

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SKECHERS U.S.A., INC.
Petitioner,

v.

NIKE, INC.,
Patent Owner.

U.S. Patent No. 9,918,511

DECLARATION OF DR. SABIT ADANUR

I declare under penalty of perjury under the laws of the United States of America that all statements made here are true and correct, 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 or Title 18 of the United States Code.

Date: 6 November 2024



Dr. Sabit Adanur

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DECLARATION OF SABIT ADANUR, PH. D

I, Sabit Adanur, do hereby declare as follows:

I. INTRODUCTION

1. I have been retained on behalf of Skechers U.S.A., Inc. (“Skechers” or “Petitioner”) as an expert to provide my opinions about the state of the art of the technology described in U.S. Patent No. 9,918,511 (“the ’511 patent”) (EX1001) and on the patentability of claims 1-20 of the ’511 patent.

2. I understand that Skechers will submit this declaration (“Declaration”) in connection with an *inter partes* review (IPR) proceeding before the Patent Trial and Appeal Board.

3. I receive compensation at my normal consulting rate of \$300.00 per hour for my time working on this matter, plus expenses. My compensation is not contingent on the outcome of this matter or the specifics of my testimony.

4. All “EX10XX” cites here are to exhibits I understand will be submitted by the Petitioner in this Proceeding. All “Appendix _” cites followed by a letter are to appendices to this Declaration. All citations to “Section XX” are internal citations to the sections of this Declaration. All citations to “Paragraph XX” are internal citations to the paragraphs of this Declaration.

II. BACKGROUND AND QUALIFICATIONS

5. I received a Bachelor of Science (BS) degree in Mechanical Engineering from Istanbul Technical University, Istanbul, Turkey, in 1982, and a Master of Science (MS) degree in Textile Engineering and Science and a Doctor of Philosophy (PhD) degree in Fiber and Polymer Science from North Carolina State University in 1985 and 1989, respectively.

6. In 1992, I joined the faculty of Auburn University in Auburn, Alabama, and am now a Professor in the Mechanical Engineering Department.

7. Over the past 35 years, my work has focused on research in manufacturing, testing, and analysis of fabrics, fabric structures and materials, and textile machinery.

8. 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 5320/6320/6970D01), and Manufacturing of Polymeric Structures (MECH5520/6520-PFEN 6200).

9. To date, 9 individuals have received their Ph.D. degree in Mechanical Engineering, Polymer & Fiber Engineering (PFEN), or Textile Engineering under my supervision.

10. I have authored or co-authored more than 80 scientific publications. I have also authored several books, including:

- Paper Machine Clothing (2d ed.) (AstenJohnson, Inc., December 2017, 1st Edition 1997)
- Handbook of Weaving (Technomic Publishing Co., Inc., 2001)
- Wellington Sears Handbook of Industrial Textiles (Technomic Publishing Co., Inc., 1995)

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

12. 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.

13. 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.

III. MATERIALS CONSIDERED

14. My opinions are based on my years of education, research and experience, as well as my investigation and study of relevant materials. In forming my opinions, I have considered the materials I identify in this report.

15. I may rely upon these materials and/or additional materials to respond to arguments raised by the Patent Owner. I may also consider additional documents and information in forming any necessary opinions — including documents that may not yet have been provided to me.

16. My analysis of the materials produced in this matter is ongoing and I will continue to review any new material as it is provided.

IV. LEGAL STANDARDS

17. In expressing my opinions and considering the subject matter of the claims of the '511 Patent, I am relying upon certain basic legal principles that have been explained to me.

18. I understand the information that is used to evaluate whether an invention is new and not obvious is generally referred to as “prior art” and generally includes patents and printed publications (e.g., books, journal publications, articles on websites, product manuals, etc.).

19. I understand that in this proceeding the Petitioner has the burden of proving that the claims of the '511 patent are anticipated by or obvious from the

prior art by a preponderance of the evidence. I understand that “a preponderance of the evidence” is evidence sufficient to show that a fact is more likely true than it is not.

20. I understand that there are two ways in which prior art may render a patent claim unpatentable. First, the prior art can be shown to “anticipate” the claim. Second, the prior art can be shown to have made the claim “obvious” to a person of ordinary skill in the art. My understanding of the two legal standards is set forth below.

A. Anticipation

21. I understand that the following standards govern the determination of whether a patent claim is “anticipated” by the prior art.

22. I understand that the “prior art” includes patents and printed publications that existed before the earliest filing date (the “effective filing date”) of the claim in the patent. I also understand that a patent will be considered prior art if it was filed before the effective filing date of the claimed invention, while a printed publication will be considered prior art if it was publicly available before that date.

23. I understand that, for a patent claim to be “anticipated” by the prior art, each and every requirement of the claim must be found, expressly or inherently, in a single prior art reference as recited in the claim. I understand that claim limitations that are not expressly described in a prior art reference may still be there if they are

“inherent” to the thing or process being described in the prior art. For example, an indication in a prior art reference that a particular process complies with a published standard would indicate that the process must inherently perform certain steps or use certain data structures that are necessary to comply with the published standard.

24. I understand that if a reference incorporates other documents by reference, the incorporating reference and the incorporated reference(s) should be treated as a single prior art reference for purposes of analyzing anticipation.

