region includes a knitted medial midfoot area, and
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p. [12.c]

160. **[6.c]** describes substantively the same features as **[12.c]** (i.e. “the knitted element” including “additional lines of broguing between the lateral midfoot area and the second area and between the medial midfoot area and the second area”) with minor changes in phrasing (i.e. **[6.c]** discloses “the additional lines of broguing being formed during the knitting step” while **[12.c]** discloses this happening during the “knitting process”) that are met by the same disclosures.

[6.c] the knitted element includes additional lines of broguing between the lateral midfoot area and the second area and between the medial midfoot area and the second area, the additional lines of broguing being formed during the knitting step.	[12.c] wherein broguing holes forming additional lines of broguing are between the lateral midfoot area and the second area and between the medial midfoot area and the second area, wherein the knitted element is knitted with the broguing holes during the knitting process.
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B. Grounds 3 and 4: Dua in view of Flusser, or Dua in view of the '762 and the '288 patents and Flusser (Claims 1-13)

161. As I explained in §IX.A, even if certain limitations, including the “lines of broguing,” are non-ornamental and entitled to patentable weight, Dua discloses or at least renders obvious claims 1-13. To the extent that further disclosure is

required for the claimed “broguing” line arrangement, those features are disclosed by Flusser. As used for the remaining grounds, references to a claim (e.g., [1]) or limitation (e.g., [1.pre]) refer to the discussion of that claim or limitation in the same Ground(s). When referring to a claim or limitation from other Ground(s), I will indicate what I am referring to identifying the relevant Ground(s) (e.g., “[1] of Grounds 1-2 above”).

1. Public Accessibility of Flusser

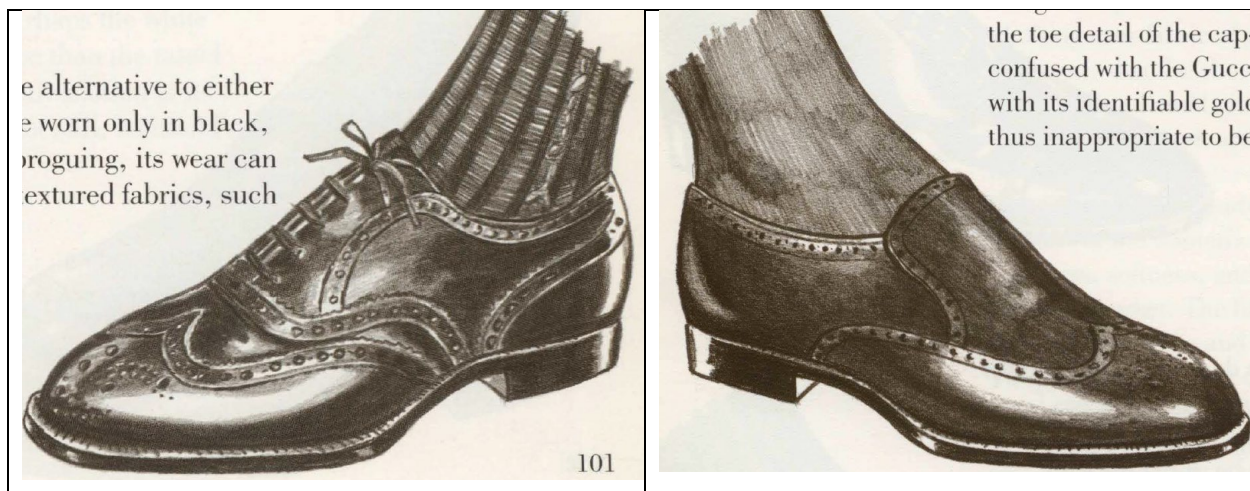
162. I have been informed that a reference is publicly accessible if it has been disseminated or otherwise made available to the extent that persons interested and ordinarily skilled in the subject matter or art exercising reasonable diligence could have located it at the time of the alleged invention.

163. Flusser was readily available to a person of ordinary skill in the art, e.g., at libraries and via Amazon (which was searchable using keywords) prior to the '262 patent's priority date. See Flusser; The Wayback Machine, <https://web.archive.org/web/20150105224030/http://www.amazon.com:80/Clothes-Man-Principles-Fine-Dress/dp/0394546237> (last visited Aug. 30, 2025) (Ex. 1049) (showing Flusser was available for purchase on Amazon as of Jan. 5, 2015). Flusser is a 1985 book published by Villiard Books, a division of Random House, Inc. Flusser, inner cover. Flusser was on sale as of at least September 20, 1985. *Publishers Weekly*, Sept. 20, 1985, at 97 (Ex. 1045). Shortly after its release, Flusser

was identified in the New York Times as one of “four new style manuals for men,” and its author, Alan Flusser, was interviewed for the article. Michael Gross, *Dressing By The Books: Getting The Word To Men*, N.Y. Times, Oct. 19, 1985, at 52 (Ex. 1048). Indeed, roughly ten years later, 85,000 copies of Flusser had reportedly been sold. Ex. 1041, at E3.

2. Overview of Flusser

164. Flusser discloses “approximately seven” “shoe styles...appropriate for business wear” including cap-toe (e.g., plain cap-toe, cap-toe brogue, perforated cap-toe brogue/medallion cap-toe brogue), wing-tip, slip-on/dress loafer (e.g., with “wing-tip style” “toe detail”), monk-strap (e.g., with “plain toe” design), suede, tassel loafer, and summer shoes (e.g., plain toe white buck oxford). Flusser, 101-104. The “traditional wing-tip or brogue shoe” includes “heavy broguing” that makes the shoe a more versatile dress shoe than more formal cap-toe designs. Flusser, 101.



“wing-tip brogue”	“dress slip-on” with “wing-tip style” “toe detail”
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Flusser, 101-102.

165. In addition to the specific styles of dress shoes, **Flusser** discloses various designs that can be applied to dress shoes, including a plain toe, a cap-toe (with or without broguing and/or a “perforated” “medallion”), and wing-tip pattern.

Flusser, 101-104.

3. Motivation to Apply Flusser’s Teachings to Dua

166. Dua and Flusser are analogous art, in the same field as the ’262, which includes footwear design, and are reasonably pertinent to purported problems addressed by the named inventors of the ’262 involving the improvement of the design of dress shoes and the manufacture of knitted or textile footwear uppers. ’262, 1:29-33, 3:39-41, 5:4-92; Dua, [0001]-[0004], [0015]; Flusser, 99-104.

167. A person of ordinary skill in the art would have been motivated to apply Flusser’s teachings of a dress shoe with a wingtip pattern including lines of broguing, to Dua’s patterned knitted upper because doing so would provide a knitted upper for a “dress shoe,” as taught by Dua, with one of the well-known styles and designs of dress shoes disclosed in Flusser.⁴ Dua, [0015]; ’762, 7:63-8:5; Flusser, 101-104.

⁴ The styles/designs disclosed in Flusser remained the same until at least the priority date of ’262. Ex. 1047, 193-208.

Dua already discloses application on a dress shoe, and the wingtip pattern was a well-known dress shoe pattern. Thus, a person of ordinary skill in the art would have found it to be simply applying a well-known pattern to a shoe.

168. In addition, a person of ordinary skill in the art would have been motivated to apply those teachings of Flusser to Dua's knitted upper as an obvious design choice. Dua expressly contemplates applying its teachings regarding a seamlessly knit, patterned upper to "dress shoes." Dua, [0015]. As disclosed in Flusser, there were a finite number of standard, well-known dress shoes styles, including the cap-toe, wing-tip, slip-on/dress loafer, monk-strap, suede, tassel loafer, and summer shoes having various ornamental designs including a plain toe, a cap-toe (with or without broguing and/or a "perforated" "medallion"), and wing-tip pattern. Thus, a person of ordinary skill in the art would have found it obvious to try the well-known wingtip dress shoe pattern as Dua's seamlessly knit pattern on the upper, and would have had a reasonable expectation of success in doing so because applying the wingtip pattern would involve simply applying Dua's teachings regarding creating a seamlessly knit, patterned upper for "dress shoes" to form a wingtip patterned dress shoe. Dua, [0015]. For example, Dua discloses forming "complex patterns" by variations in the configuration of knit stitch types and apertures formed by, e.g., omitting "stitch[es] in specific locations" ('762, 5:31-43, 7:63-8:5) in "many areas of the upper" (Dua, [0022]). Moreover, Litke discloses

patterns of holes, including the wingtip pattern of Fig. 3, can be applied to shoes with fabric uppers. Litke, 5:29-6:20.

169. Accordingly, a person of ordinary skill in the art would have had a reasonable expectation of success applying **Flusser's** teachings to **Dua's** knit upper, and a person of ordinary skill in the art would have known that the combination (yielding the claimed limitations) would predictably work and provide the expected results of a wingtip dress shoe.⁵

4. Claims 1-13

170. As explained in §IX.A, Dua renders obvious claims 1-13. To the extent additional disclosure is required for the broguing arrangement and/or knit pattern limitations, the application of Flusser's teachings to Dua renders them obvious.

a. [1.pre-1.a.iii]

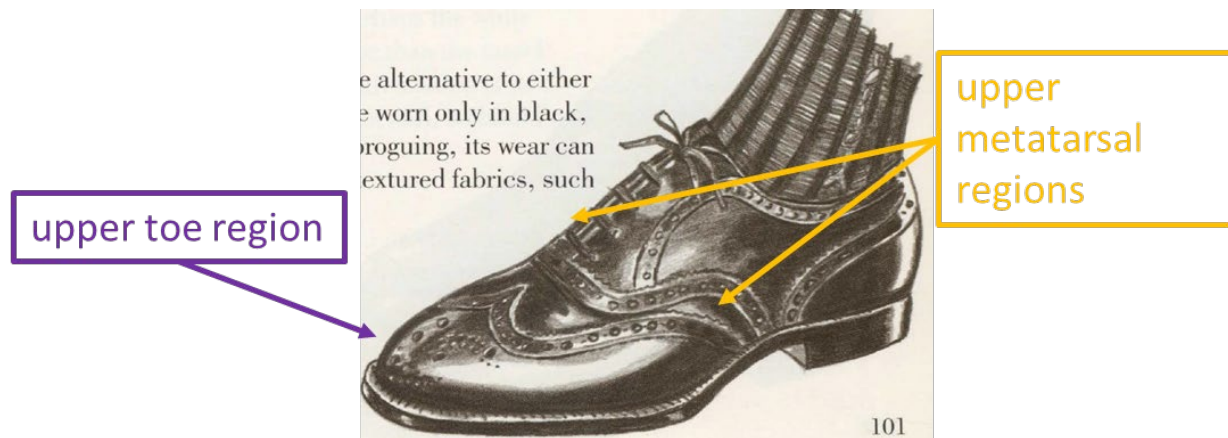
171. See §IX.A (my discussion in Grounds 1-2 explaining how these limitations are met by Dua).

b. [1.a.iv]

172. Dua in view of Flusser, or Dua in view of the '762 and the '288 patents and Flusser render this limitation obvious.

⁵ See *e.g.*, Litke, 5:29-6:20 (disclosing patterns of holes, including wingtip pattern of Fig. 3, can be applied to shoes with fabric uppers).

173. See my discussion of [1.a.iv] Grounds 1-2. Flusser discloses a first area being at least in the upper toe region, and a second area being at least in the upper lateral and medial metatarsal regions (e.g., annotated image below). Flusser, 101.



Flusser, 101

Dua, [0015]: The following discussion and accompanying figures disclose an article of footwear having an upper that includes a knitted component. The article of footwear is disclosed as having a general configuration suitable for walking or running. Concepts associated with the footwear, including the upper, may also be applied to a variety of other athletic footwear types, including baseball shoes, basketball shoes, cross-training shoes, cycling shoes, football shoes, tennis shoes, soccer shoes, and hiking boots, for example. The concepts may also be applied to footwear types that are generally considered to be non-athletic, including dress shoes, loafers, sandals, and work boots. The concepts disclosed herein apply, therefore, to a wide variety of footwear types.

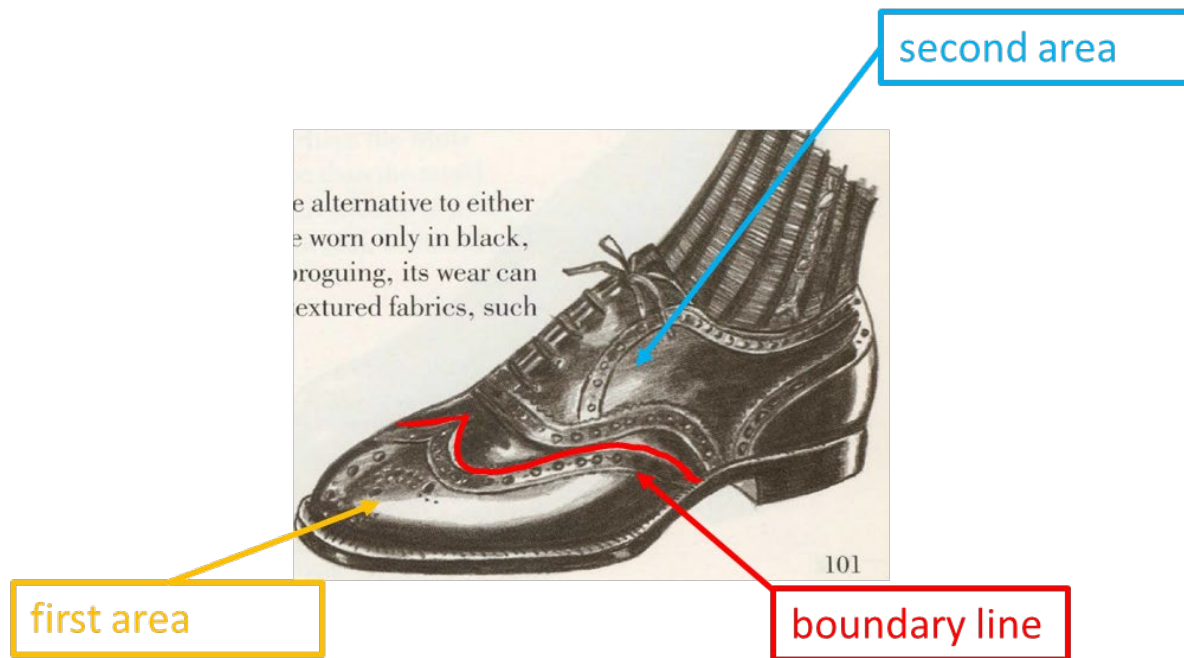
'762, 7:63-8:5: Unlike conventional two feed circular knitting machines, knitting machine 50 has four feeds of yarn, with each feed containing up to ten different types of yarns in fingers. An example of a suitable, commercially available narrow-tube circular knitting machine that may be utilized as knitting machine 50 is sold by Sangiocomo S.p.A. of Italy under the X-MACHINE trademark. The X-MACHINE has been used to produce argyle-style socks where multiple colored yarns form argyle and other complex patterns.

174. As I explained above in §IX.B.3 (Motivation to Apply Flusser's Teachings to Dua) and in [1.a.iv] in Grounds 1-2), Dua discloses (and at least renders obvious) the first area of jersey stitch knit and second area of a pointelle stitch knit (see my discussion of [1.a.v] in Grounds 1-2, and it would have been obvious to try Flusser's line of broguing as a boundary line between these areas as depicted in Flusser and to apply these teachings to Dua for aesthetic reasons and to advantageously create more ventilation; doing so would meet this limitation. Flusser, 101; Dua, [0015]; '762, 7:63-8:5.

c. [1.a.v]

175. Dua in view of Flusser, or Dua in view of the '762 and the '288 patents and Flusser render this limitation obvious.

176. See my discussion of [1.a.v] in Grounds 1-2. **Flusser discloses the first area having a rear boundary, the second area having a forward boundary, the rear boundary of the first area and the forward boundary of the second area being coincident and coextensive with each other and defining a boundary line between the first and second areas (e.g., see figure below). Flusser, 101.**



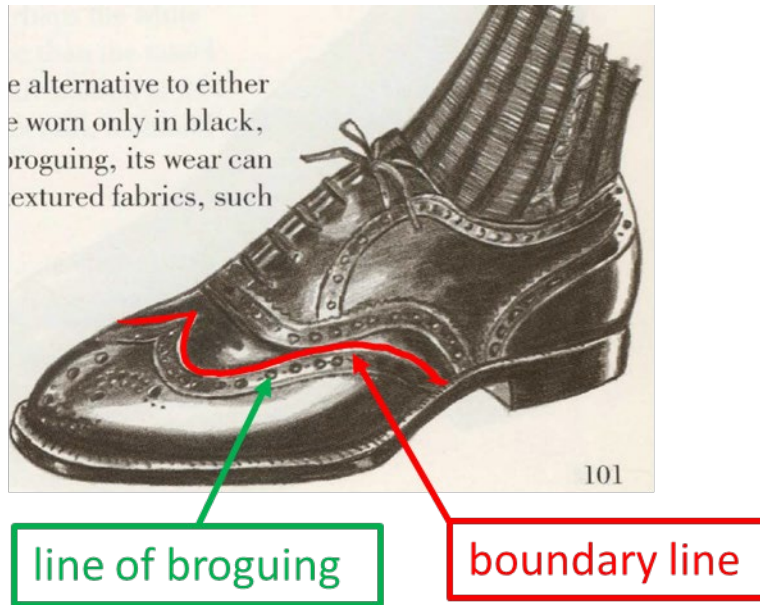
Flusser, 101.

177. As explained above (§IX.B.3, [1.a.iv], and [1.a.v] in Grounds 1-2, Dua discloses the first area and second area (see my discussion of [1.a.v] in Grounds 1-2 and knitting with the line of broguing (i.e., apertures/holes) during the knitting step, and it would have been obvious to try Flusser's line of broguing as a boundary line between those areas and to apply these teachings to Dua; doing so would meet this limitation. Flusser, 101; Dua, [0015]; '762, 7:63-8:5.

d. [1.a.vi]

178. Dua in view of Flusser, or Dua in view of the '762 and the '288 patents and Flusser render this limitation obvious.

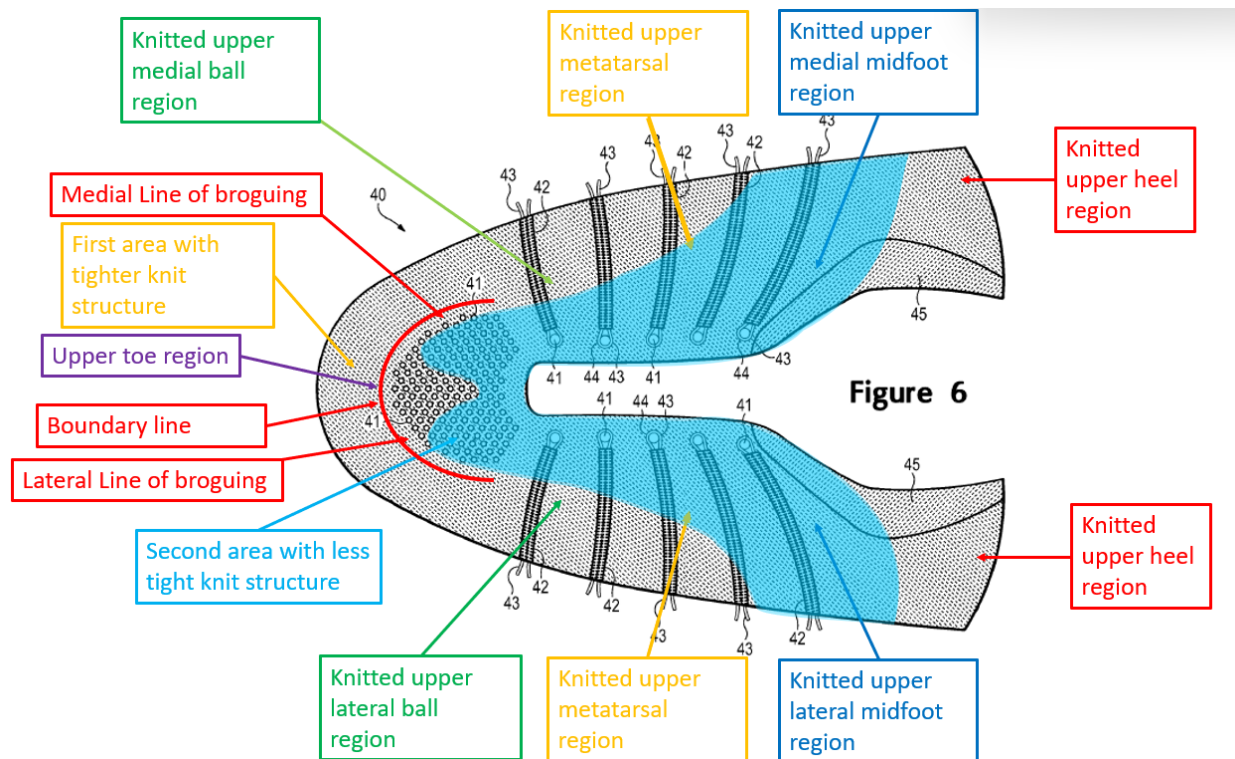
179. See my discussion of [1.a.vi] Grounds 1-2. **Flusser discloses a line of broguing adjacent the boundary line** (e.g., annotated image below). Flusser, 101.



Flusser, 101.

180. As explained above (§IX.B.3, [1.a.iv]-[1.a.v], and [1.a.v] in Grounds 1-2, Dua discloses the first area and second area (see my discussion of [1.a.v] in Grounds 1-2 and knitting with the line of broguing (i.e., apertures/holes) during the knitting step, and it would have been obvious to try Flusser's line of broguing to define a boundary line and to apply these teachings to Dua to create apertures using a pointelle stitch knit; doing so would meet this limitation. Flusser, 101; Dua, [0015]; '762, 7:63-8:5.

181. Application of **Flusser's** teachings of a wingtip style line of **broguing** to **Dua's** teachings of first and second areas with different knit types would have resulted in the claimed boundaries, as depicted below in annotated Dua Fig. 6:



Dua, Fig. 6 (annotated). While the wingtip annotation is illustrative, the claims are met regardless of the particular shape of the wingtip.

e. [1.a.vii-1.c]

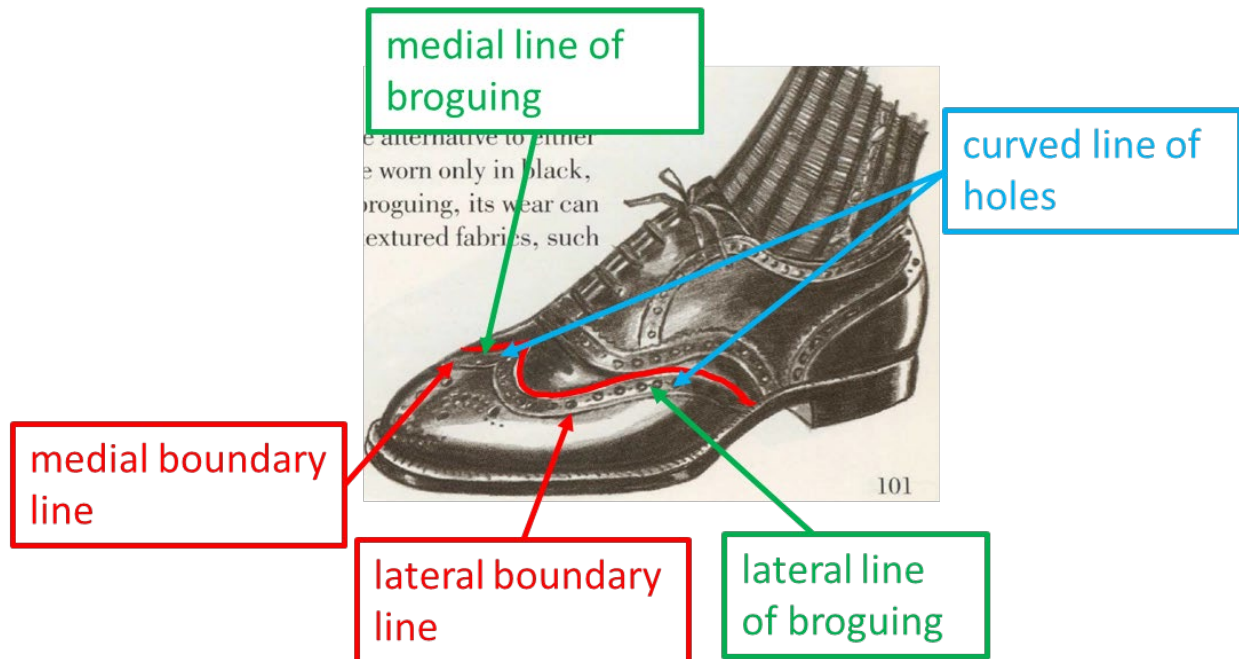
182. See §IX.A (my discussion in Grounds 1-2 explaining how these limitations are met by Dua).

f. [2]

183. Dua in view of Flusser, or Dua in view of the '762 and the '288 patents and Flusser render this limitation obvious.

184. See my discussion of [1] in Grounds 3-4, and [2] in Grounds 1-2. Flusser discloses a **medial boundary line and a lateral boundary line of the boundary line**; and a **medial line of broguing** and a **lateral line of broguing** of the line of broguing being formed during the knitting step; **the medial line of**

broguing being adjacent **the medial boundary line**, the **lateral line of broguing** being adjacent **the lateral boundary line**, the medial line of broguing comprising **a curved line of holes**, and the lateral line of broguing comprising **a curved line of holes** (e.g., annotated image below). Flusser, 101.



Flusser, 101.

185. As I explained above (§IX.B and [2] in Grounds 1-2), Dua discloses the knitted element being knitted with the medial and lateral lines of broguing (i.e., apertures/holes) during the knitting step, and it would have been obvious to apply Flusser's well-known wingtip pattern to the teachings of Dua; doing so would meet this limitation. Flusser, 101, Dua, [0015]; '762, 7:63-8:5.

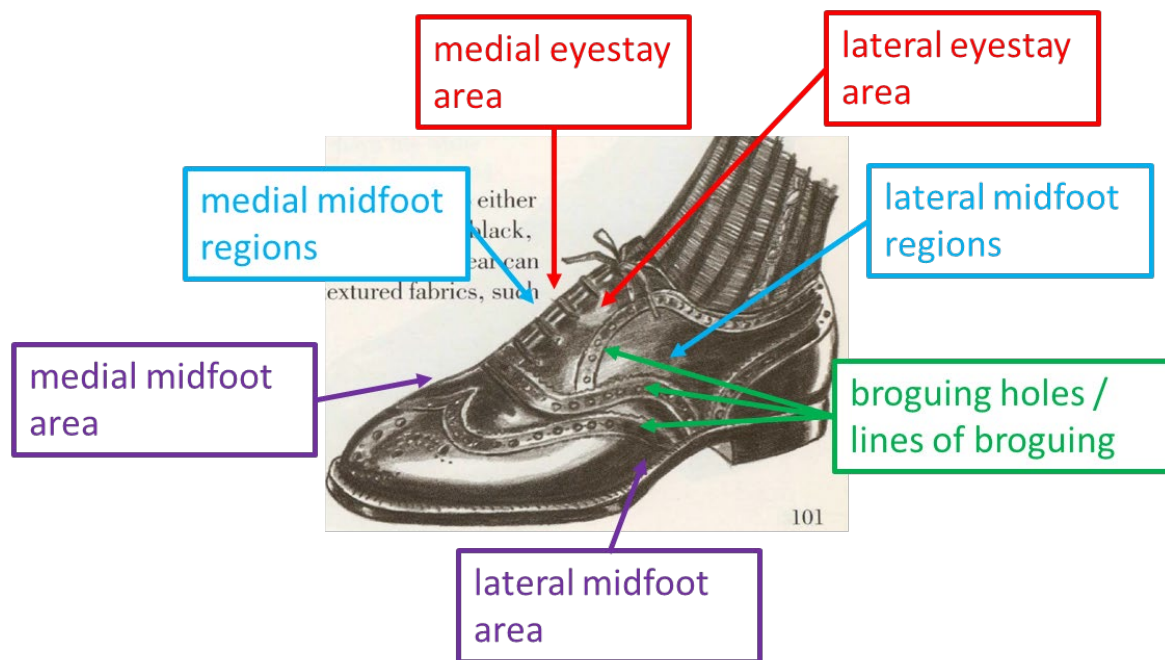
g. [3]-[5.c]

186. See my discussion of [1] in Grounds 3-4 and §IX.A (explaining how these limitations are met by Dua, in Grounds 1-2).

h. [5.d]

187. Dua in view of Flusser, or Dua in view of the '762 and the '288 patents and Flusser render this limitation obvious.

188. See my discussion of [5.d] in Grounds 1-2. **Flusser discloses additional lines of broguing between the lateral midfoot area and the lateral eyestay area and between the medial midfoot area and the medial eyestay area** (e.g., annotated image below). Flusser, 101.



Flusser, 101.

189. As I explained above in §IX.B and [5.pre]-[5.d] in Grounds 1-2, Dua discloses the claimed regions and areas are knitted and that the knitted element is knitted with the broguing holes during the knitting step, and it would have been obvious to try Flusser's well-known wingtip pattern including broguing holes forming lines of broguing and to apply these teachings to Dua; doing so would meet this limitation. Flusser, 101, Dua, [0015]; '762, 7:63-8:5; *see also* [5.pre-5.c]Grounds 1-2.

i. [6.pre]-[6.b]

190. See my discussion of [1] and §IX.A (explaining how these limitations are met by Dua).

j. [6.c]

191. Dua in view of Flusser, or Dua in view of the '762 and the '288 patents and Flusser render this limitation obvious.

192. **Flusser discloses additional lines of broguing between the lateral midfoot area and the second area and between the medial midfoot area and the second area (e.g., annotated image below).**



Flusser, 101.

193. As explained above in [5] in Grounds 1-2, [6] in Grounds 1-2 and §IX.B, **Dua** discloses the claimed regions and areas are knitted and that the knitted element is knitted with the broguing holes during the knitting step. It would have been obvious to try **Flusser's** well-known wingtip pattern including broguing holes forming lines of broguing and to apply these teachings to **Dua**; doing so would meet these limitations, as shown in the figure above. Flusser, 101, Dua, [0015]; '762, 7:63-8:5

k. [7]-[13]

194. See §§IX.A.6 (explaining the overlap between these limitations/claims and claims 1-6), IX.B.4.a-j (explaining the teachings to be applied from Flusser to meet claims 1-6). It would have been obvious to apply the teachings from Flusser for the reasons discussed above in §IX.B.3 to meet claims [7]-[13]. And thus, Dua in view of Flusser render these claims obvious.

C. Grounds 5 and 6: Dua in view of Litke, or Dua in view of the '762 and the '288 patents and Litke (Claims 1-13)

195. As I explained in §§IX.A and IX.B, even if certain limitations, including the “lines of broguing,” are non-ornamental and entitled to patentable weight, Dua or Dua in view of Flusser discloses or at least renders obvious claims 1-13. To the extent that further disclosure is required for the claimed “broguing,” those features are also disclosed by Litke and it would have been obvious to apply its teachings to Dua as an alternative to Flusser.

1. Overview of Litke

196. Litke discloses a computerized customization system for, e.g., footwear. Litke, 2:63-67. The footwear can include an upper 15a and a plurality of patterns, such as a pattern “formed of holes in the upper material” and/or another pattern “formed of stitching.” Litke, 5:7-19. The footwear can be customized by the shoe type and associated design parameters including upper material and color(s). Litke, 5:29-48. The upper materials may include “woven and non-woven fabrics.” Litke, 5:64-66. “Patterns that can be applied or formed on the materials include stitching, holes...or no pattern.” Litke, 6:17-20. Fig. 3 illustrates a wingtip pattern 15i.

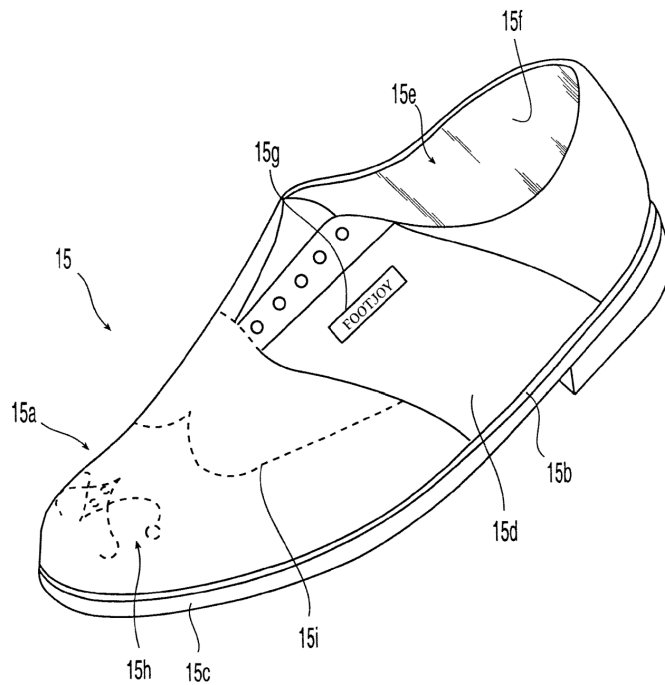


Fig. 3

Litke, Fig. 3.

2. Motivation to Apply Litke's Teachings to Dua

197. **Dua** and **Litke** are analogous art, in the same field as the '262 patent, which includes footwear, and are reasonably pertinent to purported problems addressed by the named inventors of the '262 patent involving the improvement of design and manufacture of knitted uppers for shoes. '262, 2:34-42, 3:39-41, 5:6-9; Dua, [0001]-[0004]; Litke, 2:63-67.

198. A person of ordinary skill in the art would have been motivated to apply Litke's teachings of the lines of broguing 15i (shown in Fig. 3) to Dua's seamlessly knitted, patterned upper because Dua expressly contemplates using its knit uppers in dress shoes and including "complex patterns," including, for example, the well-

known dress shoe pattern of a wing-tip. Dua, [0015]; ‘762 patent, 7:63-8:5. As described above, the wing-tip was a well known dress shoe pattern, and so applying the wing-tip pattern was obvious (see my discussion in §IX.B.3 above). Further, Litke’s broguing is a fancy pattern that would elevate a shoe. Thus, a person of ordinary skill in the art would have been motivated to apply the fancy broguing pattern of Litke to Dua.

199. In addition, a person of ordinary skill in the art would have been motivated to apply Litke’s teachings of lines of broguing 15i (shown in Fig. 3), to the knitted shoe upper having specific knit types located in desired areas of the knitted component in Dua, in order to achieve the “desired properties...and advantageous structural attributes of the article of footwear” (Dua, [0040]) with the benefit of meeting the user’s desired characteristics. Applying Litke’s line of broguing to Dua’s knitted shoe upper with specific knit types in specific areas would produce a fancy, intricate, dressy shoe.

200. Accordingly, a person of ordinary skill in the art would have had a reasonable expectation of success applying Litke’s teachings to Dua’s knit upper, and a person of ordinary skill in the art would have known that the combination (yielding the claimed limitations) would predictably work and provide the expected results of a fancy dress shoe.

3. Claims 1-13

201. As I explained in §§IX.A and IX.B, Dua or Dua in view of Flusser discloses or at a minimum renders obvious claims 1-13. To the extent additional disclosure is required for certain claims and/or limitations, the application of the teachings from Litke (instead of Flusser) renders them obvious.

a. [1.pre-1.a.iv]

202. *See* §IX.A5 (explaining how these limitations are met by Dua).

b. [1.a.v]

203. See my discussion of [1.a.v] in Grounds 1-2. **Litke discloses the first area having a rear boundary, the second area having a forward boundary, the rear boundary of the first area and the forward boundary of the second area being coincident and coextensive with each other and defining a boundary line between the first and second areas** (*e.g.*, see figure below). Litke, Fig. 3.

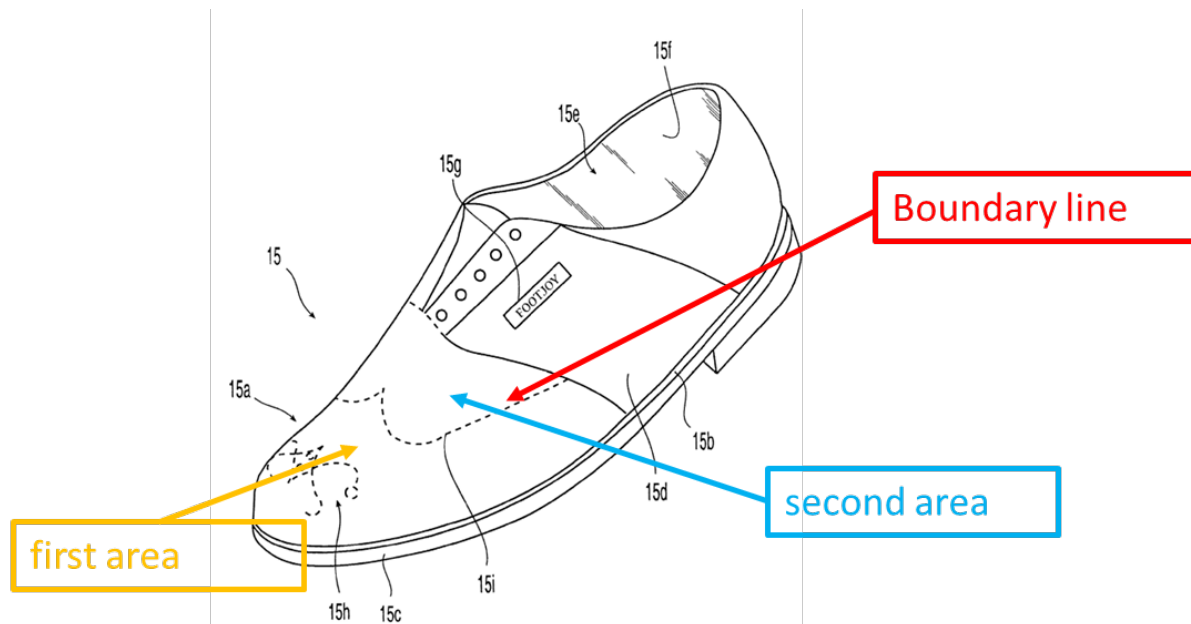


Fig. 3

Litke, Fig. 3.

Dua, [0015]: The following discussion and accompanying figures disclose an article of footwear having an upper that includes a knitted component. The article of footwear is disclosed as having a general configuration suitable for walking or running. Concepts associated with the footwear, including the upper, may also be applied to a variety of other athletic footwear types, including baseball shoes, basketball shoes, cross-training shoes, cycling shoes, football shoes, tennis shoes, soccer shoes, and hiking boots, for example. The concepts may also be applied to footwear types that are generally considered to be non-athletic, including dress shoes, loafers, sandals, and work boots. The concepts disclosed herein apply, therefore, to a wide variety of footwear types.

'762, 7:63-8:5: Unlike conventional two feed circular knitting machines, knitting machine 50 has four feeds of yarn, with each feed containing up to ten different types of yarns in fingers. An example of a suitable, commercially available narrow-tube circular knitting machine that may be utilized as knitting machine 50 is sold by Sangiocomo S.p.A. of Italy under the X-MACHINE trademark. The X-MACHINE has been used to produce argyle-style socks where multiple colored yarns form argyle and other complex patterns.

Litke, 6:17-20: Patterns that can be applied or formed on the materials include stitching, holes, pebble grain, circle or other shaped print, tumbled, cross-hatch, weave, emblems, or no pattern could be specified so that the leather is smooth.

204. As explained above (§IX.C.2 and [1.a.v] in Grounds 1-2, Dua discloses the first area and second area (see my discussion of [1.a.v] in Grounds 1-2 and knitting with the line of broguing (i.e., apertures/holes) during the knitting step, and it would have been obvious to person of ordinary skill in the art to apply Litke’s teachings of a wingtip pattern to define a boundary line, to Dua’s patterned knitted upper, modified in view of Litke to include a boundary line in the shape of a wingtip pattern, because doing so would have provided a knitted upper for a dress shoe, as taught by Dua, with the popular, well-known wingtip dress shoe design disclosed in Litke. Dua, [0015]; ’762, 7:63-8:5; Litke, 6:17-20. This would result in a fancy, dress shoe.

c. [1.a.vi]

205. See my discussion of [1.a.v] in Grounds 1-2. **Litke discloses a line of broguing adjacent the boundary line** (e.g., annotated Fig. 3 of Litke below; pattern “applied or formed on the materials” using “stitching [or] holes”). Litke, 6:17-20, Fig. 3.

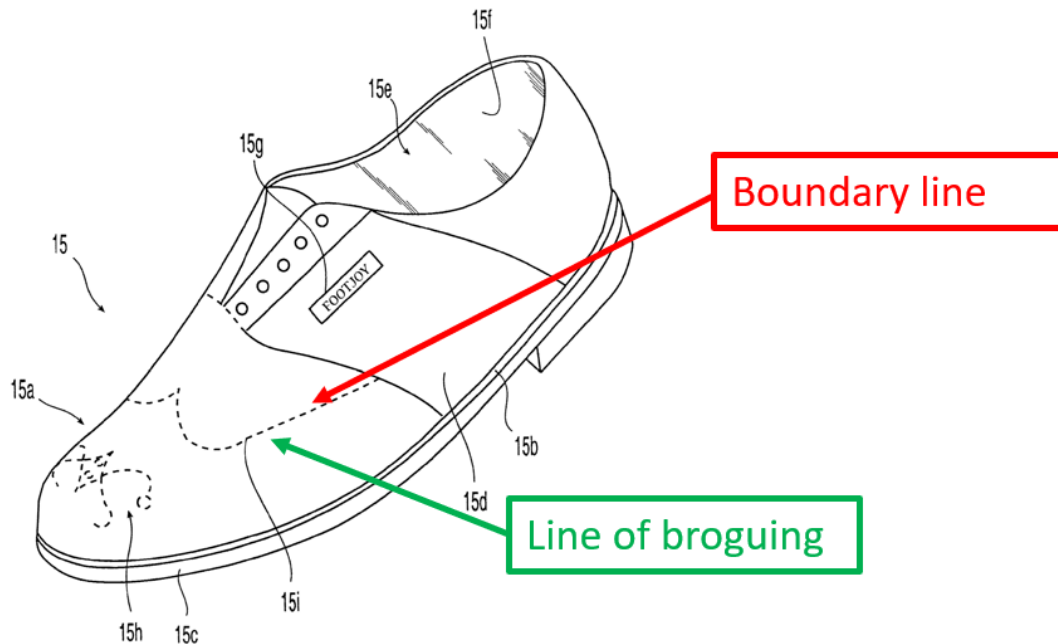


Fig. 3

Litke, Fig. 3.

206. As I explained above (§IX.C.2 and [1.a.v] in Grounds 1-2, Dua discloses the first area and second area (see my discussion of [1.a.v] in Grounds 1-2 and knitting with the line of broguing (i.e., apertures/holes) during the knitting step, and it would have been obvious to person of ordinary skill in the art to apply Litke's teachings of forming patterns using holes (i.e., lines of broguing) adjacent a boundary line, to Dua's patterned knitted upper, modified in view of Litke to include a line of broguing at a boundary line, because doing so would have provided a knitted upper for a dress shoe, as taught by Dua, with the popular, well-known wingtip dress shoe design including fancy lines of broguing disclosed in Litke. Dua, [0015]; '762, 7:63-8:5; Litke, 6:17-20.

a. [1.a.vii-1.c]

207. See §IX.A.5 (explaining how these limitations are met by Dua).

b. [2]

208. See my discussion of [1], [1]Grounds 1-2. Litke discloses a **medial boundary line** and a **lateral boundary line of the boundary line**; and a **medial line of broguing** and a **lateral line of broguing** of the line of broguing; the **medial line of broguing** being adjacent **the medial boundary line**, the **lateral line of broguing** being adjacent **the lateral boundary line**, the medial line of broguing comprising a **curved line of holes**, and the lateral line of broguing comprising a **curved line of holes** (e.g., Litke, Fig. 3).

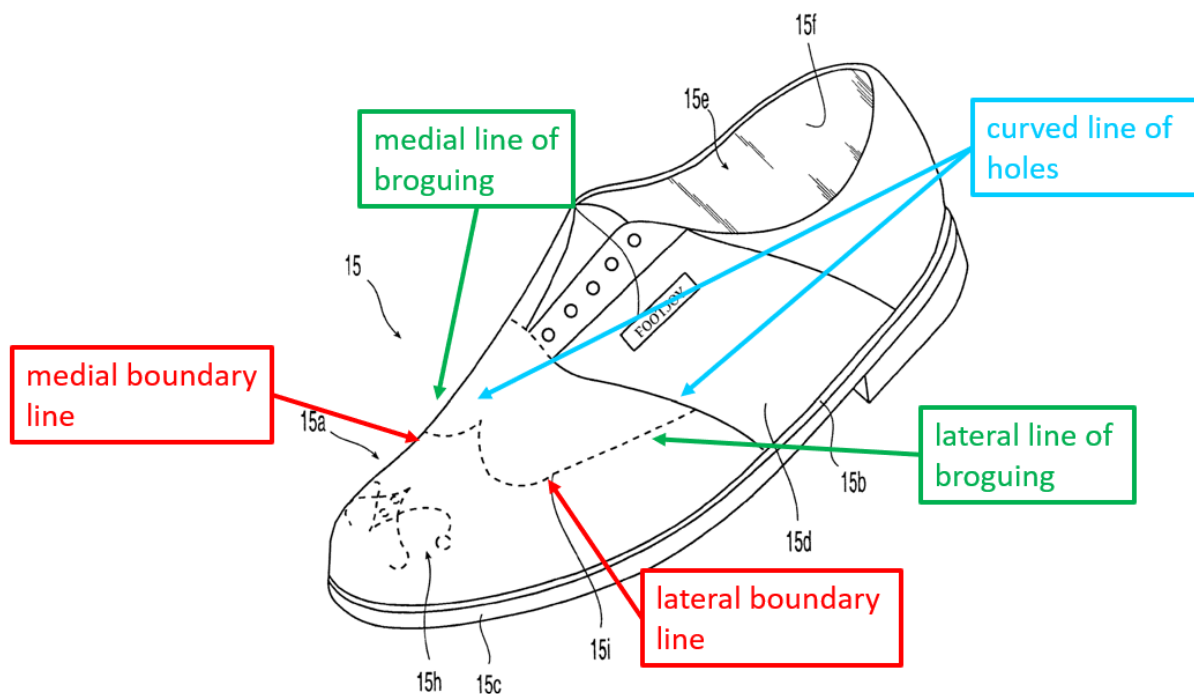


Fig. 3

Litke, Fig. 3

209. As explained above (§IX.C.2 and [2] in Grounds 1-2), **Dua** discloses the knitted element being knitted with the medial and lateral lines of broguing (i.e., apertures/holes) during the knitting step, and it would have been obvious to a person of ordinary skill to apply **Litke's** well-known wingtip pattern as defined by the boundary line to **Dua**; doing so would meet this limitation. *See* Dua, [0015]; '762, 7:63-8:5.

c. [3]-[6]

210. See my discussion of [1], §IX.A.5 (explaining how these limitations are met by Dua).

d. [7]-[13]

211. See §IX.A.6 (explaining the overlap between these limitations/claims and claims 1-6), IX.C.3.a-h (explaining the teachings to be applied from Litke to meet claims 1-6). It would have been obvious to apply the teachings from Litke for the reasons discussed above in §IX.C.2 to meet claims [7]-[13].

X. SECONDARY CONCLUSIONS

212. There is no evidence in the '262 patent's prosecution history or elsewhere supporting any secondary considerations arguments, or evidence of nexus to any challenged Claim. *See generally* the '262 patent FH. Indeed, as demonstrated by the prior art referenced herein, any purported solutions to problems or unexpected results in the '262 patent were already well known.

213. To the extent that PO contends that the accused products in the NJ Case are infringing and thus demonstrate commercial success, any such conclusory allegations would fail to provide any indication that the Claims are non-obvious. Such conclusory assertions would not demonstrate that Top Glory's products infringe, let alone show any nexus between any alleged commercial success and the Claims, or that any alleged success is due to an allegedly claimed component instead of the many unclaimed features of the accused products.

214. To the extent Patent Owner asserts the existence of any secondary considerations in its responses, Petitioners reserve the right to address any such evidence.

XI. CONCLUSION

215. In summary, I have concluded that the Challenged Claims are rendered obvious over the prior art references as I have discussed above. Specifically, in my opinion, for at least the reasons above, the Challenged Claims of the '262 patent are obvious.

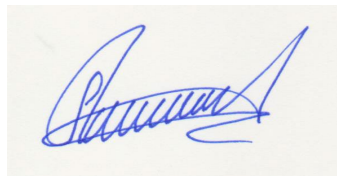
216. To the extent it is argued that any further disclosure is required for an element in the Challenged Claims that I have identified as being disclosed, a person of ordinary skill in the art would certainly have found that element obvious to include based on the sample explicit disclosure or inherent disclosures and analysis I have identified above.

217. I reserve the right to supplement my opinions in the future to respond to any arguments that Patent Owner or its expert(s) may raise and to take into account new information as it becomes available to me.

218. 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.

219. I hereby declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct, and 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.