25. I understand that it is acceptable to consider evidence other than the information in a particular prior art document to determine if a feature is necessarily present in or inherently described by that reference.

B. Obviousness

26. I understand that a patent claim is unpatentable if the subject matter of the claim as a whole would have been obvious to a person of ordinary skill in the art of the claimed subject matter, as of the time of the invention at issue.

27. I understand that the following factors must be evaluated to determine whether the claimed subject matter is obvious: (1) the scope and content of the prior art; (2) the difference or differences, if any, between each claim of the patent and the prior art; (3) the level of ordinary skill in the art at the time the patent was filed, and (4) whatever objective factors indicating obviousness or non-obviousness may be present in any particular case.

28. I understand the objective factors indicating obviousness or non-obviousness may include: commercial success of products covered by the patent claims; satisfying a long-felt need for the invention; failed attempts by others to make the invention; copying of the invention by others in the field; unexpected results achieved by the invention; praise of the invention by those in the field; the taking of licenses under the patent by others; expressions of surprise by experts and those skilled in the art at the making of the invention; and the patentee proceeded contrary to the accepted wisdom of the prior art. I also understand that any of this evidence must be specifically connected to the invention rather than being associated with the prior art or with marketing or other efforts to promote an invention. I am not presently aware of any evidence of “objective factors” suggesting the claimed inventions are not obvious, and reserve my right to address any such evidence if it is identified in the future.

29. In addition, I understand that the obviousness inquiry should not be done in hindsight, but must be done using the perspective of a person of ordinary skill in the relevant art as of the effective filing date of the patent claim.

30. I have been informed and understand that a patent claim can be considered to have been obvious even if all the requirements of a claim are not found in a single prior art reference. Specifically, I have been informed and understand that the teachings of two or more references may be combined if such a combination

would have been obvious to one having ordinary skill in the art. In determining whether a combination based on multiple references would have been obvious, it is appropriate to consider, among other factors: (1) whether the teachings of the prior art references disclose known concepts combined in familiar ways, and when combined, would yield predictable results; (2) whether a person of ordinary skill in the art could implement such a combination, and would see the benefit of doing so; (3) whether the claimed elements represent one of a limited number of known design choices, and would have a reasonable expectation of success by those skilled in the art (*see In re Rice*, 341 F.2d 309, 314 (CCPA 1965)); (4) whether a person of ordinary skill would have recognized a reason to combine known elements in the manner described in the claim; (5) whether there is some teaching or suggestion in the prior art to make the modification or combination of elements claimed in the patent; and (6) whether the claimed invention applies a known technique that had been used to improve a similar device or method in a similar way.

31. I understand the combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results. I also understand that an example of a solution in one field of endeavor may make that solution obvious in another related field. I also understand that market demands or design considerations may prompt variations of a prior art system or process,

either in the same field or a different one, and that these variations will ordinarily be considered obvious variations of what has been described in the prior art.

32. I also understand that if a person of ordinary skill can implement a predictable variation, that variation would have been considered obvious. I understand that for similar reasons, if a technique has been used to improve one product, and a person of ordinary skill in the art would recognize that it would improve similar products in the same way, using that technique to improve the other products would have been obvious unless its actual application yields unexpected results or challenges in implementation.

33. I understand that the obviousness analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, but instead can take account of the “ordinary innovation” and experimentation that does no more than yield predictable results, which are inferences and creative steps that a person of ordinary skill in the art would employ.

34. I understand that sometimes it will be necessary to look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art. I understand that all these issues may be considered to determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue.

35. I understand that a person of ordinary skill attempting to solve a problem will not be led only to those elements of prior art designed to solve the same problem. I understand that steps suggested by common sense are important and should be considered. 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. As such, the prior art considered can be directed to any need or problem known in the field of endeavor as of the priority date of the patent and can provide a reason for combining the elements of the prior art in the manner claimed. In other words, the prior art does not need to be directed towards solving the same problem that is addressed in the patent. Further, the individual prior art references themselves need not all be directed towards solving the same problem.

36. I understand that an invention that might be considered an obvious variation or modification of the prior art may be considered non-obvious if one or more prior art references discourage or lead away from the line of inquiry disclosed in the reference(s). A reference does not “teach away” from an invention simply because the reference suggests that another embodiment of the invention is better or preferred. My understanding of the doctrine of teaching away requires a clear indication that the combination should not be attempted (e.g., because it would not work or explicit statements saying the combination should not be made).

37. I understand that a person of ordinary skill is also a person of ordinary creativity.

38. I further understand that in many fields, it may be that there is little discussion of obvious techniques or combination, and it often may be the case that market demand, rather than scientific literature or knowledge, will drive design trends. When there is such a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within their technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense. In that instance, the fact that a combination was obvious to try might show that it was obvious. The fact that a particular combination of prior art elements was “obvious to try” may indicate that the combination was obvious even if no one attempted the combination. If the combination was obvious to try (regardless of whether it was actually tried) or leads to anticipated success, then it is likely the result of ordinary skill and common sense rather than innovation.

39. I have been informed and understand that in considering obviousness, it is important not to determine obviousness using the benefit of hindsight derived from the patent being considered.

40. I have been informed and understand that where there is a reason to modify or combine the prior art to achieve the claimed invention, the claims may be

rejected as prima facie obvious provided there is also a reasonable expectation of success.