220. Executed this 3rd day of September 2025, in Auburn, Alabama.



Dr. Sabit Adanur

APPENDIX A (CURRICULUM VITAE)

SABIT ADANUR

Professor

Auburn University, Department of Mechanical Engineering, Auburn, AL 36849

Phone : (334) 844-5497 (o), (334) 444-8599 (c), Fax : (334) 844-3307

e-mail: adanusa@eng.auburn.edu, <http://www.eng.auburn.edu/~adanusa>

1. EDUCATION

June 1989	Ph.D. in Fiber and Polymer Science North Carolina State University, Raleigh, North Carolina.
Dec. 1985	M.S. in Textile Engineering and Science North Carolina State University, Raleigh, North Carolina.
July 1982	B.S. in Mechanical Engineering Istanbul Technical University, Istanbul, Turkey.

PROFESSIONAL EXPERIENCE

Aug. '15 – Present	<u>Professor</u> Auburn University, Mechanical Engineering Department, Auburn, Alabama.
Oct. '00 – Aug. '15	<u>Professor</u> Auburn University, Polymer and Fiber Engineering Department, Auburn, Alabama.
Oct. '96 – Sept. '00	<u>Associate Professor</u> Auburn University, Textile Engineering Department, Auburn, Alabama.
Sep. '92 - Sep. '96	<u>Assistant Professor</u> Auburn University, Textile Engineering Department, Auburn, Alabama.
Nov. '89-Aug '92	<u>Product and Process Development Manager</u> Asten Forming Fabrics, Inc., Appleton, Wisconsin.
July '89-Oct. '89	<u>Process Development Engineer</u> Asten Forming Fabrics, Inc., Appleton, Wisconsin.
Aug. '83-Jun. '89	<u>Research/Teaching Assistant</u> North Carolina State University, Raleigh, North Carolina.

Professional Development Activities

- Attended the “WileyPLUS for Your Dynamics Course”, on 17 March 2022 for continuous improvement.
- Personal Protective Equipment (PPE) by IFAI (Industrial Fabrics Association International, Roseville, MN) for Covid 19, attended 7 webinars, May - June 2020.
- Summer Meta-Assessment Institute, July 10-14, 2017, Auburn University.
- Attended the webinar by Southern Alliance for Advanced Vehicle Manufacturing (SAAV), June 11, 2014.
- Attended the Biggio Seminar “Engaging Students in Active Learning”, 14 February 2013, Biggio Center, Auburn University.
- Attended the tutorial “Canvas Orientation”, Sept. 20, 2011, Auburn University.
- Attended the workshop “Introduction to Performance Tasks”, by [Cl]assroom Academy, 15-16 August 2011, Auburn, AL.

- Completed the Alabama Ethics Law Training, March 31, 2011.

2. ASSIGNED DUTIES FOR THE PAST THREE YEARS (average)

<u>Quarter</u>	<u>Teaching (%)</u>	<u>Research (%)</u>	<u>Extension/Service (%)</u>
Summers	10	90	0
Academic	60	30	10

3. HONORS AND AWARDS

- Ranked among the world's top 2% of all independently cited researchers by Stanford University, 2023 and 2024.
- Auburn Author Award, 2018.
- Outstanding Faculty Award, Department of Polymer and Fiber Engineering, 2008-2009
- Outstanding Faculty Award, Department of Polymer and Fiber Engineering, 2007-2008
- Outstanding Teacher Award, Department of Textile Engineering, 2002-2003.
- Outstanding Teacher Award, Department of Textile Engineering, 2001-2002.
- Auburn Alumni Professor Award (1999 – 2004).
- Outstanding Teacher Award, Department of Textile Engineering, 2000-2001.
- AU College of Engineering Birdsong Merit Teaching Award 2000
- Outstanding Teacher Award, Department of Textile Engineering, 1999-2000.
- Auburn Alumni Engineering Council Senior Faculty Research Award, 1999.
- 1995 NSF Faculty Early Career Development (CAREER) Award, National Science Foundation, \$ 210,000.00, duration: 4 years (Sept. 1, 96-Aug. 31, 2000).
- 1991 George Goldfinger Award. "This award is presented to the graduate of the North Carolina State University, College of Textiles, Fiber and Polymer Science Program who was judged to have submitted the most outstanding Ph.D. thesis over the past two years".

4. SCHOLARLY CONTRIBUTIONS

4. A. TEACHING

4.A.1 Courses Taught for the Past Three Years

<u>Course</u>	<u>Title</u>	<u>Credit</u>	<u>Enrollment</u>
<u>Fall 2025</u>			
MECH 2140	Kinematics and Dynamics	3	60
MECH 5320/6320/6520D01	Engineered Flexible Structures	3	100
<u>Spring 2024</u>			
MECH 2140	Kinematics and Dynamics	3	51
MECH 5520/65200-PFEN 6200	Manufacturing of Polymeric Structures	4 (3+1)	68
<u>Fall 2023</u>			
MECH 2140	Kinematics and Dynamics	3	31
MECH 5320/63200/6970D01	Engineered Flexible Structures	3	82
<u>Spring 2023</u>			
MECH 2140	Kinematics and Dynamics	3	64
MECH 5520/65200-PFEN 6200	Manufacturing of Polymeric Structures	4 (3+1)	76
<u>Fall 2022</u>			
MECH 2140	Kinematics and Dynamics	3	45
MECH 5320/63200/6970D01	Engineered Flexible Structures	3	81

4.A.2 Graduate Students Whose Work Has Been Completed

<u>Students for Whom The Candidate Served as Major Professor</u>					
<u>Student</u>	<u>Degree</u>	<u>Chair</u>	<u>Department</u>	<u>Graduation Date</u>	<u>Current Employer</u>
Jayswal, Ajay	PhD	Dr. Adanur	ME	Aug. 2023	Oak Ridge National Lab
Jayswal, Ajay	MS	Dr. Adanur	ME	Aug 2021	Oak Ridge National Lab
Alby, Laine	MS	Dr. Adanur	ME	May 2022	Enercon Services, Atlanta

Cermik, Ozdes	PhD	Dr. Marghitu/Adanur ME		May 2017	K. Maras University
Shen, Yang	PhD	Dr. Adanur	PFEN	Dec. 2015	Highland Ind.
Shen, Yang	MS	Dr. Adanur	PFEN	Dec. 2013	Ph.D. student in PFEN
Meeks, Steve	MS	Dr. Adanur	PFEN	May 2012	WNA
Zheng, Hai	MS	Dr. Adanur	PFEN	Dec. 2010	Graduate Student
Gocek, Ikilem	PhD	Dr. Adanur	PFEN	May 2010	Istanbul Technical Univ.
Keskin, Reyhan	PhD	Dr. Adanur	PFEN	May 2010	Pamukkale University
Liu, Wei	PhD	Dr. Adanur	PFEN	May 2010	Intertek, IL
Selver, Erdem	MS	Dr. Adanur	PFEN	May 2010	PhD Student/England
Liu, Wei	MPFEN	Dr. Adanur	PFEN	May 2009	AU PhD student
Isikel, Lale	MS	Dr. Adanur	PFEN	May 2007	A company in Turkey
Irsale, Swagat J. MN	PhD	Dr. Adanur	PFEN	Dec. 2005	Nexus Software Sol,Inc.,
Ascioglu, Birgul	PhD	Dr. Adanur	PFEN	Aug. 2005	Valeo, Inc., Bursa, Turkey
Irsale, Swagat J. PA.	MS	Dr. Adanur	Textile Eng.	Dec. 2003	Nexus Software Sol, Inc.,
Hughes, Kevin	MTE	Adanur/Tippur	Textile Eng.	May 2005	GKN Aerospace
Vakalapudi, Sathendra	MS	Dr. Adanur	Textile Eng.	Aug. 2003	Detroit (software co.)
Onal, Levent	PhD	Dr. Adanur	Textile Eng.	May 2002	Erciyes University
Turel, Tacibaht	MS	Dr. Adanur	Textile Eng.	Aug. 2002	PhD, Consumer Aff.
Tascan, Mevlut	MS	Dr. Adanur	Textile Eng.	May 01	PhD, Clemson Univ.
Orak, Hakan	MS	Adanur/Tippur	Textile Eng.	May 01	PhD, Clemson Univ.
Kayathi, K. K.	MS	Dr. Adanur	Textile Eng.	January 01	India
Xu, BaoHua	MS	Dr. Adanur	Textile Eng.	Aug. 99	PhD Student, TE
Arumugam, Yuvaraj	MS	Dr. Adanur	Textile Eng.	July 98	Goodyear Tire Co.
Qi, Jing	MS	Dr. Adanur	Textile Eng.	May 98	Grad Student in EE
Tewari. Ashutosh	MS	Dr. Adanur	Textile Eng.	Dec. 97	California Co.
Hou, Zhenwei	MS	Dr. Adanur	Textile Eng.	Dec. 97	PhD Candidate
Gongalareddy, Sreekanth	MS	Dr. Adanur	Textile Eng.	Dec. 96	Telecom., Atlanta
Mallick, Sumita B.	MS	Dr. Adanur	Textile Eng.	Aug. 96	PhD (Boston Univ.)
Zhai, Honglian	MS	Dr. Adanur	Textile Eng.	Aug. 96	TCOM, Maryland
Yuksekkaya, M. Emin	MS	Dr. Adanur	Textile Eng.	June 96	Prof., Usak U., Turkey
Tsao, Yen P.	MS	Dr. Adanur	Textile Eng.	Dec. 95	Taiwan
Tam, Chi-Wen	MS	Dr. Adanur	Textile Eng.	March. 95	Taiwan
Sartain, Stephen L.	MS	Dr. Adanur	Textile Eng.	Dec. 94	Own automotive business
Others:					
Inan, Gunes	PhD	Dr. Adanur	Textile Eng.	Aug. 04-Dec. 04	
Kilinc, F. Selcen	PhD	Dr. Adanur	Textile Eng.	Aug. 00 – Dec. 01	
Unsal, Evren	PhD	Dr. Adanur	Textile Eng.	Aug. 00-Feb. 01	
Xu, BaoHua	PhD	Dr. Adanur	Textile Eng.	June 99 – Dec. 99	
Zhenwei Hou	PhD	Dr. Adanur	Textile Eng.	Jan. 99 – Sept. 99	
Mallick, Sumita B.	PhD	Dr. Adanur	Civil Eng.	Aug. 96 – Aug. 98	
Nalamati, R. Kumar	MS	Dr. Adanur	Mech. Eng.	Sept. 95- April 96	

Students for Whom The Candidate Served as Committee Member

Student	Degree	Chair	Department	Graduation Date	Current Employer
1. Alizadeh, Nima	PhD	Dr. Auad	CHEN	Spring 2021	Posdoc

2.	Akhan, Ahmet F.	MS	Dr. Marghitu	ME	Spring 2019	Turkey
3.	Sangars, Uday B.	MS	Dr. Beale	ME	Dec. 2015	Company
4.	Furlong, Shane	MS	Dr. Broughton	PFEN	Dec. 2015	Company
5.	Snead, Ed	MS	Dr. Thomas	PFEN	May 2015	PhD
6.	Shirgaonkar, S.	MS	Dr. Beale	MECH	Dec. 2014	Hanwha, Opelika
7.	White, Charles J.	PhD	Dr. Byrne	CHEN	Aug. 2014	FDA
8.	Poyraz, Selcuk	PhD	Dr. Zhang	PFEN	June 2014	Assist. Prof., Turkey
9.	Smith, James	MS	Dr. Zhang	PFEN	May 2014	Private Industry
10.	Wang, Xialong	MS	Dr. Zhang	PFEN	Spring 2013	PhD at another univ.
11.	Blackwell, C.	MS	Dr. Thomas	PFEN	Dec. 2012	CSP
12.	Liu, Zhen	PhD	Dr. Zhang	PFEN	Spring 2012	UMaryland
13.	Liu, Yang	MS	Dr. Zhang	PFEN	Dec. 2011	PhD student at AU
14.	Quinones, Vladimir	PhD	Dr. Thomas	PFEN	Spring 2011	Post-doc at AU
15.	Luna, Eric	PhD	Dr. Tatarchuk	Chemical Eng.	Summer 2009	Syngenta Crop, NC
16.	Anthony, Rebecca	MS	Dr. Thomas	PFEN	Spring 2009	Industry, MS
17.	Hasan Kocer	M.S.	Dr. Broughton	PFEN	Fall 2007	PhD student ITAS
18.	Ray, Rebecca	M.S.	Dr. Thomas	PFEN	Fall 2006	Company
19.	Ma, Erjian	PhD	Dr. Jang	Materials Eng.	Spring 01	Company
20.	McCarthy, P. J.	MCE	Dr. Elton	Civil Eng.	Spring 96	Denver, CO
21.	Xiao, Liming	PhD	Dr. Yang	Materials Eng.	Spring 98	Postdoc, AU EE
22.	Hunt, Rich	MS	Dr. Nelms	Electrical Eng.	June 97	Company
23.	Kirkpatrick, C. T.	MS	Dr. Jang	Materials Eng.	Spring 97	California Company
24.	Kotha, S.	MS	Dr. Gowedd	Textile Eng.	Spring 97	India
25.	Xi, Xiaomei	PhD	Dr. Yang	Materials Eng.	Aug. 96	California Company
26.	Zhang, Qiang	PhD	Dr. Beale	Mechanical Eng.	Jan. 96	Maryland
27.	Vickers, Daniel	MS	Dr. Beale	Mechanical Eng.	March 95	FMP/Rauma

Students for Whom the Candidate Served as Outside Reader

Student	Degree	Chair	Department	Defense Date
Shah, Syed H. R.	PhD	Dr. Ahmed	Aerospace Eng.	TBD
Khan, Omar	PhD	Dr. Ahmed	Aerospace Eng.	Apr. 23, 2021
Ozcan Ozturk	PhD	Dr. Nadolnyak	College of Agr.	Aug. 5, 2017
Donath, Gregory W.	PhD	Dr. Duke	Chemical Eng.	Nov. 10, 2008
Ajitsaria, Jyoti K.	PhD	Dr. Choe	Mech. Eng.	Aug. 29, 2008
Butts, Daniel Alan	PhD	Dr. Gale	Materials Eng.	May 9, 2005
ElBashir, Nimir	PhD	Dr. C. Roberts	Chemical Eng.	Nov 15. 2004
Gopalakrishnan, M.	PhD	Dr. ElHalwagi	Chemical Eng.	May 21, 2002
Noureldin, M.	PhD	Dr. ElHalwagi	Chemical Eng.	Oct.12, 00
Patil, A. R.	PhD	Dr. Crocker	Mechanical Eng.	Sept. 11, 00
Park, Y.	PhD	Dr. Roberts	Chemical Eng.	July 20, 00
Shelley, M. D.	PhD	Dr. El-Halwagi	Chemical Eng.	Apr. 20, 00
Abdo, Z. A. M.	PhD	Dr. Gale	Materials Eng.	Dec. 3, 99
Garrison, W.	PhD	Dr. El-Halwagi	Chemical Eng.	May 8, 97
Yim, J. H.	PhD	Dr. Jang	Materials Eng.	Apr. 25, 97
Hamad, A. A.	PhD	Dr. El-Halwagi	Chemical Eng.	Apr. 21, 97
Mallick, R. B.	PhD	Dr. Brown	Civil Eng.	Apr. 8, 97
Zhao, Li-Ren	PhD	Dr. Jang	Materials Eng.	Feb. 26, 96
Haque, Anwarul	PhD	Dr. Raju	Mechanical Eng.	Oct. 10, 95
Yim, Jong H.	PhD	Dr. Jang	Materials Eng.	April 25, 95

4.A.3 Graduate Students on Whose Committee the Candidate is Presently Serving

<u>Student</u>	<u>Degree</u>	<u>Chair</u>	<u>Department</u>
Akhan, A. F.	MS	Dr. Marghitu	MECH

Visiting Scholars/Students Supported

<u>Name</u>	<u>Origin</u>	<u>Duration</u>
Ms. Roxanne Guarin	Undergraduate student from Univ. of Mass-Amherst	May 21, 2008- July 31, 2008
Ms. Stacy Yee	Undergraduate student from Univ. of Michigan	May 21, 2007- July 27, 2007
Ms. Christina Yacoob	Undergraduate student from SUNY Buffalo	May 29, 2006-Aug. 4, 2006
Dr. Levent Gumusel	Turkey	Jan. – Feb. 2005, Jan. 2006
Dr. Hasan Bas	Turkey	Jan. – Feb. 2005, Jan. 2006
Ms. Abibe Maimaiti	China	Sept. 2001-Sept. 2002
Dr. Gulay Ozcan	Turkey	January 01 – February 01
Dr. Tianyi Liao	China	Aug. 96 - March 99.
Dr. Sule Altun	Turkey	July 99-Sept. 99

4.A.4 Courses and Curricula Developed

New Undergraduate Courses Developed:

Dr. Adanur has developed the following courses which did not exist before.

1. MECH 5520/6520 – PFEN 6200 Manufacturing of Polymeric Structures
2. MECH 5320/6320 Engineered Flexible Structures
3. PFEN 3200 Polymer Processing
4. ENGR 1110 Introduction to Polymer and Fiber Engineering
5. PFEN 3300 Fibrous Product Testing and Instrumentation
6. PFEN 4300 Engineered Fibrous Structures
7. PFEN 5100/6100 Fabrics for Papermaking
8. TXTN 3450 Technical Textiles
9. TE 225 Fabric Design and Manufacturing
10. TE 460 Mechanics of Textile Manufacturing Processes and Systems

New Graduate Courses Developed:

1. PFEN 6100 Fabrics for Papermaking
2. PFEN 6200 Polymer Processing
3. PFEN 6250 Advanced Engineering Fibrous Structures
4. PFEN 7210 Fabric Formation and Properties
5. PFEN 8200 Advanced Textile Structure Design and Development

4.A.5 Grants Received Related to Teaching (Total \$ 241,864.00; see also 4.B.8)

1. Adanur, S., Graduate Outreach Program (GOP) Grant, \$135.00, Spring 2009.
2. Two injection molding machines were donated to polymer processing lab by ThermoFisher Scientific of Auburn, May 2007, \$9,000.00.
3. Travel fund for the ITMA 2003, Birmingham, England.
Funding Agent: Highland Takata Industries
Amount: \$ 3,428.92
Duration: Oct. 21-30, 2003.
4. Developing a Course Based on Equipment Design for Introduction to Engineering
Funding Agent: AU College of Engineering
Amount: \$ 24,050
PI: P. Jones (leader), C. A. Flood, S. Adanur
Duration: June 1, 1999-May 31, 2000

5. Title: Travel fund for IFAI Expo 1999, San Diego, CA.

Funding Agent: Highland Takata Industries

Amount: \$ 4,000.00

PI: W. Walsh, S. Adanur, R. Broughton, Y. ElMogahzy

Duration: Oct. 28-30, 1999.

6. Title: Travel fund for Messe Frankfurt Industrial Textiles Fair, Frankfurt, Germany

Funding Agent: Highland Takata Industries

Amount: \$ 4,000.00

PI: S. Adanur (50%), W. Walsh (50%)

Duration: May 11-18, 1998

7. Title: Textile Structural Composites Laboratory

Funding Agent: National Science Foundation, Instrumentation and Laboratory Improvement (ILI)

Amount: \$ 87,185.00

PI: S. Adanur (95 %), Co-PIs: W. Walsh, R. Walker, B. Jang

Duration: Sept. 1, 94- Aug. 31, 96

This NSF grant is specifically for undergraduate curriculum development purposes.

8. Title: Wellington Sears Handbook of Industrial Textiles

Funding Agent: Wellington Sears Company, Valley, Alabama.

Amount: \$ 60,000.00

PI: Sabit Adanur

Duration: Oct. 1, 93 - March 15, 95.

9. Title: Discretionary Teaching Grant-in-Aid

Funding Agent: Auburn University

Amount: \$ 200.00

PI: Sabit Adanur

Duration: Nov. 1, 92 - Apr. 30, 93.

4.A.6 Publications Pertaining to Teaching

Textbooks/Book Chapters

1. Adanur, S., Paper Machine Clothing, 2nd Edition, AstenJohnson, December 2017. Library of Congress Catalog Card No. 2017-949013, ISBN No. 978-0-692-92120-3, 279 pages (331 figures, 47 tables).
2. Updating the Wellington Sears Handbook of Industrial Textiles, which has been an industry standard since 1995. The new expanded edition has new chapters and state of the art technology related to polymers, fibers, yarns, fabrics and their manufacturing processes and applications.
3. Adanur, S., Chapter 8 – “Structure and Mechanics of Coated Fabrics”, in “Structure and Mechanics of Fibre Assemblies”, edited by P. Schwartz - Woodhead Publishing Limited and CRC Press LLC, 2008.
4. Adanur, S., Wellington Sears Handbook of Industrial Textiles, Technomic Publishing Co., Inc., Lancaster, PA, 1995. Library of Congress Catalog Card No. 95-61229, ISBN No. 1-56676-340-1, 850 pages (519 figures and 140 tables).
5. Adanur, S., Paper Machine Clothing, Technomic Publishing Co., Inc., Lancaster, PA, 1997. Library of Congress Catalog Card No. 97-60981, ISBN No. 1-56676-544-7, 405 pages (338 figures, 55 tables).
6. Adanur, S., Handbook of Weaving, Technomic Publishing Co., Inc., 2001. Library of Congress Catalog Card No. 00-107625, ISBN No. 1-58716-013-7. 446 pages (539 Figures, 52 Tables).

Lecture Notes (Bound)

1. TE 425 Technical Textiles, Lecture Notes, Auburn University, 191 pages.
2. TE 460 Mechanics of Textile Manufacturing Processes and Systems, Lecture Notes, Auburn University, 154 pages.

4.A.7 Other Contributions to Teaching

1. ABET (Accreditation Board for Engineering and Technology) coordinator. Accreditation of Textile Engineering program in 1998 (first time ever), Fiber Engineering program in 2004 and Polymer and Fiber Engineering program in 2010 was achieved.
2. Semester Transition (was responsible for the quarter to semester transition for the curriculums in the Department of Textile Engineering).
3. Expansion of Master's Program (actively participated in expanding the Master's program in the Department. There were not adequate graduate level courses that covered certain aspects of the Master of Science program in Textile Engineering. Developed four new graduate level courses for this purpose).
4. Establishment of Ph.D. Program (was a member of the Textile Engineering Department Committee to establish a joint Ph.D. program with the Consumer Affairs Department).

Establishment of High Performance Materials Laboratory

Dr. Adanur has established an industrial textiles/composites laboratory in the Department. The lab is equipped with state-of-the-art equipment and is being used for teaching. Besides teaching, the laboratory provides an excellent opportunity for undergraduate and graduate students in their projects and independent studies. The lab will strengthen the University's interaction with industry. A new Instron was purchased and installed in the lab. Dr. Adanur received funding from National Science Foundation for a computerized braiding machine which has been installed in the lab. He has purchased and installed a new compression molding machine and Dynatup impact testing machines with the NSF EPSCoR funding. The value of these machines is around \$ 600,000.00.

Establishment of Polymer Processing Laboratory

With the funding from Department of Commerce, Dr. Adanur went to University of Akron, Ohio to tour their polymer science and polymer engineering labs and analyze their equipment in 2006. Based on that analysis, Dr. Adanur specified and ordered the single screw extruder and injection molding machine for the PFEN department. These two machines are the heart of the current polymer processing lab in the department which is being used for teaching, research and extension.

4.A.7 Teaching Philosophy

My primary goal in teaching is to help produce high quality graduates to meet the needs of the industry and contribute to the advancement of engineering, science and technology in the field. I try to give the students the best education possible while preparing them for other aspects of life as well. Constant improvement of graduate and undergraduate education is essential for this purpose.

Good education of its people is the best investment that a country can make for the future. In the heart of this investment is the teachers and educational environment. Teaching is a combination of art and science and I believe that a good teacher is a gifted person. A teacher not only educates and teaches but also nurtures and prepares students for life. There is no substitute for one-to-one interaction between the student and faculty. Faculty should develop a suitable learning environment for students of different backgrounds. Although I emphasize, encourage and require teamwork in my classes, I also try to nurture the development of individual entrepreneurship and attributes in my students by giving them individually challenging tasks. I give the most importance to understanding the fundamental concepts and issues (not memorization) which should be the key to an engineering education. This gives students self-confidence and allows them to use their potential to the maximum. I try to train them to master the details without losing the "big picture" from their sight.

I believe that there are two aspects of higher education in engineering: technical and non-technical aspect. In the technical side, I provide students with education involving the application of the latest engineering and science principles to design, development, manufacturing and testing of engineered polymeric and fibrous products and processes. Polymer and fiber engineering is truly multi-disciplinary, and I am fortunate to have a multi-disciplinary background to give the students an education that has "breadth and depth". The application of technical textiles has spread into aerospace, civil engineering, architecture and construction, filtration, medicine, military and defense, paper making, safety and protection, transportation, agriculture, sports and recreation. I try to keep myself up to date with the latest engineering and science principles in these disciplines that are relevant to our profession to educate the students in a timely fashion. I incorporate the design aspect of polymer and fiber engineering in the courses that I

teach throughout the curriculum. My courses present real-world applications without sacrificing conceptual and theoretical bases.

Both theory and applications should be taught in a complementary fashion. For this purpose, I closely integrate laboratory experience with classroom teaching. Students are exposed to industry problems during college years through field trips, special projects and case studies. Interdepartmental cooperation is encouraged through team projects. Understanding of the concepts and creative thinking are the keys for a successful engineering education. Student involvement is a key factor in successful learning.

The non-technical aspect of college education is as important as the technical aspect. A university is a bridge where young teenaged minds evolve into mature, knowledgeable and responsible citizens. They learn various life skills and attributes, some of which are learned outside the classroom. Therefore, I believe in developing a mentor-mentee relationship with students so that I can help during their transition in college years. For this reason, I try to make myself always available for students and I feel very rewarded when I see that I made a difference in a student's preparation for life. I try to offer opportunities for extracurricular activities to prepare my students to meet the demands of a career in the present and future engineering workplace and be able to assume a responsible place of leadership in a complex technological society. If the students' evaluations and comments are an indicator, I feel that I am making a difference for them.

I follow the most recent developments in teaching technology closely and adapt them as soon as possible if they are feasible and useful. I have attended many seminars by the Biggio Center for the Enhancement of Teaching and Learning and will continue to do so whenever I can.

4.B RESEARCH / CREATIVE WORK

4.B.1 Books/Book Chapters (See 4.A.6)

1. Adanur, S., Paper Machine Clothing, 2nd Edition, December 2017. Library of Congress Catalog Card No. 2017-949013, ISBN No. 978-0-692-92120-3, 279 pages (331 figures, 47 tables).
2. Updating the Wellington Sears Handbook of Industrial Textiles, which has been an industry standard since 1995. The new expanded edition has new chapters and state of the art technology related to polymers, fibers, yarns, fabrics and their manufacturing processes and applications.
3. Chapter 8 – “Structure and Mechanics of Coated Fabrics”, book chapter in “Structure and Mechanics of Fibre Assemblies”, edited by Peter Schwartz - Woodhead Publishing Limited and CRC Press LLC, 2008.
4. Adanur, S., Wellington Sears Handbook of Industrial Textiles, Technomic Publishing Co., Inc., Lancaster, PA, 1995. Library of Congress Catalog Card No. 95-61229, ISBN No. 1-56676-340-1, 850 pages (519 figures and 140 tables).
5. Adanur, S., Paper Machine Clothing, Technomic Publishing Co., Inc., Lancaster, PA, 1997. Library of Congress Catalog Card No. 97-60981, ISBN No. 1-56676-544-7, 405 pages (338 figures, 55 tables).
6. Adanur, S., Handbook of Weaving, Technomic Publishing Co., Inc., 2001. Library of Congress Catalog Card No. 00-107625, ISBN No. 1-58716-013-7. 446 pages (539 Figures, 52 Tables).

4.B.2 Article-length Publications

Refereed Journal Articles Published (*: student)

1. A. Sapkota, S. K. Ghimire and S. Adanur, “Fused Deposition Modeling (FDM) Process Parameter Optimization for Mechanical Properties of 3D-Printed Woven Fabric Structures Using Taguchi Method”, submitted to Additive Manufacturing Journal, 13 January 2025, 25 pages (declined due to topic mismatch), Journal of Industrial Textiles, Vol 55: 1-35, published online April 29, 2025. <https://doi.org/10.1177/15280837251339124>.
2. A. Sapkota*, S. K. Ghimire* and S. Adanur, "Effect of FDM Process Parameters on Mechanical Properties of 3D Printed Fabrics and Yarns from Polyethylene Terephthalate Glycol, Nylon and Thermoplastic Polyurethane", Rapid Prototyping Journal, Vol. 31, No. 5, pp. 934-949, 22 April 2025. <https://doi.org/10.1108/RPJ-08-2024-0338>.
3. A. Sapkota*, S. Ghimire* and S. Adanur, “A Review on Fused Deposition Modeling (FDM)-Based Additive Manufacturing (AM) Methods, Materials and Applications for Flexible Fabric Structure, Journal of Industrial Textiles, Vol. 54, 1-51, published September 3, 2024, <https://doi.org/10.1177/15280837241282110> .

4. A. Jayswal*, J. Liu, G. Harris, R. Mailen and S. Adanur, Creep behavior of 3D printed polymer composites, *Journal of Polymer Engineering and Science*; 63: 3809-3818, 31 August 2023, doi:10.1002/pen.26486.
5. S. Adanur, A. Jayswal*, K. O. Griffin* and J. L. Hancock*, Additive Manufacturing of Weft Knitted and Braided Fabric Structures with Fused Deposition Modeling, *Journal of the Textile Institute*, <https://doi.org/10.1080/00405000.2023.2201910>, Published 25 April 2023.
6. A. Jayswal*, R. W. Mailen, J. Liu, G. Harris, M. Siwakoti, and S. Adanur, Thermo-mechanical behavior of 3D printed fabric structures, *Journal of Polymer Engineering and Science*, 63:1725-1736, June 2023, <http://doi.org/10.1002/pen.26319>.
7. A. Jayswal*, J. Liu, G. Harris and S. Adanur, Thermo-mechanical properties of composite filaments for 3D printing of fabrics, *Journal of Thermoplastic Composite Materials*, 2023, Vol. 36(12), pp. 4800–4825, <https://doi.org/10.1177/08927057231163489>.
8. L. Alby*, A. Jayswal*, S. Morris, W. McAtee*, V. Gowda and S. Adanur, A Novel Face Mask Design with Improved Properties for COVID-19 Prevention, *Textile Research Journal*, Vol. 93(11-12), pp. 2754-2764, 23 May 2023, <https://doi.org/10.1177/00405175221146295>.
9. Jayswal, A*, and Adanur, S., “An overview of additive manufacturing methods, materials, and applications for flexible structures”, *Journal of Industrial Textiles*, Vol. 52, pp. 1-42, 2022, <https://doi.org/10.1177/15280837221114638>.
10. Jayswal, A*, and Adanur, S., “Effect of heat treatment on crystallinity and mechanical properties of the flexible structures 3D printed with fused deposition modeling”, *Journal of Industrial Textiles*, 2022, Vol. 51(2S), pp. 2616S-2641S, <https://journals.sagepub.com/doi/10.1177/15280837211064937>.
11. Adanur, S., and Jayswal, A*, “Filtration mechanisms and manufacturing methods of face masks: An Overview”, *Journal of Industrial Textiles*, 2022, Vol. 51(3S), pp. 3683S-3717S, DOI: 10.1177/1528083720980169.
12. Jayswal, A*, and Adanur, S., “Characterization of PLA/TPU composite filaments manufactured for 3D printing with FDM”, *Journal of Thermoplastic Composite Materials*, <https://doi.org/10.1177/08927057211062561>, Published online, 2 December 2021, pp. 1-22.
13. Adanur, S., and Jayswal, A*, “Additive Manufacturing of Interlaced Fibrous Structures”, *Rapid Prototyping Journal*, 2021, 27(4), pp. 671-681, DOI 10.1108/RPJ-05-2020-0095.
14. Shen, Y*, Branscomb, D., and Adanur, S., “Effect of joint stiffness on torsional stiffness of open lattice composite structures”, *Journal of Industrial Textiles*, 2021, Vol. 51(3), pp. 409-423, <https://journals.sagepub.com/doi/pdf/10.1177/1528083719881818>.
15. Shen, Y*, and Adanur, S., “Mechanical analysis of the auxetic behavior of novel braided tubular structures by the finite element method”, *Textile Research Journal*, 2019, Vol. 89 (23-24), pp. 5187-5197, <https://doi.org/10.1177/0040517519851840>.
16. Shen, Y*, Meir, A. J., Cao, Y., and Adanur, S., “Finite Element Analysis of Monofilament Woven Fabrics under Uniaxial Tension”, *Journal of the Textile Institute*, <http://www.tandfonline.com/doi/full/10.1080/00405000.2014.906098>, Vol. 106, No. 1, p. 90-100, 2 Jan. 2015.
17. Adanur, S., and Liu, W*, “Desulfurization Properties of Modified Activated Carbon Fibers and Activated Carbon Fiber Paper”, *Journal of Industrial Textiles*, 5 September 2013, DOI:10.1177/1528083713502997.
18. Liu, W*, and Adanur, S., “Desulfurization Properties of Activated Carbon Fibers”, *Journal of Engineered Fibers and Fabrics*, Vol. 9, Issue 2, June 2014, pp. 70-75.
19. Adanur, S., and Zheng, H*, “Synthesis and Characterization of Sulfonated Polyimide Based Membranes for Proton Exchange Membrane Fuel Cells”, *Journal of Fuel Cell Science and Technology*, Aug. 2013, Vol. 10, 041001, pp. 1-5.
20. Liu, W*, Yee, S*, and Adanur, S., “Properties of Electrospun PVA/nanoclay Composites”, *Journal of the Textile Institute*, 2013, <http://dx.doi.org/10.1080/00405000.2013.819156>.
21. Adanur, S., and Vakalapudi, J. S*, “Woven Fabric Design and Analysis in 3D Virtual Reality, Part 1: Computer Aided Design and Modeling of Interlaced Structures”, *Journal of the Textile Institute*, DOI: 10.1080/00405000.2012.753698, published January 10, 2013.
22. Gocek, I*, and Adanur, S., “Effect of Processing Parameters on Polypropylene Film Properties”, *International Journal of Modern Engineering Research (IJMER)*, Vol. 2, Issue 5, Sep.-Oct. 2012, pp. 3056-3060.

23. Gocek, I*., and Adanur, S., "Effect of Nanoclay Amount and Compatibilizer Presence on Thermal, Morphological and Mechanical Behaviour of Nanoclay Reinforced Composite Polypropylene Cast Film", *Materials Testing*, 54 (2012) 5, pp. 318-329 (German/English).
24. Adanur, S., and Vakalapudi, J. S., "Woven Fabric Design and Analysis in 3D Virtual Reality, Part 2: Predicting Fabric Properties with the Model", *Journal of the Textile Institute* (DOI:10.1080/00405000.2012.745236, published 3 December 2012).
25. Adanur, S., and Selver, E., "Nanoclay/Polypropylene Composite Monofilament Processing and Properties using Twin and Single Screw Extruders", *International Journal of Polymeric Materials* (published 5/17/2012: <http://www.tandfonline.com/doi/abs/10.1080/00914037.2011.641696>).
26. Keskin, R*., and Adanur, S., "Improving Toughness of Polypropylene with Thermoplastic Elastomers in Injection Molding", *Polymer-Plastics Technology and Engineering*, 50:20-28, 2011 (January 2011).
27. Selver, E*., and Adanur, S., "Processing and Property Relationship of Nanoclay Reinforced Polypropylene Monofilaments", *Journal of Industrial Textiles*, Vol. 40, No. 2, Oct. 2010, pp. 123-137.
28. Isikel, L*., Gocek, I*., and Adanur, S., "Design and Characterization of Nonwoven Fabrics for Gas Diffusion Layer in Polymer Electrolyte Membrane Fuel Cell", *The Journal of the Textile Institute*, Vol. 101, No. 11, Nov. 2010, pp. 1006-1014.
29. Yacoob, C*., Liu, W.*., and Adanur, S., "Properties and Flammability of Electrospun PVA and PVA/Laponite® Membranes", *Journal of the Industrial Textiles*, Vol. 40, No. 1., July 2010, pp. 33-48.
30. Liu, W*., and Adanur, S., "Properties of Electrospun Polyacrylonitrile Membranes and Chemically-Activated Carbon Nanofibers", *Textile Research Journal*, Vol. 80(2), pp. 124-134, Jan. 2010.
31. Ascioglu, B*., Adanur, S., Gumusel, L., and Bas, H., "Transverse Direction Thermal Conductivity Modeling of Nano-micro Fiber Reinforced Composites", *Textile Research Journal*, Vol. 79 (12), 2009, pp. 1059-1066.
32. Yuksekkaya, M. E*., and Adanur, S., "Analysis of Polymeric Braided Tubular Structures Intended for Medical Applications", *Textile Research Journal*, 2009; Vol. 79, No. 2, pp. 99-109.
33. Yuksekkaya, M.E*., Thomas, H., and Adanur, S., "Influence of the Fabric Properties on Fabric Stiffness for the Industrial Textiles", *Tekstil and Konfeksiyon* (English), April 2008, pp. 263-267.
34. Adanur, S., and Qi, J*., "Property Analysis of Denim Fabrics Made on Air-Jet Weaving Machine, Part 2: Effects of Tension on Fabric Properties", *Textile Research Journal*, Vol. 78(1), Jan. 2008, pp. 10-20.
35. Adanur, S., and Qi, J*., "Property Analysis of Denim Fabrics Made on Air-Jet Weaving Machine, Part 1: Experimental System and Tension Measurements", *Textile Research Journal*, Vol. 78(1), Jan. 2008, pp. 3-9.
36. Adanur, S., and Ascioglu, B.*., "Nanocomposite Fiber Based Web and Membrane Formation and Characterization", *Journal of Industrial Textiles*, Vol. 36, No. 4, April 2007, pp. 311-327.
37. Elton, D. J., Hayes, D. W.*., and Adanur, S., "Bubblepoint Testing of Geotextiles: Apparatus and Operation", *American Society for Testing Materials (ASTM) Geotechnical Testing Journal*, Vol. 30, No. 1, Jan. 2007.
38. Onal, L.*., and Adanur, S., "Modeling of Elastic, Thermal and Strength/Failure Analysis of 2D Woven Composites – A Review", *Applied Mechanics Reviews (AMR)*, Vol. 60, Issue 1, pp. 37-49, Jan. 2007.
39. Irsale, S*., and Adanur, S., "Design and Characterization of Polymeric Stents", *Journal of Industrial Textiles*, Vol. 35, No. 3, January 2006, pp. 189-199.
40. Onal, L.*., and Adanur, S., "Optimization of Compression Molding Process in Laminated Woven Composites", *Journal of Reinforced Plastics and Composites*, Vol. 24, No. 7, 2005, pp. 775-780.
41. 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.
42. 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.
43. Adanur, S., and Turel, T.*., "Effects of Air and Yarn Characteristics in Air-Jet Filling Insertion, Part II: Yarn Velocity Measurements with a Profiled Reed", *Textile Research Journal*, 74(8), 657-661, August 2004.
44. Adanur, S., "Dynamic Analysis of Air-Jet Filling Insertion: Effect of Timing on Air and Yarn Velocity", *Developments in Theoretical and Applied Mechanics*, Eds. H. Mahfuz and M. V. Hosur, Vol. XXII, 2004, pp. 202-207.
45. Turel, T.*., Bakhtiyarov, S., and Adanur, S., "Effects of Air and Yarn Characteristics in Air-Jet Filling Insertion, Part I: Air Velocity and Air Pressure Measurements", *Textile Research Journal*, 74(7), 592-597, July 2004.

46. Adanur, S., McClain, A., and Xu, B.*, "A Novel Approach to Fast Net-Shape Manufacturing of Braided Epoxy Composites", *Journal of Elastomers and Plastics*, Vol. 35, No. 3, July 2003.
47. Adanur, S., and Arumugham, Y.*, "Characteristics of Ultraviolet Cured Glass/Epoxy Composites, Part 2: Results and Discussion", *Journal of Industrial Textiles*, Vol. 32, No. 2, October 2002, pp. 107-118.
48. Adanur, S., and Arumugham, Y.*, "Characteristics of Ultraviolet Cured Glass/Epoxy Textile Composites, Part 1: Experimental Procedures and Testing", *Journal of Industrial Textiles*, Vol. 32, No. 2, October 2002, pp. 93-106.
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Non-refereed Journal Articles

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2. LaBombard, K., and Adanur, S., "Manufacturing of Nanoparticle Reinforced Materials through Electrospinning", Auburn University, Journal of Undergraduate Scholarship, http://our.auburn.edu/wp-content/uploads/2019/01/AUJUS-2018-Workspace_0000-dragged.pdf, January 25, 2019.
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4. "Your Firm Has ISO Certification: What Comes Next?", This editorial paper was published based on our article: Allen, B*. (50%), and Adanur, S. (50%), "ISO 9000: First Results After Implementation", Textile World, August 1994.
5. Adanur, S., "Forming Fabrics in Papermaking", Textile and Technique, Turkish/English, August 1994, pp. 115-118.

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Tech Briefs

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2. "US-Turkey Cooperative Research", AL EPSCoR, 2004 Annual Report to the AL Commission on Higher Education, 10 Dec. 2004, pp. 18-19.
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4. Bakhtiyarov, S., Overfelt, R. A., and Adanur, S., "Improvements in Fabrication of Sand/Binder Cores for Casting", NASA Tech Brief, April 9, 2002.

4.B.3 Technical Presentations Made (presenter's name is in *Italic*)

1. S. K. Ghimire, A. Sapkota, *S. Adanur*, E. Kuram and R. Onler, Effect of Fused Deposition Modeling (FDM) Process Parameters on Mechanical Properties of Woven Polymeric Structures, 15th International Fiber and Polymer Research Symposium (15th ULPAS), Izmir Bakircay University, Turkey, November 8-9, 2024 (received Best Scientific Study Award).
2. *A. Sapkota*, S. K. Ghimire and *S. Adanur*, Effect of Fused Deposition Modeling (FDM) Process Parameters on Mechanical Properties of Flexible Polymeric Structures, Fiber Society Conference, Greensboro, NC, May 22-24, 2024, Online oral presentation.
3. *A. Sapkota*, S. K. Ghimire and *S. Adanur*, Additive Manufacturing of Interlaced Fibrous Structures, SUGRS 2024, Southeastern Universities Graduate Research Symposium, Online oral presentation, 24 April 2024.
4. *S. Adanur*, Additive Manufacturing of Polymeric Structures, Keynote Speech-9, 13th International Fiber and Polymer Research Symposium (13th ULPAS), Bolu Abant Izzet Baysal University, Turkey, November 3-4, 2023 (via Zoom).
5. *S. Adanur*, Latest Developments in Paper Machine Clothing as it Relates to Papermaking, TAPPIcon 2023, Technical Association of the Pulp and Paper Industry, April 22-26, 2023, Atlanta, GA.
6. Alby, L., Jayswal, A., and *Adanur, S.*, Novel Medical Facemasks for Covid-19, The Fiber Society 2022 Fall Meeting and Technical Conference, NC State University, Raleigh, NC, 19-21 October 2022.
7. *Jayswal, A.*, and *Adanur, S.*, Computational Analysis of 3D Printed Woven Fabrics, The Fiber Society 2022 Fall Meeting and Technical Conference, NC State University, Raleigh, NC, 19-21 October 2022.
8. *Jayswal, A.*, and *Adanur, S.*, Design, fabrication, and testing of novel 3D printed facemasks, CPAC Summer seminar series, Auburn University, 20 July 2021.
9. *Jayswal, A.*, and *Adanur, S.*, Effect of Heat Treatment on the Crystallinity and Mechanical Properties of FDM 3D Printed Twill Fabric Structures, AU Research 2021 Student Symposium, Auburn University, 30 March 2021.
10. *Adanur, S.*, and *Jayswal, A.*, 3D Printing of Fabric-like Structures, TechTextil North America, 19 November 2020 (Webex presentation).
11. *LaBombard, K.*, and *Adanur, S.*, "Manufacturing of Nanoparticle Reinforced Materials Through Electrospinning", The Fiber Society 2017 Fall Conference, Athens, GA, Nov. 8-10, 2017.
12. Shen, Y., Broughton, R., Beale, D., Foster, W., Branscomb, D., and *Adanur, S.*, "Failure Analysis of Open-Architecture Composite Structures Under Compression", The Fiber Society 2015 Fall Meeting and Technical Conference, October 28-30, 2015, College of Textiles, North Carolina State University, Raleigh, NC.
13. Shen, Y., Sangars, U., *Adanur, S.*, Broughton, R., *Beale, D.*, and Foster, B., "Failure Analysis of Micro-joints in Open-architecture Composite Structures (O-ACS)", TEXCOMP-12, 12th International Conference on Textile Composites, NC State University, College of Textiles, Raleigh, NC, USA, May 26-29, 2015.

14. *Shen, Y., Adanur, S., Broughton, R., Beale, D., and Foster, B., "Buckling Analysis of Open-Architecture Composite Structures (O-ACS)", This is Research: Student Symposium 2015, Auburn University, 13 April 2015.*
15. *Adanur, S., "Application of Fluid Dynamics in PFEN", presentation given to AU Fluid Dynamics Working Group, 5 March 2015, Auburn, AL (Fluid Dynamics Working Group was established as a result of the SGCOE Interdisciplinary Faculty Research Colloquium).*
16. *Shen, Y., and Adanur, S., "Modeling of tensile properties of multi-layer fabrics by multi-scale finite element method", Auburn University Graduate Scholar Forum, 5 March 2014.*
17. *Shen, Y., and Adanur, S., "A Biaxial Braiding Tubular Structure Based on Helical Auxetic Yarns", The Fiber Society International Symposium on Fibers Interfacing the World, Oct. 23-25, 2013, Clemson, SC.*
18. *Adanur, S., and Liu, W., "Desulfurization Properties of Activated Carbon Fibers in Dry Conditions", International Istanbul Textile Congress 2013, New Materials, May 30-31, 2013, Istanbul, Turkey.*
19. *Shen, Y., Adanur, S., Meir, A. and Cao, Y., "Finite Element Analysis of Uniaxial Tension of Polyester Monofilament Woven Fabric", Auburn Research Week, 3 April 2013.*
20. *Adanur, S., and Broughton, R., "Recovery and Reuse of Waste PVC Coated PET Fabrics", The 4th International R&D Project Brokerage Event, Bursa, Turkey, Feb. 2-3, 2012 (presented as poster as well).*
21. *Adanur, S., "PVA Nanofiber Based Membrane for Proton Exchange Membrane Fuel Cells", The 4th International R&D Project Brokerage Event, Bursa, Turkey, Feb. 2-3, 2012 (presented as poster as well).*
22. *Selver, E., and Adanur, S., Properties of Nanoclay Added Composite Polypropylene Monofilaments Using Twin and Single Screw Extruders, Fiber Society International Symposium on New Frontiers in Fiber Materials Science, Oct. 11-13, 2011, Charleston, SC.*
23. *Adanur, S., A Novel Filling Insertion System for Weaving, The 3rd International R&D Project Brokerage Event, Bursa, Turkey, Feb. 10-11, 2011.*
24. *Adanur, S., Conceptual Design and Characterization of 3D Interlaced Fibrous Structures, The 3rd International R&D Project Brokerage Event, Bursa, Turkey, Feb. 10-11, 2011.*
25. *Zheng, H., and Adanur, S., "Synthesis and Characterization of Sulfonated Polyimide Based Membrane for Proton Exchange Membrane Fuel Cell Applications", Alabama Composites Conference, Aug. 24-26, 2010, Birmingham, AL (presented as poster as well).*
26. *Liu, W., and Adanur, S., "Activated Carbon Fiber Filter Media in Proton Exchange Membrane Fuel Cells for Automotives", Techtextil North America Symposium, May 18-20, 2010, Georgia World Congress Center, Atlanta, GA.*
27. *Adanur, S., and Selver, E., "Processing and Properties of nanoclay reinforced polypropylene monofilaments", The 4th International Technical Textiles Congress, 16-18 May 2010, Istanbul, Turkey.*
28. *Adanur, S., and Gocek, I., "Nanoclay and Compatibilizer Effects on Polypropylene Cast Film Processing and Properties", Fiber Society Spring 2010 International Conference, May 12-14, 2010, Bursa, Turkey.*
29. *Keskin, R., and Adanur, S., "Improving Toughness of Polypropylene Injection Molded Parts with Thermoplastic Elastomer Materials", The Fiber Society 2009 Fall Meeting and Technical Conference, The University of Georgia, Athens, GA, Oct. 28-30, 2009.*
30. *Gocek, I., and Adanur, S., "Effect of Processing Parameters on Polypropylene Film Properties", The Fiber Society 2009 Fall Meeting and Technical Conference, The University of Georgia, Athens, GA, Oct. 28-30, 2009.*
31. *Selver, E., and Adanur, S., "Processing and Property Relationship of Nanoclay Reinforced Polypropylene Monofilaments", The Fiber Society 2009 Fall Meeting and Technical Conference, The University of Georgia, Athens, GA, Oct. 28-30, 2009.*
32. *Liu, W., and Adanur, S., "Application of Activated Carbon Fibers in Fuel Cell Cathode Filter Media", The Fiber Society 2009 Spring Conference: International Conference on Fibrous Materials 2009, Shanghai, China, May 27-29, 2009.*