C. Claim Construction

41. I have been instructed and advised by counsel on the law and general principles relevant to claim construction. I have applied these principles to the facts set forth in this declaration in rendering my opinions.

42. I understand that claims are interpreted from the perspective of a person of ordinary skill in the art (“POSA” or “POSITA”) at the time of the invention. I understand that claim construction is a matter of law, but that in the process of determining the meaning of a claim term, the Board has to inquire into how a POSITA would have understood the claim term at the time of the invention.

43. I understand that the words of a claim are generally given their ordinary and customary meaning to a POSITA at the time of the invention, to the extent such a meaning exists.

44. I understand that a POSITA is deemed to read a claim term not only in the context of the particular claim in which the term appears, but in the context of the entire patent, including the other claims, the specification, and the prosecution history, which is called the “intrinsic evidence.” I understand that claim terms must be construed in a manner consistent with the intrinsic evidence. I further understand that the specification is highly relevant to claim construction and claims are to be

read in light of the specification, except that limitations should not be imported or read into the claims from the specification.

45. I understand that a patentee may choose to be his or her own lexicographer and define a term differently from the plain and ordinary meaning of the term in the art, to the extent such a meaning exists, and that, under such circumstances, the patentee's own definition should control. Additionally, a claim term with a plain and ordinary meaning in the art may not be entitled to that meaning, when the patentee expressly disavowed the scope under such plain and ordinary meaning through descriptions in the specification or statements made during prosecution.

46. I understand that certain types of "extrinsic evidence," such as general purpose and scientific dictionaries, relevant scientific principles, references illustrating the meaning of technical terms, and the state of the art, may also be relevant to claim construction. Extrinsic evidence should not be considered, however, divorced from the context of the intrinsic evidence or used to contradict intrinsic evidence.

V. TECHNICAL BACKGROUND

A. Knitting Techniques

47. Knitting is an old technology that has been used in manufacturing apparel for centuries before the priority date of each of the asserted patents. *See*

EX1050 (Spencer), 7 (“The term ‘knitting’ dates from the mid-sixteenth century . . .”). In fact, knitting has been used, by hand or machine, specifically to make footwear no later than the 1930s. *See, e.g.*, U.S. Patent Nos. 1,803,554 (“Knilians”) (EX1051), 2,047,724 (“Zuckerman”) (EX1052), and 2,675,631 (“Doughty”) (EX1053); EX1054 (Knitwear in Fashion), 8 (hand-knitted “Hard Rope” shoe made in 1994/95 by Simone Memel); Chinese Patent Publication No. CN 2187379Y (“Li”) (EX1055; EX1056).

48. Knitting involves interlooping yarn to create a textile. *See* EX1050, 55-2 (“Knitting is the most common method of interlooping and is second only to weaving as a method of manufacturing textile products.”); EX1057 (Man-Made Fiber and Textile Dictionary), 4 (defining “KNITTING” to mean “[a] method of constructing fabric by interlocking series of loops of one or more yarns.”); EX1062, 127 (“[K]nitting involves the interlooping of one yarn system into continuously connecting vertical columns (wales) and horizontal rows (courses) of loops to form a knitted fabric structure.”). As David J. Spencer explained in his book “Knitting Technology: A Comprehensive Handbook and Practical Guide” published in 2001 (EX1050), “[i]nterlooping (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.” *Id.*, 2.

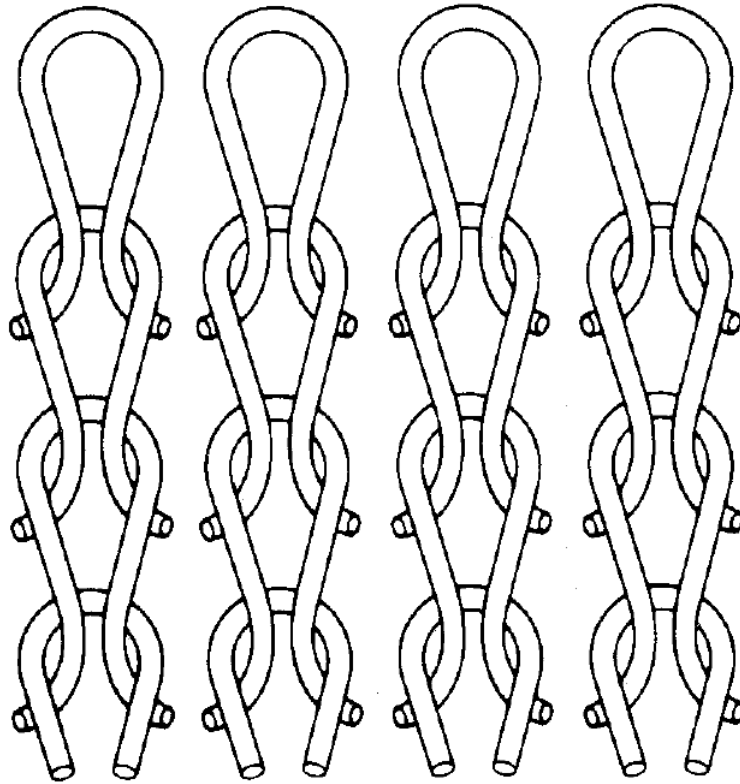


Fig. 1.3 Interlooping.