33. *Adanur, S.*, Nanotechnology Applications in Textiles, The 6th Textile Congress, Suleyman Demirel University, Isparta, Turkey, May 1-3, 2009.
34. *Liu, W.*, and *Adanur, S.*, “Activated carbon fiber filter media for PEM fuel cell cathode”, AU Annual Research Forum, 10 March 2009.
35. *Adanur, S.*, “Nanotechnologies are Coming Your Way”, Industrial Fabrics Association International (IFAI) Expo '08, October 21-23, 2008, Charlotte, NC (invited presentation).
36. *Adanur, S.*, and *Isikel, L.*, “Manufacturing of Carbon Nonwoven Gas Diffusion Layers with Wet-Laying Process”, Techtextil North America Symposium, April 1-3, 2008, Atlanta, GA.
37. *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.
38. *Adanur, S.*, and *Isikel, L.*, “Nonwoven Fabrics for Gas Diffusion Layers in Polymer Electrolyte Membrane Fuel Cells”, Conference on Structural Composites Applications in Defense, Infrastructure, Transportation, Corrosion-Prevention and Power Industry, March 4-6, 2008, Birmingham, AL.
39. *Auad, M. L.* , *Mosiewicki, M. A.*, *Richarson, T.*, *Adanur, S.*, *Aranguren, M. I.* , *Marcovich, N. E.*, *Medeiros, E. S.*, and *Mattoso, L. H. C.*, “Shape Memory Polyurethanes Reinforced with Electrically Conductive Cellulose Crystals” , COMAT 2007, December, 2007, Brazil.
40. *Ascioglu, B.*, and *Adanur, S.*, “Nanofiber Coating and Nanofiber Based Continuous Yarn Manufacturing” (including proceedings), 2nd Textile Technology and Textile Machinery Congress, 19-20 October 2007, Gaziantep, Turkey.
41. *Adanur, S.*, “Innovation in Textiles, Nanotechnology Practices and Technical Textiles”, 1st International Textile and Apparel Summit, June 2-3, 2007, Denizli, Turkey.
42. *Adanur, S.*, and *Isikel, L.*, “Design and Characterization of Nonwoven Fabrics for Gas Diffusion Layer in Polymer Electrolyte Membrane Fuel Cells”, May 23, 20007, Karadeniz Technical University, Trabzon, Turkey.
43. *Ascioglu, B.*, and *Adanur, S.*, “Hexagonal Unit Cell Model for Thermal Conductivity of Nano-Micro Fiber Composites”, ULIBTK '07, The 16th Heat Transfer Congress, May 30- June 2, 2007, Erciyes University, Kayseri, Turkey.
44. *Isikel, L.*, and *Adanur, S.*, “Manufacturing of Gas Diffusion Layers for Polymer Electrolyte Membrane Fuel Cell”, Auburn University 17th Annual GSC Research Forum, 7 March 2007, Foy Union, AU.
45. *Adanur, S.*, and *Irsale, S.*, “Textile Stent Prototyping and Modeling”, IFAI Expo 2006 Medical Textiles Symposium, Atlanta, Oct. 31, 2006.
46. *Adanur, S.*, “Wide World of Industrial Textiles”, presentation given to the teachers at the Istanbul Textile Vocational School, June 22, 2006, Istanbul, Turkey.
47. *Adanur, S.*, “Dynamics of Air-Jet Weaving”, The First Istanbul International Textile and Textile Machinery Congress, June 1-2, 2006, Istanbul, Turkey.
48. *Adanur, S.*, *Aglan, H.*, *Gumusel, L.*, and *Bas, H.*, “Textile Machinery and Processes for Composite Preform Manufacturing”, The First Istanbul International Textile and Textile Machinery Congress, June 1-2, 2006, Istanbul, Turkey.
49. *Adanur, S.*, *Isikel, L.*, and *Abdelhady, F.*, “Coated and Laminated Fabrics for Fuel Cells”, TechTextil Symposium North America, March 28-30, 2006, Atlanta, GA.
50. *Isikel, L.*, and *Adanur, S.*, “Comparative Evaluation of GDL Media for PEMFCs”, Auburn University Annual Graduate Student Research Paper Competition, 9 March 2006, Foy Union, AU.
51. *Adanur, S.*, *Schwartz, P.*, *Broughton, R.*, *S.*, *Thomas, H.*, *Byrne, M.*, and *Hong, J. W.*, “Novel Polymeric Materials and Structures for Biomedical/Health Applications”, presentation given to the AU internal committee for NSF Major Research Instrumentation (MRI) Program, 9 Dec. 2005.
52. *Adanur, S.*, “Application of Industrial Textiles”, Seminar given to ITAS 8960 Class, 8 Sept. 2005.
53. *Adanur, S.*, “High Tech Textiles”, Bossa, Adana, Turkey, 18 July 2005.

54. *Adanur, S.*, “Coated and Laminated Fabrics for Fuel Cells”, 2nd International Technical Textiles Congress, Istanbul, Turkey, 13-15 July 2005.
55. *Adanur, S.*, and *Ascioglu, B.*, “Challenges and Opportunities in Nano Fiber Manufacturing and Applications”, 2nd International Technical Textiles Congress, Istanbul, Turkey, 13-15 July 2005.
56. *Adanur, S.*, “Higher Education in the U.S”, Suleyman Demirel University, Isparta, Turkey, 8 July 2005.
57. *Adanur, S.*, “High Tech Textiles”, Suleyman Demirel University, Isparta, Turkey, 8 July 2005.
58. *Adanur, S.*, “High Tech Textiles”, Denizli Chamber of Commerce, Turkey, 7 July 2005.
59. *Adanur, S.*, “High Tech Textiles”, Pamukkale University, Denizli, Turkey, 6 July 2005.
60. *Adanur, S.*, “Higher Education in the U.S”, Karadeniz Technical University, Trabzon, Turkey, 30 June 2005.
61. *Irsale, S.*, and *Adanur, S.*, “Exporing Textile Stents: Prototyping and Modeling”, Fiber Society Spring 2005 Conference, May 25-27, 2005, St. Gallen, Switzerland.
62. *Ascioglu, B.*, and *Adanur, S.*, “Heat Transfer Modeling in Nanofiber Reinforced Composite”, Auburn University Annual Graduate Student Research Paper Competition, 10 March 2005, Foy Union, AU.
63. *Irsale, S.*, and *Adanur, S.*, “Textile Prosthesis for Vascular Applications”, NTC Paper presentation, 10 January 2005, Spidle Hall, Auburn University.
64. *Ascioglu, B.* and *Adanur, S.*, “Heat Transfer Modeling in Nanofiber Reinforced Composite”, NTC Paper presentation, 10 January 2005, Spidle Hall, AU.
65. *Adanur, S.*, “High Performance and Nano Fibers”, Twichell Corporation, Dothan, AL, Sept. 2, 2004.
66. *Adanur, S.*, “Dynamic Analysis of Air-Jet Filling Insertion: Effect of Timing on Air and Yarn Velocity”, SECTAM XXII, 22nd Southeastern Conference on Theoretical and Applied Mechanics, August 15-17, 2004, Tuskegee, AL.
67. *Ascioglu, B.*, and *Adanur, S.*, “Heat Transfer Behavior of Particle Reinforced Nanofibers”, SECTAM XXII, 22nd Southeastern Conference on Theoretical and Applied Mechanics, August 15-17, 2004, Tuskegee, AL.
68. *Irsale, S.*, and *Adanur, S.*, “Compression Force Modeling of Braided Textile Stents”, SECTAM XXII, 22nd Southeastern Conference on Theoretical and Applied Mechanics, August 15-17, 2004, Tuskegee, AL.
69. *Ascioglu, B.*, and *Adanur, S.*, “Modeling of Thermal Conductivity in Nanofiber Composites”, ICCE-11, 11th Annual International Conference on Composites/Nano Engineering, Hilton Head, SC, August 8-14, 2004.
70. *Adanur, S.*, and *Ascioglu, B.*, “Processing Characterization of PVA Nanofibers in Electrospinning”, ICCE-11, 11th Annual International Conference on Composites/Nano Engineering, Hilton Head, SC, August 8-14, 2004.
71. *Adanur, S.*, “Geotextiles”, Unsa, Inc., Istanbul, Turkey, July 19, 2004.
72. *Adanur, S.*, and *Vakalapudi, J. S.*, “Fabric Design and Analysis System in 3D Virtual Reality”, The 2nd International Istanbul Textile Congress, April 22-24, 2004, Istanbul, Turkey.
73. *Irsale, S.*, and *Adanur, S.*, “Monofilament Yarns in Braided Vascular Prostheses”, TechTextil Symposium North America, Atlanta, GA, March 30-April 1, 2004.
74. *Ascioglu, B.*, *Adanur, S.*, *Patra, P. K.*, *Inan, G.*, *Kim, Y.*, and *Warner, S.*, “Heat Transfer Modeling in Nanofiber Reinforced Composites”, ICCE-10, New Orleans, July 20-26, 2003.
75. *Inan, G.*, *Patra, P. K.*, *Warner, S. B.*, *Kim, Y. K.*, *Ascioglu, B.*, and *Adanur, S.*, “In-Situ Polymerized Flame Retardant Nanocomposites”, ICCE-10, New Orleans, July 20-26, 2003.
76. *Onal, L.*, and *Adanur, S.*, “A Novel 3D Structure, 3D Hybrid Woven/Knitted Fabric”, Proceedings of the The Fiber Society 2003 Spring Symposium, “Advanced Flexible Materials and Structures: Engineering with Fibers”, June 30-July 2, 2003, Loughborough, England.
77. *Adanur, S.*, “Wide World of Industrial Textiles”, June 19, 2003, Marmara University, Istanbul, Turkey,
78. *Sathendra, V.*, and *Adanur, S.*, “Fabric Design and Analysis System in 3D Virtual Reality”, Auburn University Annual Research Forum, Auburn, AL, 20 March 2003.
79. *Adanur, S.*, “Wide World of Industrial Textiles”, Dong Hua University, Shanghai, China, 26 Sept. 2002.

80. *Adanur, S.*, and Onal, L., "Experimental Analysis of Textile Composites", TechTextil North America Symposium, Atlanta, GA. April 9-11, 2002, April 9-11, 2002.
81. *Elton, D. J.*, Howie, D. L., and *Adanur, S.*, "Bubblepoint Testing of Nonwoven Geotextiles", 37th Symposium on Engineering Geology and Geotechnical Engineering, Boise, Idaho, March 27-29, 2002.
82. *Adanur, S.*, and Turel, T., "Mechanics of Air-Jet Filling Insertion", 2001 ASME International Mechanical Engineering Congress & Exposition, New York, NY, Nov. 14, 2001.
83. *Adanur, S.*, "Role of Technical Fabrics in Papermaking: An Overview", Techtextil Symposium North America, March 13-15, 2001, Atlanta, Georgia.
84. *Adanur, S.*, and Onal, L., "Effects of Production Variables on Stress-Strain Behavior of Glass/Epoxy Textile Composites in Compression Molding", The 2000 American Society of Mechanical Engineers (ASME) Congress & Exposition, Orlando, FL, Nov. 5-10, 2000.
85. *Adanur, S.*, and Onal, L., "Impact Failure Analysis of Glass/Epoxy Textile Composites", The 2000 American Society of Mechanical Engineers (ASME) Congress & Exposition, Orlando, FL, Nov. 5-10, 2000.
86. *Adanur, S.*, and Orak, H., "Textile Composites", DOE/TACOM Army 21st Century Truck Program, Auburn University, Auburn, Al. 3 August 2000.
87. *Adanur, S.*, Xu, B., and Orak, H., "Braided Composite Automotive Chassis Frame", ICCE/7 Seventh International Conference on Composites Engineering, July 2-8, 2000, Denver, CO.
88. *Elton, D. J.*, and *Adanur, S.*, "Varying Pore Sizes in Hydroentangled Geotextiles", Techtextil North America International Trade Fair for Technical Textiles and Nonwovens", March 22-24, 2000, Atlanta, GA.
89. *Adanur, S.*, Bakhtiyarov, S., and Beale, D., "Characterization of Air-Yarn Interface in Air-Jet Weaving", National Textile Center Annual Forum, January 27-29, 2000, Myrtle Beach, SC.
90. Hou, Z., and *Adanur, S.*, "Direct Use of Waste PVC Coated Fabrics to Reinforce Composites", 1999 International Mechanical Engineering Congress & Exposition, November 17, 1999, Nashville, Tennessee.
91. *Bakhtiyarov, S.* (50%), and *Adanur, S.* (50%), "Airflow over Wavy Yarn in Air-jet Filling Insertion", Second International Symposium on Mathematical & Computational Applications, Baku, Azerbaijan, September 1-3, 1999.
92. *Adanur, S.* (50%), and *Bakhtiyarov, S.* (50%), "Numerical Study of Collision Efficiency of Dust Particles", Second International Symposium on Mathematical & Computational Applications, Baku, Azerbaijan, September 1-3, 1999.
93. *Yuksekkaya, M. E.*, Thomas, H., and *Adanur, S.*, "Analysis of Elastic Deformation of Braided Tubular Structures for Medical Applications, The Fiber Society 58th Annual General Conference, Symposium on Textile and Polymer Based Biomaterials, Philadelphia, PA, May 3-4, 1999.
94. *Adanur, S.*, Gawayed, Y., and Thomas, H., "On-Line Measurement of Fabric Properties ", National Textile Center Annual Forum, January 28-30, 1999, Myrtle Beach, SC.
95. *Adanur, S.*, and Xu, B., "Influence of Microwave Fast Preheating on Epoxy Resin Chemorheology Properties", The 1998 International Mechanical Engineering Congress and Exposition, November 15-20, 1998, Anaheim, CA.
96. *Adanur, S.*, and Liao, T., "3D Modeling of Textile Composite Preforms", ICCE/5 Fifth International Conference on Composites Engineering, July 5-11, 1998, Las Vegas, NV.
97. *Adanur, S.*, and Xu, B., "Impact Resistance of Microwave Cured Glass/Epoxy Composites", ICCST/2, Second International Conference on Composite Science and Technology, Durban, South Africa, June 9-11, 1998.
98. Mallick, S. B., Elton, D. J., and *Adanur, S.*, "A New Approach in Modeling of Soil-Geotextile Interface Behavior in Pullout Tests", Sixth International Conference on Geosynthetics, March 25-29, 1998, Atlanta, GA.
99. *Adanur, S.*, and Hou, Z., "Recycling and Reuse of PVC Coated Polyester Fabric", TCL7, The 7th International Conference on Textile Coating and Laminating, Nov. 17-18, 1997, Charlotte, NC.
100. *Adanur, S.*, and Xu, B., "Characteristics of Microwave-Cured Braided Glass/Epoxy Composites", Composites at Lake Louise, CALL '97, October 12-17, 1997, Canada.

101. *Adanur, S., Arumugam, Y. S., and Xu, B., "Fast Net Shape Manufacturing of Braided Textile Structures", ICCE/4, Fourth International Conference on Composites Engineering, July 6-12, 1997, Big Island of Hawaii.*
102. *Adanur, S., and Sreekanthreddy, G., "Compression Behavior of 3D Reinforced Glass/Epoxy Laminar Composite Profiles", ICAPC-97, International Conference on Advanced Polymer Composites, Materials, Processing and Applications, Beijing University of Aeronautics and Astronautics, Beijing, China, June 3-5, 1997.*
103. *Adanur, S., "Geotextiles: Design and Applications in Alabama", Presentation to Alabama Congressional Delegation, May 9, 1997.*
104. *Basu Mallick, S., Elton, D. J., and Adanur, S., "An Experimental Characterization of Soil-Woven Geotextile Interface in Large Box Pullout Tests", Geosynthetics '97, March 10-13, 1997, Long Beach, CA.*
105. *Yuksekkaya, M., Thomas, H., Adanur, S., Chaikof, E., "Polymeric Braided Stents for Medical Applications", 1996 ASME International Mechanical Engineering Congress and Exposition, Nov. 17-22, 1996, Atlanta, GA.*
106. *Ghosh, T., and Adanur, S., Design and Characterization of Geotextiles for High Performance Applications, Nonwovens Cooperative Research Center, Semi-Annual Meeting, Year 5, Nov. 20, 1996, Raleigh, NC.*
107. *Adanur, S., Mallick, S., and Zhai, H., "Analysis of Geotextile-Soil Interaction in Pull-Out Tests", IS Kyushu '96, International Symposium on Earth Reinforcement, November 12-14, 1996, Fukuoka, Japan.*
108. *Warren, A., El-Halwagi, M. and Adanur, S., "Design of a New Process for Converting Textile Solid Waste into Transportation Fuel", TIEES-96, The First Trabzon International Energy and Environment Symposium, July 29-31, 1996, Karadeniz Technical University, Trabzon, Turkey.*
109. *Adanur, S., and Gongalareddy, S., "Compressive Properties of Stitched Woven Fiberglass Fabric Reinforced Composite Sections for Civil Engineering Applications", ICCE/3, Third International Conference on Composites Engineering, July 21-26, 1996, New Orleans, LA.*
110. *Adanur, S., Design and Characterization of Geotextiles for High Performance Applications, Nonwovens Cooperative Research Center, 5th Annual Meeting, May 29, 1996, Raleigh, NC.*
111. *Adanur, S., "Manufacturing of Industrial Textiles: Requirements and Opportunities", Sulzer-Ruti Technical Fabric Symposium, February 21-23, 1996, Spartanburg, SC.*
112. *Adanur, S., "State of the Art in Technical Textiles", Discover EXPO '95, Industrial Fabric and Equipment Exposition, Industrial Fabrics Association International, Charlotte, NC, Oct. 12-14, 1995.*
113. *Wang, S., Adanur, S. and Jang, B. Z., "Thermo-Mechanical Behavior of Fiber/Filler Reinforced Phenolic Matrix Composites", 2nd International Conference on Composites Engineering (ICCE/2), August 21-24, 1995, New Orleans, LA.*
114. *Adanur, S., and Tam, C. A., "On-machine Stitching of 3-D Laminate Structures for Composites", 2nd International Conference on Composites Engineering (ICCE/2), August 21-24, 1995, New Orleans, LA.*
115. *Wang, S., Adanur, S. and Jang, B. Z., "Mechanical Behavior of Fiber/Filler Reinforced Phenolic Matrix Composites", Proceedings of the 2nd International Conference on Composites Engineering (ICCE/2), August 21-24, 1995, New Orleans, LA.*
116. *Adanur, S., Mallick, S. B., and Zhai, H., "Design and Characterization of Geotextiles for High Performance Applications", Hi-Tech Textiles Exhibition and Conference, July 24-26, 1995, Greenville, SC.*
117. *Broughton, R. M., Bakhtiyarov, S. I., Brady, P., and Adanur, S., "Initial Design of Nonwoven Fabrics for Air Filtration", Hi-Tech Textiles Exhibition and Conference, July 24-26, 1995, Greenville, SC.*
118. *Adanur, S., and Tsao, Y. P., "Stitch Bonded Textile Structural Composites", The 26th International Technical Conference, SAMPE, October 24-27, 94, Atlanta, GA.*
119. *Adanur, S., Tsao, Y. P., and Tam, C. W., "Improving Fracture Resistance in Laminar Textile Composites", First International Conference on Composites Engineering, August 28-31, 1994, New Orleans, LA.*
120. *Adanur, S., "Design and Structure of Fabrics for Papermaking", Third International Hi-Tech Textiles Exhibition & Conference, June 21-22, 1994, Greenville, SC.*
121. *Adanur, S., and Walker, B., "Yarn Preparation for Weaving in the Future (Yarn Preparation for the Second Loom)", 33rd Annual Textile Slashing Short Course, September 22, 1993, Auburn University, AL.*

122. *Adanur, S.*, "Paper Machine Clothing", Istanbul Technical University, Textile Engineering Department, August 4, 1993.
123. *Adanur, S.*, "Effects of Forming Fabric Design on Paper Properties", 2nd International Hi-Tech Textiles Conference, July 21, 1993, Greenville, SC.
124. ElMogahzy, Y., Gawayed, Y. and *Adanur, S.*, "Mechanical Characterization of Geotextiles/Soil Interaction", The Fiber Society Spring Meeting, May 1993, Raleigh, NC.
125. *Adanur, S.*, "Design and Applications of Forming Fabrics in Papermaking", North Carolina State University, College of Textiles, Fiber, Polymer and Textile Seminar Program, March 17, 1993, Raleigh, NC.

4.B.4 Poster Sessions Presented (presenter in *Italic*)

1. *A. Sapkota* and *S. Adanur*, Effects of Print Parameters on Additively Manufactured Flexible Fibrous Structures, Graduate Student Research Poster Session, 22nd Annual Elements of Mechanical Engineering Conference, Auburn University, 27 September 2024.
2. *A. Sapkota*, *S. K. Ghimire* and *S. Adanur*, Study of Additively Manufactured Textile Structures and Effect of Print Parameters, Graduate Engineering Research Showcase (GERS), March 26, 2024, Huntsville, AL (poster presentation).
3. *S. K. Ghimire*, *A. Sapkota*, *A. Jayswal* and *S. Adanur*, Study of PLA/TPU Polymer Blends for Additive Manufacturing of Fabric-like Structures, Graduate Engineering Research Showcase (GERS), March 26, 2024, Huntsville, AL (poster presentation).
4. *S. Adanur*, *A. Sapkota* and *S. Ghimire*, Manufacturing of Polymeric Structures, AU Undergraduate Research Showcase poster presentation 17 October 2023.
5. *A. Sapkota*, *A. Jayswal* and *S. Adanur*, Manufacturing and Mechanical Properties Evaluation of 3D Printed Fabric-like Structures, Graduate Engineering Research Showcase (GERS) poster presentation, 12 October 2023, Auburn University.
6. *S. Ghimire*, *A. Jayswal* and *S. Adanur*, Study of PLA/TPU Mixture Composites for Additive Manufacturing of Flexible Materials, Graduate Engineering Research Showcase (GERS) poster presentation, 12 October 2023, Auburn University.
7. *S. Ghimire* and *S. Adanur*, Studying the potential of PLA/TPU Blended Composite for 3D Printing of Fabric-like Structures, MECH-MATL Graduate Student Research Poster Competition, 1 October 2023.
8. *A. Sapkota* and *S. Adanur*, Additive manufacturing of polymeric flexible structures, MECH-MATL Graduate Student Research Poster Competition, 1 October 2023.
9. *A. Jayswal* and *S. Adanur*, Additive manufacturing of polymeric flexible structures, AU Student Research Symposium, March 28, 2023, Auburn University.
10. *A. Jayswal* and *S. Adanur*, Additive manufacturing of polymeric flexible structures, Graduate Engineering Research Showcase (GERS), March 23, 2023, Huntsville, AL.
11. *Jayswal, A.*, and *Adanur, S.*, Manufacturing and Characterization of Composite Filaments for 3D Printing of Fabrics, The Fiber Society 2022 Fall Meeting and Technical Conference, NC State University, Raleigh, NC, 19-21 October 2022.
12. *Alby L.*, and *Adanur, S.*, Novel Reusable Textile Facemask to Prevent Spread of COVID-19, AU SGCoE, Graduate Engineering Research Showcase, Huntsville, AL, March 29, 2022.
13. *Jayswal, A.*, and *Adanur, S.*, Characterization of Composite Filaments for 3D Printing of Fabrics, AU SGCoE, Graduate Engineering Research Showcase, Huntsville, AL, March 29, 2022.
14. *Alby, L.*, and *Adanur, S.*, Design, Fabrication, and Testing of Novel Medical Facemasks to Prevent Covid-19, 2021 Graduate Engineering Research Showcase, 28 October 2021.
15. *Jayswal, A.* and *Adanur, S.*, Characterization of PLA/TPU Composite Filaments Manufactured for 3D Printing with FDM, Poster presentation, 2021 Graduate Engineering Research Showcase, 28 October 2021.

16. Jayswal, A., and Adanur, S., Additive Manufacturing of Fabric-like Structures, 2020 Virtual Student Research Symposium, April 2020.
17. Adanur, S., "Air-Jet Filling Insertion System", Mechanical Engineering Undergraduate Research Information Poster Session, 10 October 2017, Wiggins Hall, Auburn University.
18. Adanur, S., "Air-Jet Filling Insertion System", Mechanical Engineering Undergraduate Research Information Poster Session, 1 September 2016, Wiggins Hall, Auburn University.
19. Adanur, S., Shen, Y., "Braided Structures Based on Helical Auxetic Yarns", Uludag Textile Exporters Association UTIB International R&D Brokerage Event, Bursa, Turkey, May 27-29, 2015.
20. Shen, Y., Adanur, S., Broughton, R., Beale, D. and Foster, B., "Failure Analysis of Micro-joints in Open-architecture Composites Structures (O-ACS)", Fall 2014 Graduate Engineering Research Showcase, Auburn University, Oct. 23, 2014.
21. Shen, Y., and Adanur, S., "Finite Element Analysis of Monofilament Woven Fabrics under Uniaxial Tension", 2nd Annual Graduate Engineering Research Show Case, Auburn University, Oct. 24, 2013.
22. Adanur, S., "A Novel Braided Structure to Increase Compression and Torsion Resistance of Composites", The 5th International R&D Project Brokerage Event, Bursa, Turkey, 4-5 April 2013.
23. Adanur, S., "Prevention of PEM Fuel Cell Poisoning via Adsorption using Activated Carbon Fiber Based Cathode Filters", The 5th International R&D Project Brokerage Event, Bursa, Turkey, 4-5 April 2013.
24. Adanur, S., "Health and Safety Effects of Nanoparticles Embedded in Textile Materials", The 5th International R&D Project Brokerage Event, Bursa, Turkey, 4-5 April 2013.
25. Adanur, S., and Broughton, R., "Recovery and Reuse of Waste PVC Coated PET Fabrics", The 4th International R&D Project Brokerage Event, Bursa, Turkey, Feb. 2-3, 2012.
26. Adanur, S., "PVA Nanofiber Based Membrane for Proton Exchange Membrane Fuel Cells", The 4th International R&D Project Brokerage Event, Bursa, Turkey, Feb. 2-3, 2012.
27. Adanur, S., A Novel Filling Insertion System for Weaving, The 3rd International R&D Project Brokerage Event, Bursa, Turkey, Feb. 10-11, 2011.
28. Adanur, S., Conceptual Design and Characterization of 3D Interlaced Fibrous Structures, The 3rd International R&D Project Brokerage Event, Bursa, Turkey, Feb. 10-11, 2011.
29. Liu, W., and Adanur, S., "Activated carbon fiber filter media for proton exchange membrane fuel cell cathode", The Fiber Society 2009 Spring Conference: International Conference on Fibrous Materials 2009, Shanghai, China, May 27-29, 2009 (chosen as one of the 4 best posters).
30. Liu, W., and Adanur, S., "Activated carbon fiber filter media for proton exchange membrane fuel cell cathode Fiber Society Meeting, Shanghai, China, June 2009. Won the best poster award.
31. Adanur, S., and Irsale, "Development of Drug Eluting Textile Stents", NTC Forum, June 3, 2008, Greenville, S.C.
32. Lee, S., Liu, W., and Adanur, S., "Nonwoven Fibrous Structures from Electrospun Nanofibers", NSF Research Experience for Undergraduates REU Program in Micro/Nano-Structured Materials, Therapeutics and Devices Poster Session, AU Saugahatchee Club, July 26, 2007.
33. Liu, W., and Adanur, S., "Characterization of PVA and PAN Electrospun Nonwoven Fibers", Auburn University 17th Annual GSC Research Forum, 7 March 2007, Foy Union, AU.
34. Isikel, L., Adanur, S., Tatarchuk, B., Isikel, L., (Auburn University), Warner, S., Fan, Q., and Narvekar, V., "Coated and Laminated Fabrics for Fuel Cells", NTC Forum, Feb. 25-27, 2007, Hilton Head, S.C.
35. Thomas, H., Riggs, L., Elton, D., and Adanur, S., "Reinforcement Fabrics with Electronic Antenna Capabilities", NTC Forum, Feb. 25-27, 2007, Hilton Head, S.C.
36. Yacoub, S., Isikel, L., and Adanur, S., "Nonwoven Fabric Manufacturing and Testing Using Electrospinning", NSF Research Experience for Undergraduates (REU) Program, Moores Mill Club, Auburn, 4 August 2006.

37. Adanur, S., Isikel, L., and Abdelhady, F., "Coated and Laminated Fabrics for Fuel Cells", TechTextil Symposium North America, March 28-30, 2006, Atlanta, GA.
38. Adanur, S., Choe, B., Fan, Q., and Warner, S., "Coated and Laminated Fabrics for Fuel Cells", National Textile Center 14th Annual Forum, February 19-21, 2006, Hilton Head, SC.
39. Adanur, S., Swagat, I., Warner, S., and Chaikof, E., "Textile Prostheses for Vascular Applications", National Textile Center 14th Annual Forum, February 19-21, 2006, Hilton Head, SC.
40. Adanur, S., Choe, B., Fan, Q., and Warner, S., "Coated and Laminated Fabrics for Fuel Cells", National Textile Center 13th Annual Forum, March 20-22, 2005, Raleigh, NC.
41. Adanur, S., Swagat, I., Warner, S., and Chaikof, E., "Textile Prostheses for Vascular Applications", National Textile Center 13th Annual Forum, March 20-22, 2005, Raleigh, NC.
42. Adanur, S., Ascioğlu, B., Prabir, K. P., Warner, S. B. et al, "Nano Engineered Fire Resistant Composite Fibers", National Textile Center 13th Annual Forum, March 20-22, 2005, Raleigh, NC.
43. Irsale, S., and Adanur, S., "Exploring Textile Stents: Prototyping and Modeling", AU Annual Graduate Student Research Forum, March 10, 2005, Auburn, AL.
44. Adanur, S., and Irsale, S., "Textile Prosthesis for Vascular Applications", Presentation and Poster Session, TechTextil Symposium North America, Atlanta, GA, March 30-April 1, 2004.
45. Adanur, S., Ascioğlu, B., Prabir, K. P., Warner, S. B. et al, "Nano Engineered Fire Resistant Composite Fibers", National Textile Center Annual Forum, February 15-17, 2004, Hilton Head, SC.
46. Adanur, S., Swagat, I., Warner, S., and Chaikof, E., "Textile Prostheses for Vascular Applications", National Textile Center Annual Forum, February 15-17, 2004, Hilton Head, SC.
47. Ascioğlu, B., and Adanur, S., "Nano Engineered Fire Resistant Composite Fibers", Auburn University Annual Research Forum, Auburn, AL, 20 March 2003. This poster won the 2nd place in Engineering.
48. Adanur, S., Ascioğlu, B., Prabir, K. P., Warner, S. B. et al, "Nano Engineered Fire Resistant Composite Fibers", National Textile Center Annual Forum, February 16-18, 2003, Hilton Head, SC.
49. Adanur, S., and Sathendra, V., "Fabric Design and Analysis System in 3D Virtual Reality", National Textile Center Annual Forum, February 16-18, 2003, Hilton Head, SC.
50. Adanur S., and Onal, L., "Design and Characterization of a Novel 3D Hybrid Knitted/Woven Fibrous Structure for Composites", 2003 NSF Design, Service and Manufacturing Grantees and Research Conference, January 6-9, 2003, Birmingham, AL.
51. Turel, T., Adanur, S., Bakhtiyarov, S., Ahmed, A., and Beale, D., "Filling Yarn Insertion in Air-Jet Weaving", National Textile Center Annual Forum, February 10-12, 2002, Charlotte, NC.
52. Sathendra, V., and Adanur, S., "Fabric Design and Analysis System in 3D Virtual Reality", National Textile Center Annual Forum, February 10-12, 2002, Charlotte, NC.
53. Adanur, S., and Onal, L., "Factors Affecting the Mechanical Properties of Laminated Glass/Graphite-Epoxy Hybrid Composites", 2002 NSF Design, Service and Manufacturing Grantees and Research Conference, January 7-10, 2002, San Juan, Puerto Rico.
54. Tascan, M., and Adanur, S., "Filling Yarn Insertion in Air-Jet Weaving", 11th Research Forum, Auburn University, March 19, 2001.
55. Onal, L., and Adanur, S., "Impact Properties of Textile Composites", 11th Research Forum, Auburn University, March 19, 2001.
56. Kilinc, F. S., and Adanur, S., "3D Fabric Design and Analysis", 11th Research Forum, Auburn University, March 19, 2001.
57. Tascan, M., Adanur, S., Bakhtiyarov, S., Ahmed, A., and Beale, D., "Filling Yarn Insertion in Air-Jet Weaving", National Textile Center Annual Forum, February 11-13, 2001, Myrtle Beach, SC.
58. Kilinc, F. S. and Adanur, S., "Fabric Design and Analysis System in 3D Virtual Reality", National Textile Center Annual Forum, February 11-13, 2001, Myrtle Beach, SC.

59. Adanur, S., and Orak, H., "Design and Manufacturing Automotive Chassis Frame with Net Shape Braided Composite Structures", 2001 NSF Design and Manufacturing Research Conference, January 7-10, 2001, Tampa, FL.
60. Adanur, S., Bakhtiyarov, S., and Beale, D., "Filling Yarn Insertion in AirJet Weaving", National Textile Center Annual Forum, January 27-29, 2000, Myrtle Beach, SC.
61. Adanur, S., and Xu, B., "Design and Manufacturing Automotive Chassis Frame with Net Shape Braided Composite Structures", 2000 NSF Design and Manufacturing Research Conference, January 3-6, 2000, Vancouver, British Columbia, Canada.
62. Adanur, S., Gawayed, Y., and Thomas, H., "On-Line Measurement of Fabric Properties ", National Textile Center Annual Forum, January 28-30, 1999, Myrtle Beach, SC.
63. Adanur, S., and Xu, B., "Fast Net Shape Manufacturing of Braided Textile Composites", NSF CAREER Awardees Meeting, January 10-12, 1999, Washington D.C.
64. Adanur, S., and Xu, B., "Process Development of Microwave Preheating and Infrared Post Curing of Braided Polymer/Epoxy Composites", The 1999 National Science Foundation (NSF) Design and Manufacturing Grantees Conference, January 5-8, 1999, Long Beach, CA.
65. Adanur, S., Liao, T., and Ghosh, T., "Design and Characterization of Geotextiles for High Performance Applications", National Textile Center Annual Forum, January 29-31, 1998, Panama City, FL.
66. Adanur, S., Gawayed, Y., and Thomas, H., "On-Line Measurement of Fabric Properties", National Textile Center Annual Forum, January 29-31, 1998, Panama City, FL.
67. Adanur, S., and Xu, B., "Fast, Net Shape Manufacturing of Textile Composites", National Science Foundation, Design and Manufacturing Grantees Conference, January 5-8, 1998, Monterrey, Mexico.
68. Adanur, S., Gawayed, Y., Ghosh, T., Goswami, B., Mallick, S. B., Zhai, H., "Design and Characterization of Geotextiles for High Performance Applications", National Textile Center Annual Forum, January 28-30, 1997, Myrtle Beach, SC.
69. Adanur, S., Thomas, H., Gawayed, Y., "On-Line Monitoring", National Textile Center Annual Forum, January 28-30, 1997, Myrtle Beach, SC.
70. Adanur, S., and Xu, B., "Fast, Net Shape Manufacturing of Textile Composites", National Science Foundation, Design and Manufacturing Grantees Conference, Seattle, Washington, Jan. 7-10, 1997.
71. Adanur, S., Mallick, S., and Zhai, H., "Analysis of Geotextile-Soil Interaction in Pull-Out Tests", IS Kyushu '96, International Symposium on Earth Reinforcement, November 12-14, 1996, Fukuoka, Japan.
72. Adanur, S., Mallick, S., and Zhai, H., "Design and Characterization of Geotextiles for High Performance Applications", National Textile Center Annual Forum, January 24-26, 1996, Raleigh, NC.
73. Adanur, S., et al., "Textile Structural Composites", National Textile Center Annual Forum, January 24-26, 1996, Raleigh, NC.
74. Adanur, S., Mallick, S., and Zhai, H., Design and Characterization of Geotextiles for High Performance Applications, National Textile Center, Annual Forum, Atlanta, GA, January 26-28, 1995.
75. Mohamed, M., Adanur, S., et al., "Textile Structural Composites", National Textile Center, Annual Forum, January 26-28, 1995, Atlanta, GA.
76. Adanur, S., and Tam, C. W., "Fabrication and Testing of On-loom Stitched 3-D Glass/Epoxy Laminar Composites", The 8th Annual Alabama Materials Research Conference, Tuscaloosa, AL, Sept. 26-27, 1994.
77. Walker, B., Beale, D., Broughton, R., and Adanur, S., "Improving the Woven Fabric Production Rate by Braiding Process", National Textile Center, Annual Forum, Greenville, SC, February 1994.
78. Mohamed, M., Adanur, S., et al., "Textile Structural Composites", National Textile Center, Annual Forum, Greenville, SC, February 1994.
79. Walker, B., Beale, D., Broughton, R., and Adanur, S., "Improving the Woven Fabric Production Rate by Braiding Process", National Textile Center, Annual Forum, Auburn, AL, February 1993.

80. Mohamed, M., Adanur, S., et al., "Textile Structural Composites", National Textile Center, Annual Forum, Auburn, AL, February 1993.

4.B.5 Senior Design Projects Supervised

1. Chris Upp and Nicholas Hammond, "GKN Postcured Composite Structures", Spring 2018.
2. Matthew A. Phillips and Alexandria Gunter, PFEN 4820, GKN Aerospace Vacuum Port Redesign", Spring 2017.
3. John C. Sampson, and Jon C. Walker, PFEN 4820, "Solving the Edge Problem During Manufacturing of Composite Parts for the Bell 525 Helicopter Project", Spring 2016.
4. Webb Broussard and Blake Townsend, "Normalizing Autoclave Heat Rate Regardless of Mass or Mold Material", PFEN 4820, Spring 2015.
5. Chris Lee, Chris Porter and Austin Yuill, "Formula SAE Composite Wheel", Spring 2013.
6. Mason Brummal and James Smith (PFEN 4810-4820), "Weight Reduction of Mandrels Used in Composite Manufacturing", GKN Aerospace Alabama, Tallassee, AL, Spring 2012.
7. Melanie McDonald and Charles Blackwell (PFEN 4820), "Bulkhead Core Crushing", GKN Aerospace Alabama, Tallassee, AL, Spring 2011.
8. Joseph Rossi Schell, Steven Crace and James Clay Graben (PFEN 4820), "Carbon Tow Tension Control in Malimo Stitch Bonding Process for Composite Preform Manufacturing", V2 Composites, Auburn, AL, Spring 2011.
9. Sam A. Missioum and Betsy Claunch (PFEN 4820), "Engineering Solutions for Increased Efficiency in Hollow-fiber Production of Hemodialysis", Gambro Renal Products, Opelika, AL, Spring 2011.
10. Ozbasli, Halil, "Stadium Covers", TXMT 4900, Fall 2006.
11. Anthony, Rebecca, and Hudson, Katie, "Hail Storm Protective Fabrics, FBEN 4910-4920, Fall-Spring 2006.
12. George, Mellany, "Performance of Coated and Laminated Fabrics for Fuel Cells", FBEN 4920, Fall 2005.
13. Bates, Tiffany, and Williams, Jennie, "Medical Stents: Textile Materials versus Metals", FBEN 4920, Spring 2005.
14. Willams, Gerald, "Endovascular Stent Grafts", TXMT 4910, Spring 2005.
15. Cooper, Jared, "Biocompatible Polyester Stents for Vascular Applications", FBEN 4920, Fall 2004.
16. McCollum, Brian, "Composite Drumsticks", FBEN 4920, Fall 2004.
17. Stroud, Megan, "The Price of Turf", FBEN 4920, Fall 2004.
18. Nicole Sizemore, "Bubble Point Test Method", TXEN 4920, Summer 2004.
19. Andrea Rogers, "Operating Room Material Requirements", TXMT 4910, Spring 2004.
20. Joseph Godfrey, "Fiber Optics Woven into Fabrics", TXEN 4920, Fall 2003.
21. Melissa Mitchell "UV Resistance of Coated Fabrics for Stadium Covers", Summer 2003.
22. Andrea Janel Smith, "Turfgrass Reinforcement", Spring 2003.
23. Thomas Hogan, "Composite Tree Climber", Spring 2003.
24. Carlos Eduardo Handal, "Recycling of T-shirt Waste, Spring 2003.
25. Jason Mattox, "Geocomposite Design", Spring 2003.
26. Kalitha Mitchell, "Carpet Tile Manufacturing Problems", Fall 2002.
27. Eric Chambers, "Composite Baseball Bat", Fall 2002.
28. Jeremy Legg, "Heat Stress Analysis: Making Aubie Cooler", Fall 2002.
29. Paula Bates, "An Examination of Acoustic Textile Structures", Spring 2002.

30. Margaret Harris, "Design of a Polymeric Y Shaped Braided Stent for Aortic Implantation", Spring 2002.
31. Colin Dawson, "The Design, Construction and Testing of Composite Canoes", Spring 2002.
32. Sarah Robinson, "Western Saddle Design", Spring 2002.
33. Dan C. Siggers, "Canine Body Armor", Spring 2002.
34. Leslie Alexander, "Development of Golf Driver Shaft Using Industrial Textiles", Fall 2001.
35. Rebecca A. Bevis, "Interfacial Shear Strength Evaluation of Thermoplastic and Thermoset Resins by the Single Fiber Pullout Test", Fall 2001.
36. Kevin Hughes, "Carbon Composite Billiard Cue", Spring 2001.
37. Meredith Kaye Fetner, "Evaluation of Quality Problems Associated with the Manufacture of Inflatable Evacuation Systems", Spring 2001.
38. Fatma Erdonmez, "Fiber Reinforced Bricks", Spring 2000.
39. Heather M. Anders and Daniel A. Butts, "Fiber Reinforced Concrete", Spring 2000.
40. Mary M. Jacobs, Leia A. Cutcliffe and Ron Levitzke, Jody Aaron, "Composite Golf Club", Spring 2000.
41. Julee E. Diplacido, "Design and Fabrication of a Three-Dimensional Woven Fabric Structure Using a Jacquard Loom", Winter 2000
42. Dina R. Tareea, "Composite Bone", Winter 2000.
43. Elizabeth A. Bray, "Braided Tennis Racquet", Winter 2000.
44. Tareek Mohamed, "Permeability of Geotextiles", Winter 99.
45. Leigh N. Haugseth, "Application of Sampling Plan for Codon Airbag Fabric", Winter 99.
46. Robert Gallardo and Dustin Jowers, "Design of a Polymer Stent", Winter 99.
47. Jason Eisele, "Puncture Resistant Military Textiles", Winter 99.
48. Rebecca Kenney and Charles Moore, "Design and Development of a New Geotextile Structure for Soil Reinforcement", Winter 99.
49. Casey Blythe and Wesley Greer, "Incorporating Polypropylene Filament Yarns and Nonwoven Structures for Geotextile Applications", Fall 98.
50. Jeannie Stephens, Erica Graves and Ryan Radel, "Composite Bicycle Frame", Spring 1998 (co-advisor with Dr. Gowayed).
51. James Collier and Kasey Myers, "Flame Resistant Military Fabrics", Spring 1998.
52. Mary Elizabeth Stahr, "Properties of Airbag Fabric Contributing to Strength and Foldability", Winter 1998.
53. Paul Roberts, "Geotextile Pullout Test: Study of Geotextile-Soil Interaction", Fall 1997.
54. Kenneth Cole and Russell Matoy, "Effects of Forming Fabrics on Paper Formation", Spring 1997.
55. Jonathan Douglas and Samuel Mooney, "Design and Development of a Y-Shaped Braided Polyester Aortic Stent", Winter 1997.
56. Barclay Payne, "Warp-out Process", Winter 1997.
57. Leanna Land, "Design of Polyester Stent for Aortic Implantation", Fall 1996.
58. Tara Schaneville and Rotricia Smith, "Design and Applications of Biomaterials for Coronary Artery Reinforcement", Spring 1996.
59. Michelle Struth, "Tiger Textiles", Winter 1996.
60. Stephanie Carnley, "Computers and Computer Aided Design in the Textile Industry", Winter 1995.
61. Coley Jay Smith, "Effects of Fabric Structure on Bending Stiffness", Winter 95.
62. Karen Countess, "Performance Comparison of Woven Geotextiles in Fabric-Soil Interaction", Winter 95.

63. Keith Rollins, "Adhesion Characteristics of Reinforcement Fabrics to Rubber", Fall 1994.
64. Amy N. Goddard, "Ultrasonic Seaming", Spring 94.
65. Dayna M. Smith, "Medical Textiles: Design of Absorbency Tester for Medical Toweling", Spring 94.
66. Brian Allen, "The Effects of ISO 9000 Quality Systems on Textile Product Quality", Winter 94.
67. Mike McCauley and Eva Shelton, "Design and Fabrication of a New Textile Structural Composite Racket" Winter 1994.
68. Brian Wingfield, "Pack Design for a 3/4" Laboratory Extruder", Winter 94.
69. Thomas L. Pritchard, "The Properties of Non-crimp Fabric Based Composites", Winter 94.
70. Westley Mixon, "The Effects of Forming Fabric Design Parameters on Tissue Paper Properties", Spring 93.
71. Philip Douglas Tierce, Jr., "The Effect of Forming Fabric Design on Final Sheet Qualities", Winter 93.
72. David C. Terrell, "Laminated Textile Structural Composites", Winter 93.

4.B.6 Patents / Inventions / Disclosures

1. Adanur, S., Alby, L., and Jayswal, A., "A Novel Multiuse Facemask with Hybrid Materials", filed on 2/26, 2021 (patent disclosure).
2. Adanur, S., "Improving Sheet Dryness in Papermaking with the Inclusion of High Surface Area Polymeric Fibers", filed on 1/24/2017 (patent disclosure).
3. Adanur, S. and Zheng, H., "A novel way of measuring proton conductivity of fuel cell membranes", AU Technology Disclosure, filed on 7/9/2010.
4. Adanur, S., Vakalapudi, J. S., and Liao, T., "VirtualFabric Design and Analysis System", Auburn University Software Disclosure, 20 July 2006.
5. Adanur, S., and Ascioglu, B., "Modification of Smooth Polymeric Surfaces with Nanofibers using Electrospinning", Auburn University Technology Disclosure, 12 October 2005.
6. Adanur, S., and Irsale, S., "Polymeric Textile Prostheses for Vascular Surgery Applications", Auburn University Technology Disclosure, 25 July 2005.
7. Adanur, S., "Air-Jet Filling Insertion Simulator", Auburn University Patent Technology Disclosure, Dec. 16, 2003.
8. Adanur, S., "Rotational Curing Device for Fast Net-shape Manufacturing of Braided Composites", Auburn University Patent Technology Disclosure, July 20, 2000.
9. Bakhtiyarov, S. I., Overfelt, R. A., and Adanur, S., "Reinforced Sand-Binder System for Coremaking Process", Patent Disclosure, November 1998.
10. Adanur, S., Hou, Z., and Broughton, R. M., "A New Method to Separate the Components of Coated Fabrics", Patent Disclosure, July 22, 1997.
11. McCumsey, K., and Adanur, S., "Two Layer Fabric with Two Extra Strands", Patent Disclosure, April 15, 1992.

4.B.7 Other Research Contributions

1. Irsale, S., "Exploring Textile Stents: Prototyping and Modeling", submitted to the Fiber Society Graduate Student Research Competition, March 3, 2006.

Technical Reports Submitted

1. Adanur, S., Design, Fabrication and Testing of Novel Medical Facemasks to Prevent COVID-19, 6 Quarterly Reports and Final Report, submitted to Alabama Department of Economic and Community Affairs (ADECA), 18 May 2022.
2. National Science Foundation annual reports
3. Adanur, S., Gowayed, Y., Elton, D., and Ghosh, T. K., Design and Characterization of Geotextiles for High Performance Applications, Nonwovens Cooperative Research Center, Annual Report, Year 5, May 29, 1996, Raleigh, NC.

4. National Textile Center (NTC) quarterly and annual reports
5. Semi-annual and annual reports to US Army Natick
6. NSF EPSCoR annual reports
7. Final report to NSF for Instrumentation and Laboratory Improvement Program
8. Monthly progress reports to Wellington Sears Company, Valley, AL.

Thesis and Dissertation

1. Adanur, S., "Dynamic Analysis of Single Nozzle Air-Jet Filling Insertion", Ph.D. Thesis, North Carolina State University, May 1989, 219 pages.
2. Adanur, S., "Air-Jet Filling Insertion: Velocity Measurement and Influence of Yarn Structure", Master's Thesis, North Carolina State University, 1985, 133 pages.