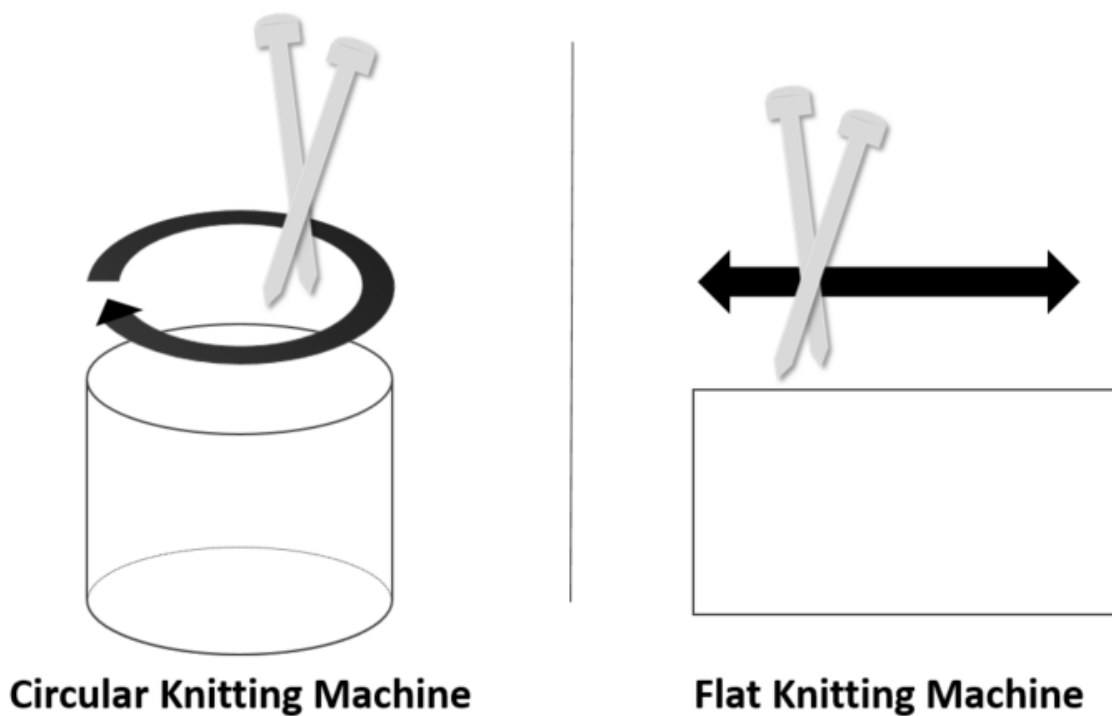
Id., 3.

49. Knitting techniques can be generally divided into two sectors: weft knitting and warp knitting. EX1057 (Man-Made Fiber and Textile Dictionary), 4 (“The two major classes of knitting are warp knitting and weft knitting[.]”); EX1062, 127. Warp knitting is a “type of knitting in which the yarns generally run lengthwise in the fabric,” whereas in weft knitting “one continuous thread runs crosswise in the fabric making all of the loops in one course.” EX1054, 4. “Weft knitting is the more diverse, widely spread and larger of the two sectors, and accounts for approximately

one quarter of the total yardage of apparel fabric compared with about one sixth for warp knitting.” EX1050 (Spencer), 49.

50. Different knitting processes can be used to make textiles with a variety of different patterns, textures, and other characteristics, such as flexibility, elasticity, strength, and thickness.

51. Two common weft knitting techniques are circular knitting and flat knitting. Circular knitting produces textiles in a continuous tube, while flat knitting produces textiles in sheets. EX1062, 128-29.



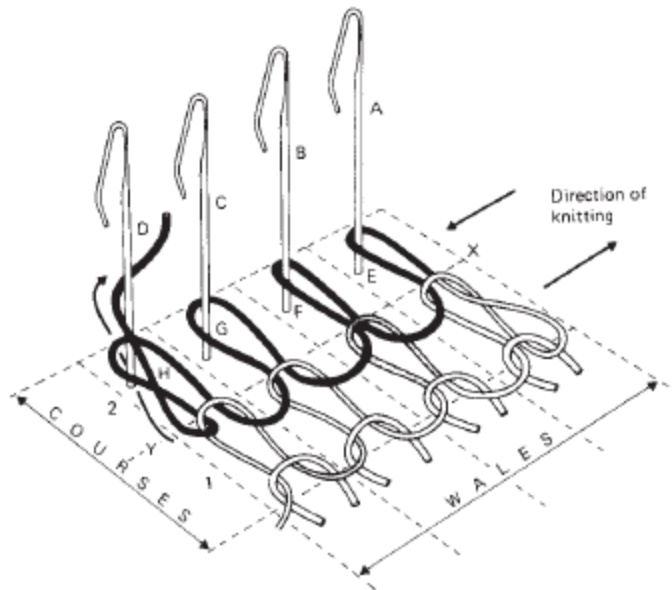


Fig. 6.1 Weft knitting.

EX1050 (Spencer), 48.

52. The use of different textures 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 contrasting or complementary textures, the shapes of the textured elements, and the locations of such textured elements, among other examples. This is also the case for using different colors or patterns in the same knit element.