4.B.8 Grants and Contracts

1. Jayswal, A. (PI) and Adanur, S., "Manufacturing, characterization, and computational analysis of composite filaments for additive manufacturing of fabrics", ICAMS (Interdisciplinary Center for Advanced Manufacturing Systems, 15 May 2022-15May 2023, \$2,610.00.
2. Griffin, K., and Adanur, S., Additive Manufacturing of Braided Structures for Composite Reinforcement, AU Undergraduate Research Fellowship, \$2,250.00 for student, \$750.00 for mentor, May 15 – August 15, 2022.
3. Design, Fabrication and Testing of Novel Medical Facemasks to Prevent COVID-19, \$75,000.00, State of Alabama, Department of Economic and Community Affairs (ADECA), Feb. 1, 2021 – May 15, 2022.
4. OVPR Undergraduate Research Program Project, Electrospinning of Polymeric Fibers, Adanur budget: \$1,500.00 (Student, Kiana LaBombard, assistantship: \$5,000.00). May 15, 2017-May 15, 2018.
5. Adanur, S., "Polymeric and Textile Materials for Spherical Air Ships". Sponsor: Skyborne International, Duration: 2 years (2/1/2015-1/31/2017), Budgeted: \$75,000.00.
6. Broughton, R. (PI), Beale, D., Adanur, S., and "Design and Analysis of Stiffeners and Tension Compression Struts Using Braided, Open-Architecture Composite Structures (O-ACS)", \$150,000.00, 21 November 2013-December 2015.
7. Adanur, S. (PI), Meir, A. J., and Cao, Y., "Virtual 3D Interlaced Fabric Design and Characterization", \$50,890.44, AU-IGP, 1 February 2012 - 31 December 2015.
8. National Science Foundation, REU Site for Micro/Nano-Structured Materials, Therapeutics, and Devices, PI: M.E. Byrne, Co-PI: S. Duke, Period: 03/1/11 - 02/28/14; \$357,191. Faculty Mentors: S. Adanur, M. Auad, M. Byrne, S. Duke, A. Gorden, E. Davis, V. Davis, O. Fasina, R. Gupta, J.W. Hong, E. Lipke, B. Prorok, W. Ravis, C. Roberts.
9. Adanur, S., "Development of Composite and Sandwich Structured Fuel Cell Membranes", Department of Commerce, Sept. 2009-Aug. 2010, \$100,000.00, 9/1/2009-8/31/2010.
10. Secured donation of 10, 862 kg of polymers and color additives to the Polymer and Fiber Engineering by Thermo Fisher, whose value is around \$21,600 (April 2010).
11. Adanur, S., Graduate Outreach Program (GOP) Grant, \$135.00, Spring 2009 (teaching).
12. Adanur, S., "Nanoparticle Reinforced Hybrid Fibers and Films", Department of Commerce, \$119,999.00, 6/1/08-5/31/09.
13. Davis, Ed (PI/Mentee), and Adanur, S. (Mentor), "Imogolite/PEO Nanocomposite Fibers and Membranes", \$4,000.00, AU 2008 Faculty Mentoring Program.
14. Adanur, S., and 4 other researchers from Clemson University, "Development of Drug Eluting Textile Stents", \$4,000, NTC, 2008-2009.
15. Tatarchuk, B. (PI), Adanur, S., and Broughton, R., Tank and Automotive Command Center (TACOM) Project, Prevention of Fuel Cell Poisoning, PFEN share \$72,000, Fall 2005-Spring 2010.
16. Ikiz, Y., "Development of Nanofibers for Filtration Using Electrospinning", Pamukkale University, sponsored by TUBITAK of Turkey, 80,500 YTL (~\$ 61,923), Jan. 2006-Dec. 2008, (Dr. Adanur is a "consultant" with no compensation).

17. Duke, S. (PI), Byrne, M. E. (Co-PI), Adanur, S., and 10 other researchers, "REU Site for Micro/Nano-Structured Materials, Therapeutics, and Devices", NSF Research Experiences for Undergraduates (REU), \$297,846, Summer 2006-Summer 2008.
18. Adanur, S. (PI), and Aglan, H. (Co-PI, Tuskegee University), "U.S.-Turkey Cooperative Research: Design and Processing Characteristics of Novel Three Dimensional Fibrous Preforms for Composite Reinforcement", \$34,201.00, Sept. 1, 2004-Aug. 31, 2007, National Science Foundation.
19. Adanur, S. (PI), Choe, B., Fan, Q., and Warner, S., "Coated and Laminated Fabrics for Fuel Cells", \$318,074.00, May 1, 2004-April 30, 2008, National Textile Center.
20. Thomas, H., (PI), Adanur, S., Elton, D., and Riggs, L., "Reinforcement Fabrics with Electronic Transmission Capabilities", \$278,390.00, May 1, 2005-April 30, 2008, National Textile Center.
21. Adanur secured donation of two injection molding machines to Auburn University on May 3, 2007 by Thermofisher Scientific of Auburn:
 - FU CHIN SHIN 75 TON, MODEL: KT-75G, SERIAL # H03185, YEAR: 1988, Value: \$4,500.00
 - FU CHIN SHIN 75 TON, MODEL: KT-75, SERIAL # H03172, YEAR: 1988, Value: \$4,500.00.
22. Adanur, S., (PI), and Warner, S., "Textile Prostheses for Vascular Applications", \$389,753.00, Auburn's share: \$241,510.00, May 1, 2003-April 30, 2006, National Textile Center.
23. Patra, P. (PI), Adanur, S., and 4 other researchers, "Nano Engineered Fire Resistant Composite Fibers", Auburn's share: \$90,920.00, May 1, 2002-April 30, 2005, National Textile Center.
24. Parker, F., Dyer, D. (leaders), Adanur, S., and several other Engineering Faculty, "AU Priority Areas; Transportation Pinnacle: Commercial Highway Systems", October 1, 99-September 30, 2004 (total budget amount is unknown at this time). Budget for Adanur: \$24,000.
25. Adanur, S., (leader) ElMogahzy, Y., and Abdelhady, F., "Yarn and Fabric Design and Analysis in 3D Virtual Reality", National Textile Center, \$ 177,938, May 1, 2000 - April 30, 2003.
26. Adanur, S. (PI), Bakhtiyarov, S., and Beale, D., "Characterization of Air-Yarn Interface in Air-Jet Weaving", National Textile Center, \$ 262,742.00, May 1, 1999-April 30, 2002.
27. Equipment Secured for Air-Jet Research

L5200 S 210 N2 IK TE Air-Jet Weaving Machine (L5200 series, filament execution, 210 cm max. reed width, low built (without superstructure), two color picks at will, crank shedding motion, electronic filling feeders)

Manufacturing # 031166
 Serial # JA 2663
 Machine # 0003
 Manufacturing date: 1997.08
 Market Value: \$15,000.00.
 Donor: Sulzer Textile, Inc.
 Date Received: Nov. 22, 2002
28. Adanur, S., Fast Net-Shape Manufacturing of Polymer Composite Structures, 1995 NSF Faculty Early Career Development (CAREER) Program, National Science Foundation, \$ 210,000.00; duration: 5 years, Sept. 1, 96-Aug. 31, 2001.
29. ElHalwagi, M. (leader), Adanur, S., and 15 other faculty, "Bicomplexity Incubation Project Proposal FY 2000-2002", \$ 220,000.00, National Science Foundation, Duration: 1 year, Sept. 2000- August 2001.
30. Adanur, S., and Shalaby, S. E. (Egypt), "Design and Manufacture of Stitch Bonded, Thermoplastic Textile Composites", US-Egypt Science and Technology Joint Fund, \$ 39,978, September 1, 1998 - August 31, 2001.
31. P. Jones (leader), C. A. Flood, S. Adanur, "Developing a Course Based on Equipment Design for Introduction to Engineering", AU College of Engineering; \$ 24,050; June 1, 1999-May 31, 2000.

32. Adanur, S. (team leader), Thomas, H., Gawayed, Y. and Ghosh, T., On-line Measurement of Fabric Mechanical Properties for Process Control, National Textile Center, \$ 446,912.00; duration: 3 years, March 1, 96 – April 31, 2000.
33. Jang, B. Z., Yang, X. F., and Adanur, S. (30%), "Solid Free Form Fabrication of Advanced Alloys and Metal Matrix Composites", College of Engineering Graduate Research Assistantship, \$ 20,000.00; duration: October 1, 1997-September 30, 1999.
34. Elton, D., and Adanur, S. (50%), "Waterjet Manufacturing of Custom Geotextiles", College of Engineering Infrastructural Awards, \$ 62,524.00; duration: October 1, 1997-September 30, 1999.
35. Utilization of Solid Waste in Alabama, Y. Gawayed (Project Coordinator), S. Adanur and 15 other researchers, NSF/EPSCoR, \$ 3 million, Dr. Adanur's share: \$ 150,000.00; duration: 4 years, Aug. 95-July 99.
36. Design and Characterization of Geotextiles for High Performance Applications, National Textile Center, Sabit Adanur (PI) and 5 other researchers from 4 universities; amount: \$ 915,000.00; Auburn's share \$ 520,000.00; duration: March 1, 1994 - April 30, 1998.
37. A New Military Fabric with Flame Resistance Properties; US Army Natick R&D and Engineering Center; PI: S. Adanur (100%), \$ 40,000.00; 24 months, Dec. 1995 - Dec. 97.
38. Fingerprinting and Backward Quality Projection in Textile Products, PIs: Y. Elmogahzy (leader), R. Broughton, S. Adanur, Y. Gawayed (Auburn), S. Jayaraman (Ga Tech), M. Suh, W. Oxenham, J. Woo, J. Rust (NC State), E. Backe (ITT), \$ 540,000.00, Dr. Adanur's share: \$ 40,000.00, National Textile Center, Duration: 1 year, March 1, 1995 - February 28, 1996.
39. Textile Structural Composites Laboratory, National Science Foundation, Instrumentation and Laboratory Improvement (ILI) Award, \$ 87,185.00 (42.5% NSF, 42.5 % Auburn cost share, 15% Private Industry Contribution), PI: S. Adanur (95%), Co-PIs: W. Walsh, R. Walker, B. Jang, 30 months, September 1, 94 - August 31, 96 (See 4.A.5).
40. Textile Structures for Composites: Stitch Bonded Laminar Composites, National Textile Center, \$ 2,310,000 for 4 universities; Auburn's share \$ 223,656.00, PI: S. Adanur (50 %), Yasser Gawayed (50%), March 1, 1993 - February 28, 1996.
41. Wellington Sears Handbook of Industrial Textiles, Wellington Sears Company, Valley, AL, PI: Sabit Adanur (100%), \$ 60,000.00, October 1, 1993-March 15, 1995.
42. Design of a Braiding Machine to Produce Wide, Flat Woven Structures at a Significantly Increased Production Rate, PIs: R. Walker (leader), R., Broughton, S. Adanur, D. Beale, M. Nelms, National Textile Center, \$ 570,000.00, Adanur's share: \$ 90,000.00, March 92 - February 94.

4.B.9 Description of the Scholarly Program

The objectives of my research program are to design, fabricate, test and analyze high-performance polymeric materials, fibrous structures and composites in order to improve overall performance; to develop new, innovative products and manufacturing processes and to reduce the total cost of high-performance materials production.

As part of this plan, I have started new research programs in textile structural composites, nanocomposites, extrusion, injection molding, geotextiles, paper machine clothing, medical textiles, safety and protective materials, transportation materials, and nanomaterials in the department. Funding for several research projects has been secured from a variety of sources including National Science Foundation (NSF), US Army, National Textile Center (NTC) and private industry. A lab for high performance fibrous structures has been established in the department. The lab is equipped with state-of-the-art equipment for both research and teaching. The research results are being disseminated in national and international platforms as indicated in this document.

I am implementing an integrated design/fabrication/analysis/testing research program for high performance polymers, fibers, fabrics, composites, nanocomposites and plastics. The outline of my research program includes development of new structures, computer aided design and modeling, analysis, testing and database development. The research plan is aimed at increasing our understanding of the manufacturing, processing and performance of high-performance fibrous structures. This research program requires a multi-disciplinary background in mechanics, materials, physics, fibers, polymers, textile technology, heat transfer, computers and programming which are my

expertise areas. I will continue to interact with other faculty and cooperate closely with other laboratories in local and regional universities.

My research group at Auburn University is recognized nationally and internationally in high performance polymeric, fibrous and composite structures. We are frequently invited to give lectures, seminars and papers in national and international organizations. We conduct both fundamental and applied research; in either case, we do original, state of the art research. Fundamental research expands our knowledge and contributes to the literature database. Fundamental research for the sake of doing research is not much use unless it is used in design, development, manufacturing and application of a useful product or process. Therefore, in every chance, I try to apply the knowledge gained from the fundamental work to a practical application. This is used to solve the current and emerging problems of the industry. Fundamental and theoretical research should be confirmed with experimental and real-life data whenever possible.

Graduate students are an important part of my research program. One of my goals is to develop an understanding and appreciation of research in my graduate students. Moreover, I strongly encourage my undergraduate students to take part in graduate research projects and I give them that opportunity whenever possible. I supported several undergraduate students to conduct research at Auburn through NSF REU program. I encourage and require team work strongly among my students while allowing each one to develop his/her own research personality, creativity and analytical thinking method. I have transferred several graduate research procedures into undergraduate courses.

I believe that research is essential to the future of Auburn University along with teaching and extension. Although, they may have been perfected in the industry, almost every major invention started at the universities. I incorporate my research findings into the classroom teaching promptly. A curriculum that is not continuously fed with new research findings may become stagnant. Research should not be done for the sake of doing research; it should be focused with a goal in mind while keeping an open eye for possible surprising developments along the way.

4.C21

Short Courses / Workshops / Seminars (presenter's name is in *Italic*)

1. *Adanur, S.*, Composite Materials, Short course given to Boy Scouts at Merit Badge University, March 2, 2013, Auburn University.
2. *Adanur, S.*, "Higher Education in Alabama", Panelist and presenter in "Workshop: Restructuring of Higher Education in Turkey, Problems and Solutions", Marmara University, Istanbul, Turkey, 6 July 2012.
3. *Adanur, S.*, Composite Materials, Short course given to Boy Scouts at Merit Badge University, March 3, 2012, Auburn University.
4. *Adanur, S.*, Composite Materials, Short course given to Boy Scouts at Merit Badge University, March 5, 2011, Auburn University.
5. *Adanur, S.*, Composite Materials, Short course given to Boy Scouts at Merit Badge University, March 6, 2010, Auburn University.
6. *Adanur, S.*, Composite Materials, Short course given to Boy Scouts at Merit Badge University, March 7, 2009, Auburn University.
7. *Adanur, S.*, Composite Materials, Short course given to Boy Scouts at Merit Badge University, March 17, 2007, Auburn University.
8. *Adanur, S., and Isikel, L.*, Fuel cell research at PFE, presentation and demonstration given to Civil Air Patrol students, July 17, 2006, Auburn.
9. *Adanur, S., and Demir, A.*, Manufacturing of Industrial Textiles, Workshop given to Hassan Textile Inc., Istanbul, Turkey, July 20, 1999.
10. *Adanur, S.*, "Manufacturing of Geotextiles", 5th NSF/IFAI Professor Training Course for Geosynthetics, AU Engineering Extension Service, Auburn, AL, August 9-14, 1998 (also, gave an instructional tour of the Geotextiles and Fabric Formation labs to the course participants).
11. *Adanur, S.*, "Wide World of Industrial Textiles", Seminar given to the faculty of the Department of Textile Science, University of Port Elizabeth, Port Elizabeth, South Africa, June 8, 1998.

12. *Adanur, S.*, "Testing of Technical Textiles", Industrial Textiles Short Course, Clemson University, January 28-29, 1998, Clemson, SC.
13. *Adanur, S.*, "Textile Research Update", presented at the Georgia Association of Family and Consumer Sciences District K Meeting, Tuesday, Nov. 11, 1997, Columbus, GA.
14. *Adanur, S.*, and Broughton, R. M., "Manufacturing, Properties and Testing of Geotextiles", AU-IFAI (Industrial Fabrics Association International) Educate the Educators Short Course, July 20-25, 1997, Auburn, AL (also, gave an instructional tour of the Geotextiles and Fabric Formation labs to the course participants).
15. *Adanur, S.*, and Hou, Z., "Recycling of Coated Fabrics", Workshop on Added Value Reclamation of Solid Waste, NSF EPSCoR, July 22-23, 1997, Auburn, AL.
16. *Adanur, S.* (90%), and *Mohamed, M. H.* (10%), "Manufacturing of Industrial Textiles", US-Egypt Workshop on Manufacturing Technologies, Dec. 6-9, 1996, Alexandria, Egypt.
17. Prepared the Weaving and Knitting sessions for the short course Introduction to Textiles for Industry Professionals (ITIP-96), May 14-15, 1996 (cancelled).
18. *Adanur, S.*, "Overview of Industrial Textile Applications", Industrial Fabrics Association International (IFAI) Tutorial "Textiles Used in Structural Composites", 41st International SAMPE Symposium and Exhibition, March 24-28, 1996, Anaheim, CA.
19. *Adanur, S.*, "ISO 9000", Total Quality Management in the Textile Industry (SPC & Quality Engineering), Quality Tech, March 20-22, 1996, Pine Mountain, GA.
20. *Adanur, S.* (70%), and Broughton, R. M. (30%), "Manufacturing, Properties and Testing of Geotextiles", AU-IFAI (Industrial Fabrics Association International) Educate the Educators Short Course, July 7-12, 1996, Auburn, AL (also, gave an instructional tour of the Geotextiles and Fabric Formation labs to the course participants).
21. *Adanur, S.* (50%) and Walker, R. P. (50%), "Yarn Preparation for Weaving in the Future (Yarn Preparation for the Second Loom)", the 33rd Annual Textile Slashing Short Course, September 20-22, 1993, Auburn University, AL.; enrollment: 81.

Technical Sessions Developed/Chaired

1. Session 103 Chair, 15th International Fiber and Polymer Research Symposium (15th ULPAS), Izmir Bakircay University, Turkey, November 8-9, 2024.
2. International Istanbul Textile Congress 2013, Session: New Materials, Room 3, May 30-31, 2013, 13.40-15.40, Istanbul, Turkey.
3. Session 202: Composites, Techtextil North America Symposium, Wednesday, April 2, 2008, 8:30 a.m. - 11:00 a.m., Atlanta, GA.
4. Session 3 (afternoon session) at the First Istanbul International Textile and Textile Machinery Congress, June 2, 2006, Istanbul, Turkey.
5. Session 4, 2nd International Technical Textiles Congress, Istanbul, Turkey, 13-15 July 2005.
6. Session TC-1: Computational Mechanics, 1.45 pm – 3.15 pm, Tuesday, August 17, 2004, SECTAM XXII, Twenty Second Southeastern Conference on Theoretical and Applied Mechanics, August 15-17, 2004, Tuskegee University, Tuskegee, AL.
7. Session 4a, NANO 4, 7.20 pm-10.00 pm, Monday August 9, 2004, ICCE-11, 11th Annual International Conference on Composites/Nano Engineering, Hilton Head, SC, August 8-14, 2004.
8. Session 203 Paper Making Fabrics, Techtextil Symposium North America, March 13-15, 2001, Atlanta, Georgia. Developed and chaired the session with 5 speakers.
9. ICCE/5, Fifth International Conference on Composites Engineering, Session 7a, Textile I, 3.40 pm-6.00 pm, July 5-11, 1998, Las Vegas, NV.
10. ICAPC-97, International Conference on Advanced Polymer Composites, Materials, Processing and Applications, Session 2, Mechanics of Composite Materials (I), Beijing University of Aeronautics and Astronautics, Beijing, China, June 3-5, 1997.

11. ICCE/4, Fourth International Conference on Composites Engineering, Session 16c, Textile V, 8.00 am-11.00 am, July 6-12, 1997, Big Island of Hawaii.
12. The Fiber Society, Fall 1996 General Technical Conference, Session IV: Marine Applications of Textiles, Wednesday, Oct. 16, 1996, Newport, Rhode Island.
13. ICCE/3 Third International Conference on Composites Engineering, July 21-26, 1996, New Orleans, LA. Session 12b, July 25, 96, 3.45 pm-5.45 pm, Textile Composites III, Adanur, S., and Wang, Y.
14. ICCE/2 Second International Conference on Composites Engineering, August 21-24, 1995, New Orleans, LA.
 - Session 4d, Aug. 22, 1995, 10.10 am-12.10 pm, Textiles: 3D structures.
 - Session 5d, Aug. 22, 1995, 1.20 pm - 3.20 pm, Textiles: Applications.
 - Session 9d, Aug. 23, 1995, 3.35 pm-5.35 pm, Textiles: Analysis.
15. Paper Machine Clothing: Materials and Technologies. Third International Hi-Tech Textiles Exhibition & Conference, June 21-22, 1994, Greenville, SC. Planned and organized the presentation topics and found five speakers.

Workshops Attended

1. Attended the ITM Texpo Euroasia 2013, in Istanbul, Turkey, May 29, 2013.
2. Composite Manufacturing Workshop, March 30-31, 2005, Auburn, AL.

Editorships

1. Area Editor and Editorial Board Member, "Yenilikçi Mühendislik ve Doğa Bilimleri" Journal, Türkiye (November 2024 – present).
2. Member of the Editorial Board for Journal of Industrial Textiles, Sage Publications (Jan. 2000 - present).
3. Member of the Editorial Board for the Electronic Journal of Textiles (August 2002 – 2010)
4. Member of the Editorial Board for the POLITEKNIK (Turkish/English), (Dec. 2004-2009).
5. Member of the Editorial Board for the Electronic Journal of Textiles (August 2002 – 2009).
6. Member of the Editorial Board for Journal of Coated Fabrics, Technomic Publishing, Co., Inc., Lancaster, PA, (January 1998 – Jan. 2000).
7. Member of the editorial board for Textile and Technique which is a specialized monthly textile magazine published in Turkey (Turkish/English), 1993-2003.

4.D. SERVICE

Department, College and University Service Work

1. Member, AU Master Plan Committee, Fall 2025-present.
2. ME Undergraduate Curriculum Committee, Fall 2022-present.
3. Founding faculty advisor for AU Chess Club, August 2020 – present.
4. Mechanical Engineering Senator for AU Faculty Senate, June 2020 – June 2024, August 2025 - present.
5. Member of the Academic Standards Committee, August 2020 – 2023.
6. Member of the Student Conduct Committee, August 2020 – 2023.
7. Member of the Academic Honesty Committee, Aug. 2019 – Aug. 2022.
8. Member of the Patent and Invention Disclosure Committee, Aug. 2017 - Aug. 2020.
9. Chair of the Academic Computing Committee, Aug. 2019 - Aug. 2020 (member Aug. 2017 - Aug. 2020).
10. Member of the Faculty Salaries and Welfare Committee, Aug. 2015 – Aug. 2018.
11. Prepared and submitted SACS Assessment Reports for PFEN Masters and Ph.D. programs, June 2017.
12. Prepared and submitted SLO7 report for SACS, 20 November 2014.
13. Member of the Calendar and Schedules Committee, Aug. 2014 – Aug. 2017.
14. Member of the Academic Program Review Committee, Aug. 2013-Aug. 2016.
15. Prepared and submitted SACS Assessment Reports for TE/PFEN B.S., M.S. and Ph.D. programs, 2011-2017.