53. Both techniques have been in use for more than a century for knitting garments. *See, e.g.*, EX1050 (Spencer), 207 (“The first flat bar machine (Section 8.4.2) was demonstrated in 1862 and patented in 1865 by the Rev. Isaac Wixom Lamb, an American clergyman. He later changed the arrangement to the inverted V-bed shape patented by Eisenstuck.”), 258 (“Circular machinery entered hosiery

production inauspiciously during the nineteenth century[.]”). Nowadays both techniques are being used 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. *See, e.g., id.*, 57, 102-104, 111-14, 137-38, 154-55.

54. Flat knitting can be more efficient than circular knitting in this regard. Specifically, flat knitting offers many advantages and benefits, including the flexibility of the manufacturing process, the ability to change fabric structures and forms “very fast,” the possibility of changing yarn types in the same structure, and the ability to knit to shape “without cutting waste or making-up time” and to produce complex shapes. EX1050, 379.

55. Flat knitting is particularly suitable for “integral garment knitting” or “knitting to shape,” with which garments “are knitted in one piece,” requiring “little or no seaming when they leave the knitting machine.” EX1059, 3; EX1050, 193 (explaining the “reason is that knitting to shape generally involves wale fashioning achieved by selective loop transfer to and from needles in the same bed – a technique not readily available on circular machines”).

56. Integral garment knitting techniques are particularly advantageous at least for the following reasons:

- Time saving:

Even if - depending on the actual design- the summarized knitting time for the individual components of a sweater might be less than the manufacturing of a complete sweater, the overall production time, needed to sew and finish the product, generally takes much longer. Compared to the manufacturing period required to produce, for example, a complete woman's fully fashion sweater, time savings of about 35% can be reached.

EX1058, (Melliand International (September 2003)) at 5.

- Fewer production steps:

Depending on the production organization further stages like a build up of garment components, handling and shipping of the individual parts to the making-up locations and all relevant organizational and control efforts around these stages are not required either.

Id.

- Reduction in yarn waste:

The production of complete garments is the optimal process regarding yarn consumption, since there virtually is no waste generated due to the missing cutting and sewing operations. All yarn is supposed to run into the sweater. The particular knitting

process also allows the continuous use of yarn cones and facilitates and optimizes the actual yarn processing. The volume of the yarn orders can be adapted and does not need to foresee a comprehensive excess charge.

Id.

- Positive economic advantages:

An economic evaluation of the aforementioned points indicates that due to shortened lead time the cash flow is positively activated due to an overall reduction in idle times. The streamlined process resulting in the knitting being the major production part reduces the number of personnel being involved in the manufacturing and the production control.

Further positive cost reductions are achieved by the optimized yarn consumption, minimized storage and logistic costs as well as by less expenditure for waste disposal.

Id.

- Better quality:

The decreased number of production and handling steps reduces the risk of defects and damages. As a consequence of the single piece production method, the product quality can be seen as more

constant and homogenous. This helps avoiding the damage and loss caused by defective parts.

Id.; see also EX1061 (International Textile Bulletin (May 2003)), 6 (“The latest [whole garment knitting] technology offers to the customer the promise of comfort, particularly in close fitting garments, children’s wear and underwear tops”; “The excess material which occurs in traditional knitwear can be avoided, resulting in lighter garments,” as well as “significantly lower” “material consumption and make-up costs”; “High quality stitch construction combined with the use of high quality yarns will be available to customers at more affordable prices.”).

57. Flat knitting also allows for intarsia designs to integrate “coloured areas into a cohesively-knitted structure.” EX1050, 102-104.

58. There are four primary or “base structures from which all weft knitted fabrics and garments are derived.” EX1050, 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.” *Id.* Each of these base structures may be used “in combination with another primary structure in a garment-length sequence,” though not all knitting machines can produce all types of base structures. *Id.* “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.” *Id.*, 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.” *Id.*, 52; *see also id.*, 105.

59. Because different knit stitches and combinations of stitches 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, rib stitches are “particularly suitable for the extremities of articles such as tops of socks, cuffs of sleeves, rib borders of garments, and stolling and strapping for cardigans. Rib structures are elastic, form-fitting, and retain warmth better than plain structures.” *Id.*, 68. 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. EX1062, 565-68, 575, 581-82, 586-97. These characteristics in turn affect the properties of the textile elements in which the yarns are used. As just one example, natural fibers (such as cotton and wool) are hygroscopic, meaning they are able to absorb water, whereas many man-made or synthetic fibers (such as acrylic and vinyon) are much less absorptive. *Id.*, 593.

60. Moreover, the consideration and possible use of (1) rib or stripe patterns; (2) contrasting patterns; (3) differently shaped elements in the pattern; (4) different orientations of the elements in the pattern; and (5) different locations of the elements in 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 POSITA familiar with either footwear or textiles. Indeed, rib or stripe patterns are among the simplest and most ubiquitous of a finite number of aesthetic design elements in footwear and in knit fabrics, and their use and success is predictable.

61. Moreover, flat knitting machines by the time of the alleged inventions were capable of producing multiple gauges in the same garment, which “involves a combination of techniques, including half-gauging, using different numbers of yarn ends, intarsia zoning, and blocks of different gauges of needles each working with its corresponding count of yarn and yarn carrier.” *Id.*, 234. Gauge “defines the spacing of the needles in the needle bed (usually as *needles per inch*),” such that a finer gauge results in a higher density of stitches. *Id.*, 4. Multiple gauge machines, such as those discussed below, can be used to produce a single garment with numerous patterns, each having different properties (*e.g.*, elasticity, breathability, recovery, etc.):



Fig. 19.6 Multi-gauge technique garment.

Id., 235.

62. A variety of weft knitting techniques may also be used to shape a textile element as it is knit, including “varying the number of needles in action in the knitting width,” “changing the knitting construction,” and “altering the stitch length.” *Id.*, 184; *see also id.*, 185-192. For example, “[i]n *needle selection shaping*, the selvedge needle(s) is introduced or withdrawn from the knitting width by means

of needle selection,” thus changing the width of a textile element by adding to or removing from the number of needles in operation and the number of loops (or “stitches”) formed in each row (or “course”). *Id.*, 188.

B. Knitting Machines

63. Long before the priority date of the patents, 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. EX1050 (Spencer), 18-19. Users of knitting machines can therefore manufacture textiles with a wide variety of characteristics, including patterns and textures. *See, e.g., id.*, 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[.]”).

64. Common knitting machines used no later than the early 2000s included weft knitting machines, which included flat-bed machines and circular machines, and warp knitting machines, which included tricot and raschel machines. EX1054, 26-27 (printed pages 174-175).



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].

EX1050, 137.

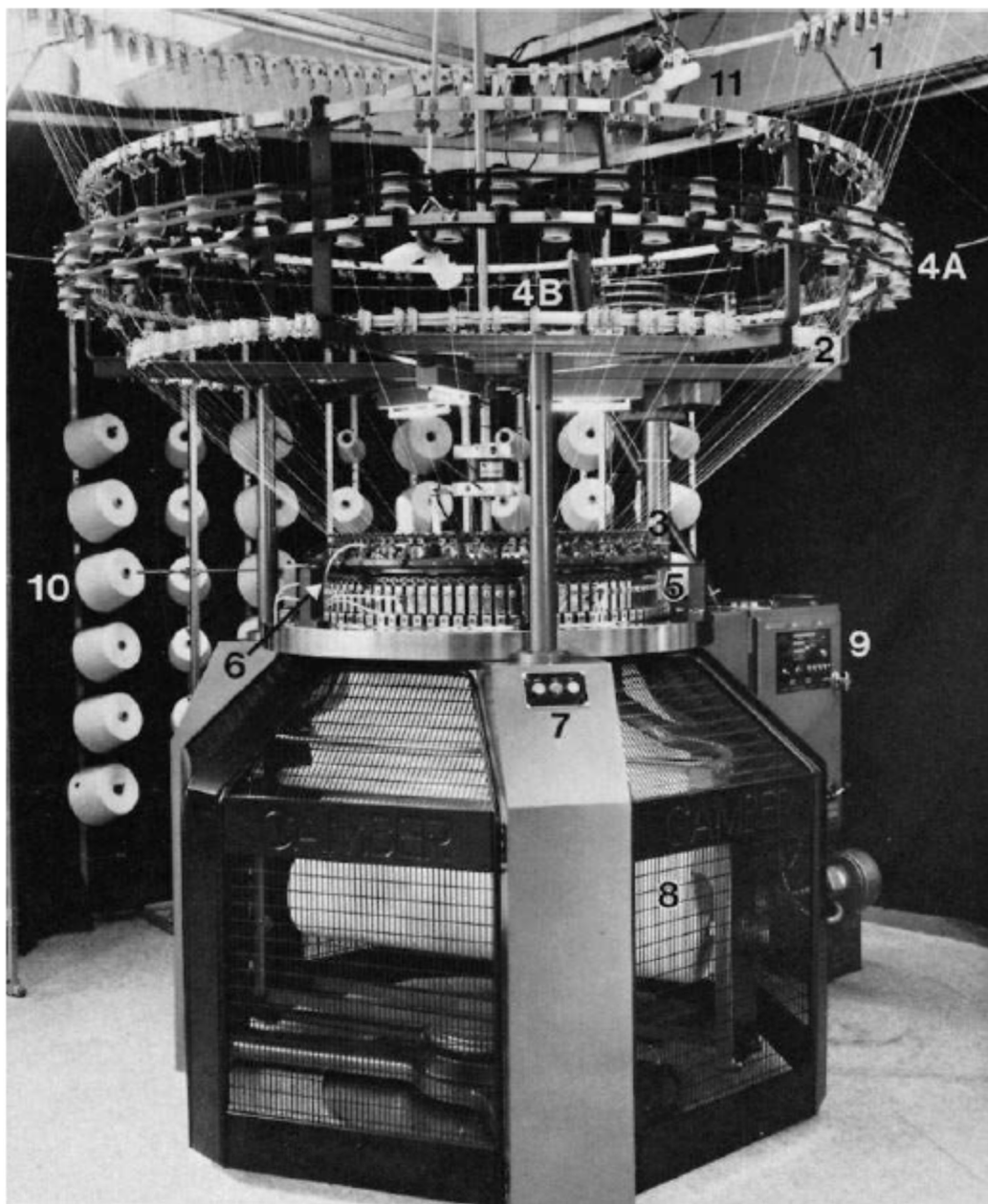


Fig. 13.12 The modern circular single jersey fabric machine.