16. ABET Coordinator for the TE/PFEN department, 1992-2016. Successfully got ABET accreditation in 1998 (first time ever), 2004 and 2010. Prepared the Termination Report in 2016.
17. Participated in the AU Strategic Planning Focus Group sponsored by the Office of the Provost, 19 March 2013.
18. Member of the Academic Standards Committee, Aug. 2012-Aug. 2015.
19. Member of the Post Tenure Review Committee, Aug. 2012-Aug. 2015.
20. Prepared the 2011 SACS assessment reports for PFEN B.S., M.S., and Ph.D. programs, Jan.-Feb. 2012.
21. Member of the PFEN faculty search committee, Aug. 2011- Aug. 2012.
22. Member of the Faculty Handbook Review Committee, Aug. 2011-Aug. 2014.
23. Member of the Faculty Dismissal Committee, Aug. 2010-Aug. 2013.
24. Mentor - AU Early Career Faculty Mentoring Program, Sept. 2009-present.
25. Chair of the AU Faculty Grievance Committee, Aug. 2009-Aug. 2010.
26. Member of the Student Discipline Committee, Aug. 2009-Aug. 2012
27. Hosted TALON exhibit for incoming engineering freshman with Julia Freeman at the AU Hotel and Conference Center, Feb. 18, 2008.
28. Member of the new PFEN PhD Program Committee, Apr. 2008-present.
29. Member of the AU Faculty Grievance Committee, Nov. 2007-May 2009.
30. Member of the PFEN Faculty Search Committee (Chair: Dr. Buschle-Diller), Aug. 2007-Apr. 2008.
31. Member of the CoE Graduate Student Recruiting Committee (appointed by the Dean), Chair of the Best Practices Subcommittee, March. 2007-present (unofficially started Fall semester 2006).
32. Chair of the PFEN Faculty Search Committee, Fall 2006-Spring 2007.
33. Member of the Alumni Engineering Research Award Committee (meeting held on March 10, 2008).
34. Responsible for the polymer processing equipment purchase (visited University of Akron, Oct. 2006).
35. Chair of the AU Student Academic Grievance Committee, Jan. 2006-Aug. 2008.
36. Member of the AU Student Academic Grievance Committee, Aug. 2005- Dec. 2005.
37. Member of the AU Academic Honesty Committee, 2003-2006.
38. Member of the Alumni Professorship Committee, 2002-2005.
39. Member of the Budget Advisory Committee, Feb. 2003-2005.
40. Graduate Faculty (reappointed November 2002)
41. Member of the Ginn Professorship Selection Committee, 2002.
42. Member of the Engineering Faculty Council (EFC), 2002-2205.
43. Member of the AU Diversity Leadership Council, May 2002-2004.
44. TE Department Futures Committee Member, 2001.
45. Mentoring Committee member for Dr. Aliecia McClain, Assistant Professor. February 2001- 2004.
46. Member of the AU Senate Research Grant-in-Aid Committee, Fall 2000- Fall 2003.
47. Member of the Textile Engineering Department Head Search Committee, 1999-2000.
48. Member of the College of Engineering Freshman Computing Initiative (FCI) Committee (1999-2000)
49. National Textile Center (NTC) Site Director for Department of Textile Engineering (June 1998 to October 2001). Responsible for the overall coordination of NTC proposals, projects and budgets for the Textile Engineering Department.
50. Chairman of the Textile Engineering Curriculum Committee (1993-2000).

51. Coordinated the Semester Transition activities for TXEN, TXCH, TXMT, TXTS and ITAS programs. Prepared/edited the departmental semester transition package (162-page document)
52. College of Engineering Priorities Task Force Member (1998). Participated in two task force teams: one in research and one in teaching.
53. Member of the College of Engineering Curriculum Committee (1993 to 2016).
54. Chairman of the Textile Engineering Award Committee. The committee nominated Pat Smith and Paul Brady for the Spirit of Excellence Award which they won (1992-2000).
55. Member of the new PhD program in Integrated Textiles and Apparel (ITAS) preparation committee (1994 - 1998).
56. Member of the three new faculty and two new technician search committees in Textile Engineering (1994-2000).
57. Participated in the 1994-1995 and 1995-96 Faculty/Student Mentor Program
58. Honorary Member of the Phi Psi Textile Fraternity.
59. Freshmen scholarship interviewer (1993-2000)

Professional Society Activities

1. Member of the TASSA (Turkish-American Scientists and Scholars Association) Interim Council, 2004-2006.
2. Member, Industrial Fabrics Association International (IFAI) Safety & Protective Products Division, 2003-2010.
3. Chair of the American Society of Mechanical Engineers-Textile Engineering Division, ASME-TED (2000-2001). Attended the ASME Technical Executives Committee (TEC) meeting in New York, NY, November 2001.
4. Vice-Chair of the American Society of Mechanical Engineers-Textile Engineering Division, ASME-TED (1998-2000). Attended the ASME Technical Executives Committee (TEC) meeting in Houston, TX, March 3-5, 2000.
5. Newsletter Editor of the American Society of Mechanical Engineers-Textile Engineering Division, ASME-TED (1995-present). Prepared and published the ASME Textile Engineering Division Newsletter - Fall 1996 issue.
6. Secretary-Treasurer of the American Society of Mechanical Engineers-Textile Engineering Division, ASME-TED (1995-1997).
7. Program Chairman of the American Society of Mechanical Engineers (ASME), Chattahoochee Section (1995-96)
8. Secretary of the American Society of Mechanical Engineers (ASME), Chattahoochee Section (1994-95).
9. Treasurer of the American Society of Mechanical Engineers (ASME), Chattahoochee Section (1993-94).
10. Member of the American Society of Mechanical Engineers-Textile Engineering Division (ASME-TED) Revitalization Task Force. There has been a lack of enough activity in recent years in TED and the objective of the Task Force is to retain Textile Engineering as an active ASME technical division (1994 - 1995).

Membership

- American Society of Mechanical Engineers (ASME)
- Technical Association for the Pulp and Paper Industry (TAPPI)
- Manufacture Alabama
- Honorary member of the Phi Psi Textile Fraternity

Proposals Reviewed:

1. National Science Foundation, Future Manufacturing Seed Grants (FMSG) - Polymers, reviewed 5 proposals and attended online panel meetings, July 2-3, 2024.
2. National Science Foundation, SBIR Phase I, Proposal # 2304234, Reviewed 23 June 2023.
3. Reviewed 4 AU internal proposals for the NSF MRI program, 11 August 2023.
4. National Science Foundation, STTR Phase I. Reviewed 3 proposals online, Sept. 2, 2021.
5. National Science Foundation, CMMI-FM Future Manufacturing Program. Reviewed 3 multi-million dollar, 4-year proposals, 25 June 2021. Attended 2-day online panel on June 30-July 1, 2021.
6. National Science Foundation, SBIR/STTR Program (reviewed 5 proposals), Sept. 11, 2020.
7. National Science Foundation FMSG Materials and Construction Virtual Panel, 6 proposals reviewed out of 17 (panelist for others), July 27-28, 2020, Zoom Meeting.
8. National Science Foundation SBIR/STTR Program (reviewed 4 proposals), Oct. 10-11, 2019.
9. National Science Foundation SBIR/STTR Program (reviewed 4 proposals), March 11-12, 2019.
10. NSF Panelist for Nanomanufacturing Proposals (Panel #: P100737), Dec. 14, 2009, Arlington, VA. Reviewer/Lead/Scribe for 8 proposals, Panelist for 26 proposals.
11. Panelist for NSF SBIR-STTR Program, Aug. 23, 2007, National Science Foundation, Arlington, VA.
12. NSF Proposal No. 0242891 entitled "Human Powered Wearable Computers" by Hechmi Hamouda and Warren J. Jasper, November 2002.
13. Proposal No: INT-9811022, National Science Foundation, PI: C. L. Smith, North Carolina State University, June 1998.
14. Reviewer for the National Textile Center Proposals (Fabrication Competency), 1998-2001.
15. Visited National Science Foundation on Nov. 4, 1999 as a panel reviewer of 15 CAREER proposals.

Reviewing for Journals:

Textile Research Journal, Journal of Elastomers and Plastics, International Composites Engineering Journal, Journal of Cotton Science, Journal of the Textile Institute (England). More than 100 articles have been reviewed to date.

Other:

1. Judge for Engineering Orientation (ENGR 1100) Shark Tank Projects (5 projects judged), 16 April 2024.
2. Judge for SGCoE Capstone Design Showcase (6 poster presentations judged), 4 April 2024.
3. Judge for AU GERS 3M Research Presentations (5 presentations judged), 12 October 2023.
4. Judge for the MECH-MATL Graduate Student Research Poster Competition, 1 October 2023 (8 posters).
5. Judge for AU Student Research Symposium, March 28, 2023 (judged 4 oral presentations).
6. Judge, 2021 Graduate Engineering Research Showcase, 28 October 2021 (6 posters).
7. Judge for the ME Graduate Student Poster Competition, 25 Sept. 2022 (7 posters).
8. Judge, AU Research 2021 Student Symposium, 31 March 2021, (4 online presentations).
9. Judge, College of Engineering FiveInFive Graduate Student Presentations (4 online presentations), 28 October 2020.
10. Judge, 2020 Virtual Auburn Student Research Symposium (6 posters), 1 May 2020.
11. Judge for Three Minute Thesis (3MT), Auburn University, 24 October 2019.
12. Judge for ME Conference Graduate Student Poster Session, 15 Sept. 2019.
13. Judge, Auburn Research Student Symposium, 9 April 2019.
14. Judge for AU SG Graduate Engineering Research Showcase, 24 October 2018.
15. Judge for AU This is Research Student Symposium, Biomedical Health (Oral Presentations), 26 March 2018.
16. Judge for ME Conference Graduate Student Poster Session, 30 Sept. 2018.
17. Gave a presentation about the education opportunities in the U.S.A. to a group of university students in Istanbul, Turkey, July 16, 2018.

18. Judge for AU This is Research Student Symposium, Biomedical Health (Oral Presentations), 26 March 2018.
19. Judge for Graduate Student Poster Contest at ME Conference, 17 September 2017.
20. Prepared and submitted SACS Assessment Reports for PFEN Masters and Ph.D. programs, June 2017.
21. Judge for two proposals submitted to UTIB International R&D Brokerage Event, 27-28 April 2017, Bursa, Turkey (14 April 2017).
22. Judge for AU This is Research Student Symposium, 13 April 2017.
23. Judge, "2017 Finish in 5 Competition", AU SG College of Engineering Graduate Students (CEGS), 22 March 2017.
24. Judge, AU SG College of Engineering, Graduate Engineering Research Showcase, 20 October 2016.
25. Judge for AU This is Research Student Symposium, 13 April 2016.
26. Judge for several proposals submitted to UTIB International R&D Brokerage Event, 12-13 May 2016, Bursa, Turkey.
27. Judge for AU SG College of Engineering Fall 2015 Graduate Engineering Research Showcase, 22 October 2015.
28. Judge for eight proposals submitted to UTIB International R&D Brokerage Event, 27-29 May 2015, Bursa, Turkey.
29. Judge for oral session; This is Research: Student Symposium 2015, Auburn University, 13 April 2015.
30. Feb. 27, 2015; gave polymer processing lab tours during the E-day.
31. Judge, Fall 2014 Graduate Engineering Research Showcase, Auburn University, Oct. 23, 2014.
32. Judge for the "Turkey Innovation Week", Dec. 6-8, 2012, Istanbul, Turkey. Judged 10 proposals.
33. Recommendation letter for promotion of a professor at an NTC University, December 2004.
34. Member of the Fiber Society Award Committee, 2011- 2013.
35. Member of the Scientific Committee for the International Congress of Innovative Textiles, ICONTEX2011, 20-22 October 2011, Tekirdag, Turkey. Reviewed manuscripts for acceptance to the conference.
36. Gave the commencement speech at Marmara University, College of Engineering Graduation Ceremony, Istanbul, Turkey, 6 July 2011.
37. Presented the NTC booth, 1.00-5.00 pm, Techtextil North America Symposium, April 2, 2008, Atlanta, GA.
38. Helped with the Engineering Technologies Academy for Civil Air Patrol cadets, July 8-12, 2003, Auburn University.
39. Organized the AU Textile Engineering booth for the Techtextil North America International Trade Fair for Technical Textiles and Nonwovens, March 23-25, 2000, Atlanta, GA.
40. Gave a lecture to Prof. Richard Penaskovic's class RELG 0304 – Western Religions on June 1, 1999.
41. Attended the Milliken Summer Challenge University/Industry Programs (1997 and 1998).
42. Served as judge in the Industrial Fabrics Association International (IFAI)'s annual International Achievement Awards competitions (1995-2000)
43. International Advisory Board Member, International Conference on Composites Engineering (ICCE); ICCE/9 (2002 San Diego, CA), ICCE/8 (2001 Tenerife, Spain), ICCE/7 (2000, Denver, Colorado), ICCE/6 (1999, Florida Resort, FL), ICCE/5 (1998, Las Vegas, NV), ICCE/4 (1997, Big Island of Hawaii).
44. Reviewer of Proposals for National Science Foundation (NSF)
45. Attended the workshop "Integrating Design into the Engineering Curriculum", which was offered by the Southern Methodist University, in Dallas, TX on March 19-21, 1998. This was part of ABET preparation activities.
46. "Two-man, Three Season, Double Walled Tent for the US Marine Corps Systems Command (MARCORSYSCOM)". Proposal prepared on behalf of National Apparel, Inc., of Montgomery, AL for the US Marine Corps. Project Total: \$ 18,750,000.00; 150 pages, July 97.
47. Gave a presentation to Alabama Congressional Delegation on Geotextiles, May 9, 1997.
48. Prepared and presented the AU Textile Engineering booth during the 3rd International High-Tech Textiles Conference, Greenville, SC, June 94.
49. Prepared and presented the AU Textile Engineering booth during the 2nd International High-Tech Textiles Conference, Greenville, SC, July 93.

Companies and Organizations Served

Some of the work was done on a no charge bases. Inquiries varied; some visits, some by analysis and transmittal of samples and/or data, some literature search, technical reports, patent infringement cases, testimonies, expert witness, trials, etc. The following list does not include companies that I served through the phone.

- 3Tex, Raleigh, NC. Analysis of McGinley System.
- A-Carb LLC
- Alexander Shunnarah
- Allied Signal, Medical Textiles, Virginia.
- Amoco Fabrics and Fibers Company, Bainbridge, GA.
- Asten Forming Fabrics, Appleton, WI.
- AU Vet. School, testing of ligaments on Instron, Sept. 29-Oct. 3, 1995.
- Berry Plastics
- Best Fabrics
- Bo-Tex Sales Corporation, Hogansville, GA. Recycling.
- Bruin Plastics Co. Recycling.
- C. M. Offray & Son, Inc. Recycling.
- Clark Schwebel, Inc. 3D weaving.
- Commissariat A L'energie Atomique and Aerospatiale of France. Composite research.
- Continental AG
- Cooley Inc. Recycling.
- Cordis Corp.
- Deerfield Specialty Papers, Inc., Augusta, GA on wear of forming fabrics.
- Development and testing of "Hail no Hail" fabric for Marks & Flinn of Montgomery, AL, 1994.
- DeWayne Layfield
- Doran Textiles, Shelby, NC. Mr. Reuben Bond on 'Team Weaving' concept. (6.5.93)
- Dority-Manning
- Eastern Technologies
- Eaton Corp, Milwaukee, Woven and knit reinforcements for composites
- Emory University, Atlanta, GA. Polymeric stents.
- Environmental Technical Services. Recycling.
- EverCare Co.
- Flexol Packaging
- Gallery Co.
- Hanon Systems
- Hassan Textile Inc., Istanbul, Turkey.
- Hoechst Celanese, Mr. Dan Cain, Spartanburg, SC on developing a warp knitted structure using elastomeric monofilament fiber.
- Howard Rubenstein
- HSN
- Hunting rope testing for Alexander Shunnarah
- Illinois Tool Works
- Industrial Fabrics Association International (IFAI). Recycling.
- Industrial Textile Associates, Greer, SC. Analysis of a rayon fabric carbonized after weaving.
- InterVascular

- John Boyle & Co., Inc. Recycling.
- Johnston Composite Reinforcements, Inc., Phenix City, AL. Process improvement.
- Johnston Industries, Utilization Plant, Valley, AL. Fibrograph.
- KilpatrickStockton
- Kimberly Clark
- Kinedyne Corporation, Prettvile, AL.
- Lindsay Wire, Florence, MS. Mr. Ton Rietzelt on Jacquard Weaving (6.30.93)
- Maples Industries
- Mesa Associates.
- Milliken
- Milliken & Company, Specialty Industrial Business, LaGrange, GA. Geotextiles, composites.
- Mr. Les Letlow
- N. V. Bekaert S. A., Belgium.
- National Apparel, Inc., Montgomery, AL. Combat tent.
- Nollapelli
- North Carolina State University, College of Textiles. Consultant for the Air-Jet Loom Simulator.
- Novus
- NSF Panelist
- PE Technikon and CSIR of South Africa. Textile Engineering education and research.
- Seattle Textile Company, Seattle, WA, on testing of PVC coated polyester sheeting designed for use in flame resistant, coated fabric type hose.
- Shakespeare Monofilament, Columbia, SC. Development of Forming Fabric, 1994.
- Softbelly's
- Southern Mills
- Startex, Spartanburg, SC. Recycling of coated fabrics.
- State of Maine/AAAS
- Sulzer-Ruti, Inc., Spartanburg, SC. Forming fabrics.
- SulzerTextil.
- Textrade.com
- TrustForte Corporation.
- Twitchell Corporation, Dothan, AL. Weaving.
- Tyco Industries, AL.
- U.S. CRDF Science Center
- Unsa, Istanbul, Turkey.
- US Geotextiles, Opelika, AL., Evaluation of ultrasonic seams of geotextiles.
- Weblon, Inc. Recycling.
- Wellington Sears Co., Valley, AL.
- Zyvex Corporation

Community Service

1. Soccer coach, U13G, Auburn Parks and Recreation Department, Fall 2013 season
2. Soccer coach, U13G, Auburn Parks and Recreation Department, Spring 2013 season
3. Soccer coach, U13G, Auburn Parks and Recreation Department, Fall 2012 season
4. Soccer coach, U10G, Auburn Parks and Recreation Department, Spring 2012season
5. Participated at the Spring Fling, Yarbrough Elementary School, Apr. 29, 2011

6. Soccer coach, U10G, Auburn Parks and Recreation Department, Spring 2011 season
7. Soccer coach, U16, Auburn Parks and Recreation Department, Fall 2010 season
8. Soccer coach, U16, Auburn Parks and Recreation Department, Fall 2009 season
9. Gave a tour of the Polymer Processing lab to Drake Middle School 6th graders Cosmic Cat team, Spring 2009.
10. Chaperon for AU Explore field trip of Yarbrough Elementary School 5th graders, Apr. 25, 2008, 8.30-13.30.
11. Soccer Coach for U13 Boys, Auburn Parks and Recreation Department, Fall 2007.
12. Soccer Coach for U6 coed team, Auburn Parks and Recreation Department, Spring 2007 and Fall 2007.
13. Attended the ‘football throwing’ booth at Yarbrough Elementary School’s “Spring Fling”, 28 April 2006.
14. Gave a seminar about Polymer and Fiber Engineering to Mrs. Fleming’s 5th grade class at Yarbrough Elementary School, Thursday, April 27, 2006.
15. Soccer Coach for U10 and U13 Boys, Auburn Parks and Recreation Department, Spring 2006, Fall 2006, Spring 2007.
16. Soccer Coach for U10 and U13 Boys, Auburn Parks and Recreation Department, Spring 2005 and Fall 2005.
17. Participated at the Yarbrough Elementary School WinterFest, Feb. 25, 2005.
18. Soccer Coach for U8 Boys, Auburn Parks and Recreation Department, Fall 2004
19. President of the Auburn Ministerial Association (AMA) 2003-2004, member since 2002.
20. Seminar given at the Leadership Alabama Retreat: “Religion: Does it Unite or Divide?”, Tuskegee University Chapel, Jan. 30, 2004.
21. Participated in home building for Habitat for Humanity (2002-present)
22. Participated in Community Market activities (2003-present)
23. Presentation made at the Interfaith Community Service of Thanksgiving, Nov. 21, 2000, Auburn University Chapel.
24. Gave 5 seminars/tours to Auburn City School students between 1994 to 2000.
25. Member of the United Way of Lee County, Campus Division, Campaign pilot program, 1996-present.
26. Certified soccer coach for Under 6, Under 8, Under 10 and Under 13 years old kids, Auburn Parks and Recreation Department, 1993-present.
27. Gave a lab tour to AU Child Study Center Preschool Class, January 19, 2000.

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APPENDIX B (LIST OF MATERIALS CONSIDERED) APPENDIX B (LIST OF MATERIALS CONSIDERED)

Exhibit No.	Description
1001	U.S. Patent No. 11,041,262 (“’262” or “’262 patent”)
1002	File History of U.S. Patent No. 11,041,262 (“’262FH”)
1004	U.S. Patent Publication No. 2010/0154256 (“Dua”)
1005	U.S. Patent No. 6,931,762 (“’762” or “’762 patent”)
1006	U.S. Patent No. 6,910,288 (“’288”)
1007	Alan J. Flusser, <i>Clothes and the Man: The Principles of Fine Men’s Dress</i> (1985) (“Flusser”)
1008	U.S. Patent No. 7,949,570 (“Litke”)
1009	U.S. Patent Pub. No. 2014/0237856 (“Podhajny”)
1010	U.S. Patent Pub. No. 2014/0109286 (“Blakely”)
1011	U.S. Patent No. 10,327,511 (“’511” or “’511 patent”)
1012	File History of U.S. Patent No. 10,327,511 (“’511FH”)
1013	Reserved
1014	Reserved
1015	U.S. Patent No. 8,028,440
1016	U.S. Patent Pub. 2015/0313316
1017	U.S. Patent Pub. 2013/0260104
1018	Complaint for Patent Infringement in <i>Cole Haan LLC v. Top Glory Trading Group Inc. et al.</i> , 2:25-cv-00176 (D.N.J.)
1019	<i>Man-Made Fiber and Textile Dictionary</i> , (4th ed. Issued 1978, Reprinted 1983)
1020	Wingate, <i>Fairchild’s Dictionary of Textiles</i> (6th ed. 1979)

Exhibit No.	Description
1021	H. Stoll GmbH & Co, <i>Stoll Training: Manual Flat Knitting Machine</i> (2013)
1022	American & Efird, <i>Footwear Glossary: Shoe Construction Terminology</i> , available at https://www.amefird.com/wp-content/uploads/2010/01/2Footwear-Glossary-Shoe-Construction-03-08-08.pdf (2008)
1023	David J. Spencer, <i>Knitting Technology: A Comprehensive Handbook and Practical Guide</i> (3rd ed. 2001)
1024	Wonseok Choi, <i>Three Dimensional Seamless Garment Knitting on V-Bed Flat Knitting Machines</i> , 4 J. Textile and Apparel, Tech. and Mgmt., 1-33 (2005)
1026	Hong et al., <i>The Development of 3D Shaped Knitted Fabrics For Technical Purposes on a Flat Knitting Machine</i> , 19 Indian Journal of Fibre & Textile Research, 189-94 (September 1994)
1027	Lewis et al., <i>A Machine Knitter's Guide To Creating Fabrics</i> (1986)
1028	<i>Complete Textile Glossary</i> (Celanese Acetate 2001)
1029	U.S. Patent No. 1,803,554
1030	U.S. Patent No. 1,841,518
1031	U.S. Patent No. 2,675,631
1032	U.S. Patent No. 5,345,638
1033	U.S. Patent No. 2,440,393
1034	U.S. Patent No. 2,147,197
1035	U.S. Patent No. 2,400,692
1036	Reserved
1037	European Patent No. 1338690A1
1038	A. W. Koester, <i>Fashion Terms: Apparel Fabric Glossary</i> (1992)
1039	Sabit Adanur, <i>Wellington Sears Handbook of Industrial Textiles</i> (Johnston Industries Group 1995)

Exhibit No.	Description
1040	D. Ann Gioello, <i>Understanding Fabrics: From Fiber to Finished Cloth</i> (1982)
1041	Cammy Sessa, “Clothes and the Man” by Flusser, <i>The Virginian-Pilot</i> , Sept. 7, 1995, at 37, available at: https://pilotonline.newsbank.com/signup?docref=doc/image/v2%253A146D908D09F2E7FE%2540NGPA-VAVP-1811A5D2D47F25A0%25402449968-18109F1A6F5E4F71%254036-18109F1A6F5E4F71%2540
1042	Phyllis G. Tortora, <i>Understanding Textiles</i> 344 (4th ed. 1992)
1043	Jess Power, <i>Functional to Fashionable: Knitwear's Evolution Throughout the Last Century and into the Millennium</i> , 5 J. Textile and Apparel, Tech. and Mgmt. 1-16 (2006)
1044	<i>Advances in Knitting Technology</i> (K.F. Au ed. 2011)
1045	William Morrow, <i>Best Sellers for Winter</i> , <i>Publishers Weekly</i> , Sept. 20, 1985, at 97
1046	Alan J. Flusser, <i>Getting a Solid Footing</i> , <i>The New York Times Magazine</i> , Sept. 13, 1981, § 6, at 98, available at: https://www.nytimes.com/1981/09/13/magazine/getting-a-solid-footing.html
1047	Alan Flusser, <i>Dressing the Man</i> , 188-208, HarperCollins, 2002
1048	Michael Gross, <i>Dressing by the Books: Getting the Word to Men</i> , <i>The New York Times</i> , Oct. 19, 1985, § 1, at 52, available at: https://www.nytimes.com/1985/10/19/style/dressing-by-the-books-getting-the-word-to-men.html
1049	Internet Archive Capture dated October 12, 1985, of “Clothes and The Man; The Principles of Fine Men’s Dress”, available at: https://web.archive.org/web/20150105224030/http://www.amazon.com:80/Clothes-Man-Principles-Fine-Dress/dp/0394546237
1051	<i>Spandex Technology</i> (1965)
1052	Pointelle, <i>Merriam-Webster’s Collegiate Dictionary</i> (10th ed. 2001)
1053	Pointelle, <i>The Oxford American College Dictionary</i> (2002)
1054	U.S. Patent No. D905,386