Id., 156.

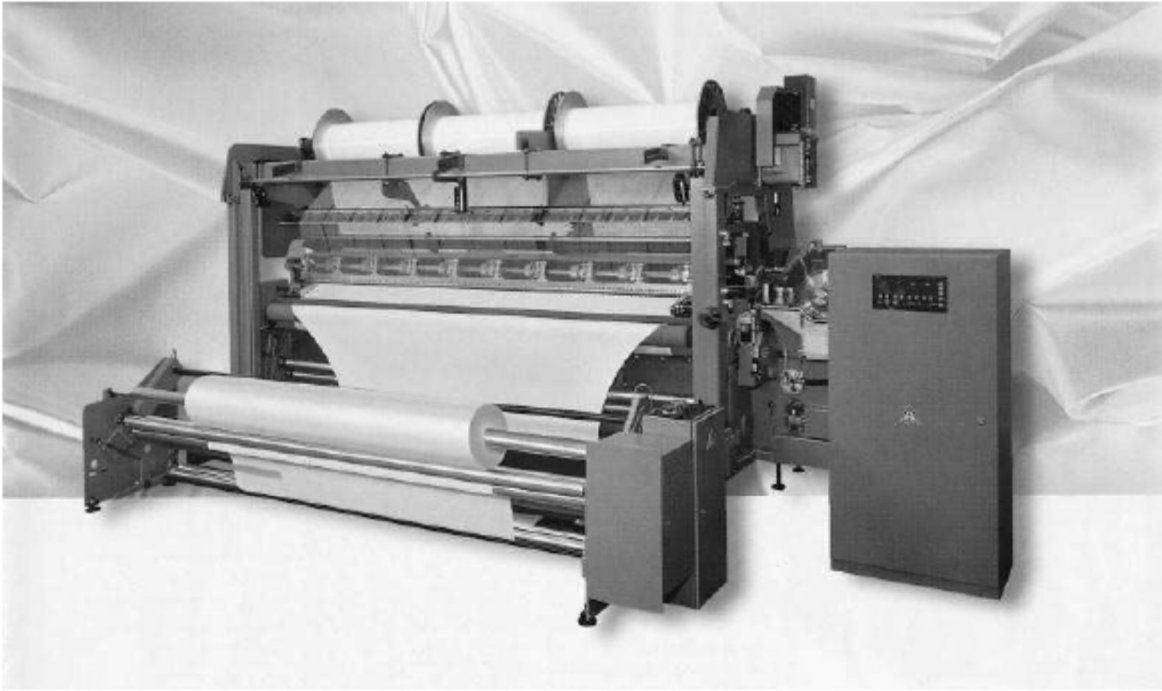


Fig. 23.2 Tricot machine HKS 2-3 [Karl Mayer].

Id., 287.

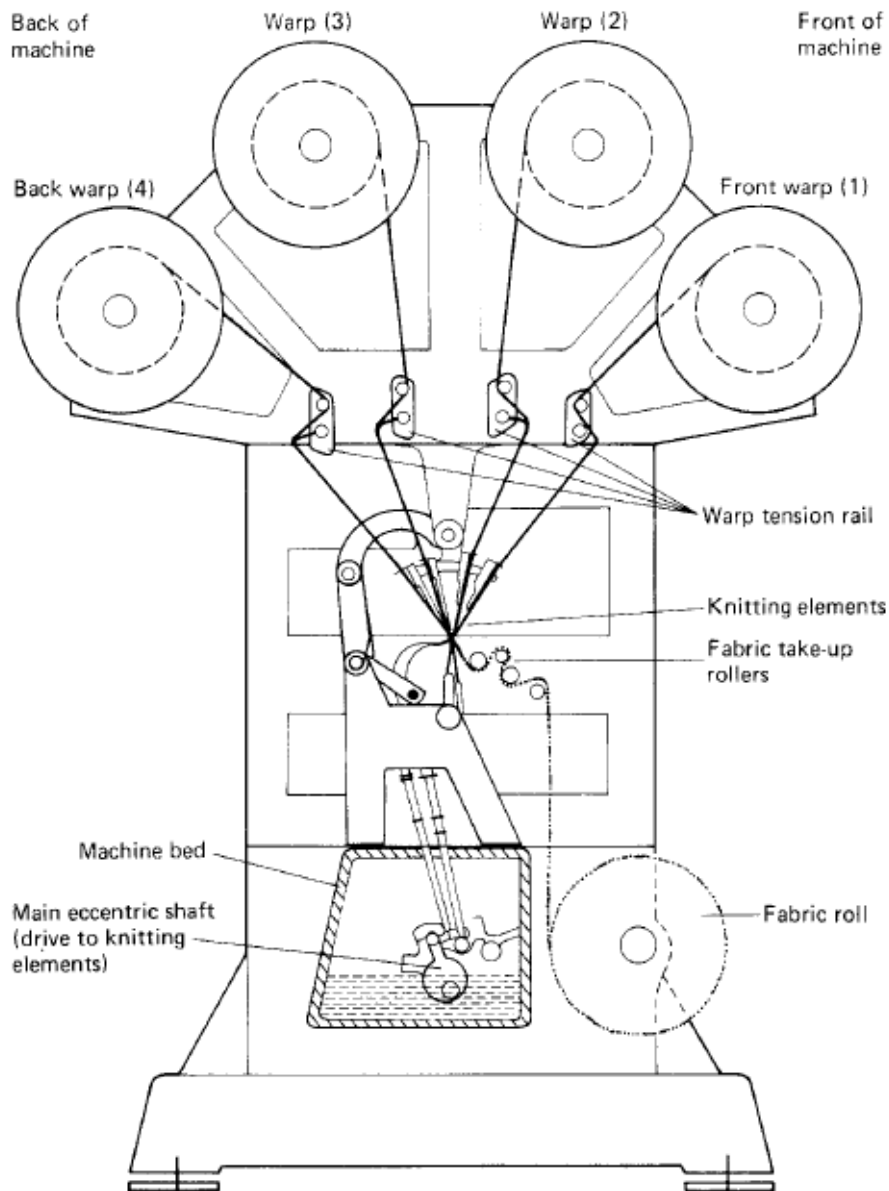


Fig. 24.5 Cross-section of a latch needle raschel machine [Reprinted by permission of *Knitting Times*, official publication of the NKSA in the USA].

Id., 303.

65. As discussed above, flat knitting is particularly suitable for integral and complete garment knitting. At least two flat knitting machine manufacturers, H. Stoll GmbH & Co. and Shima Seiki Manufacturing, Ltd., had “developed machinery for integral garment knitting” by 2003. *See* EX1054, 30 (printed page 178); *see also*

EX1050, 234 (“Stoll ready-to-wear integrates many of the laborious and time-consuming making-up processes into the knitting process; for example, pockets, button-hole panels, facings, overlapping collars, bows, and loops.”), 237-38 (“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.”); EX1059, 3-5 (“If ITMA 1995 in Paris witnessed the dawn of commercial complete garment knitting, then IKME 2003, held during October in Milan was the venue where this exciting technology really did come of age.... Shima Seiki ... exhibited its trademark WholeGarment machines in four different needlebed configurations New from Stoll at IKME was the CMS 330 TC Knit & Wear machine.”); EX1060, 4 (“Completed knitted (‘Whole-Garment’ knit and wear) or fully fashioned products were running on most machines” from “the leading flat knitting machinery manufacturers at IKME – Shima Seiki (J), Stoll (D), Steiger (CH), Universal (D) Protti (I).”).

66. These innovative integral knitting machines offered great potential for both fashion designers and knitwear manufacturers. The machines not only resulted in “yarn material saving” and reduction in “making-up operations,” but “allow[ed] the completely knitted garment to appear visually as a whole – a new creation dimension for the designer.” EX1060, 4.

C. The Use of Flat Knitting to Create Footwear and Textiles Having Strips With Different Properties Was Well-Known In The Art

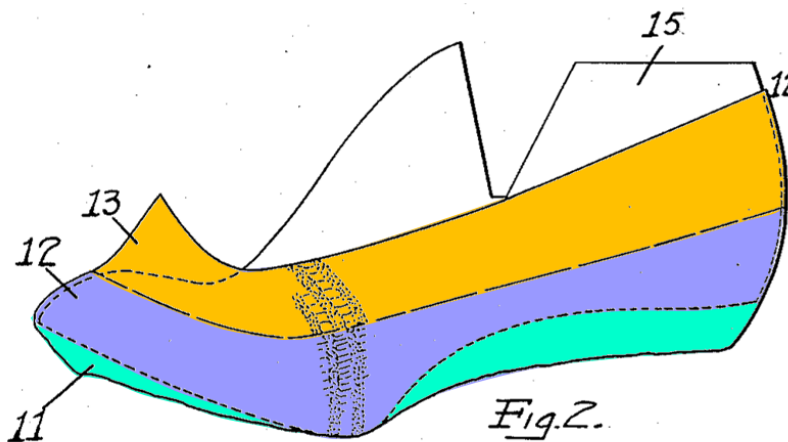
67. Knitting machines have been in use for the manufacture of textiles for centuries. For example, the stocking frame, which “laid the foundations for today’s weft and warp knitting and machine lace industries,” was invented in 1589. EX1050 (Spencer), 9. As I discussed above, by the critical date of the ’511 patent in the early 2000s, machine manufacturers including Shima Seiki, Santoni, Simplex, Milanese, Stoll, and Karl Meyer had commercially available tricot, raschel, flat bar, straight bar, and circular knitting machines on the market. *See id.*, 174; EX1001, 7:22-51.

68. Both circular and flat knitting machine techniques are described in the ’511 patent. *Id.*, *see also* 10:30-36. These techniques have both been used to create a single textile element, or workpiece, to avoid the extra labor and expense associated with stitching together multiple elements, and both of these techniques can be used to manufacture footwear. *See, e.g.*, EX1016 (“Herbert”), 2:5-15. As I explained above in Section V.A, flat knitting can be more efficient than circular knitting in certain regards. *See* EX1050 (Spencer), 379 (“[A]dvantages of flat knitting are...[the p]ossibility of knitting to shape”). “[F]lat knitting can be used to provide textile structures for use in footwear uppers of a final desired shape such that textile cutting steps can be avoided (which eliminates waste, avoids the need to finish cut edges, saves time, saves money, etc.).” EX1021, 4:51-55.

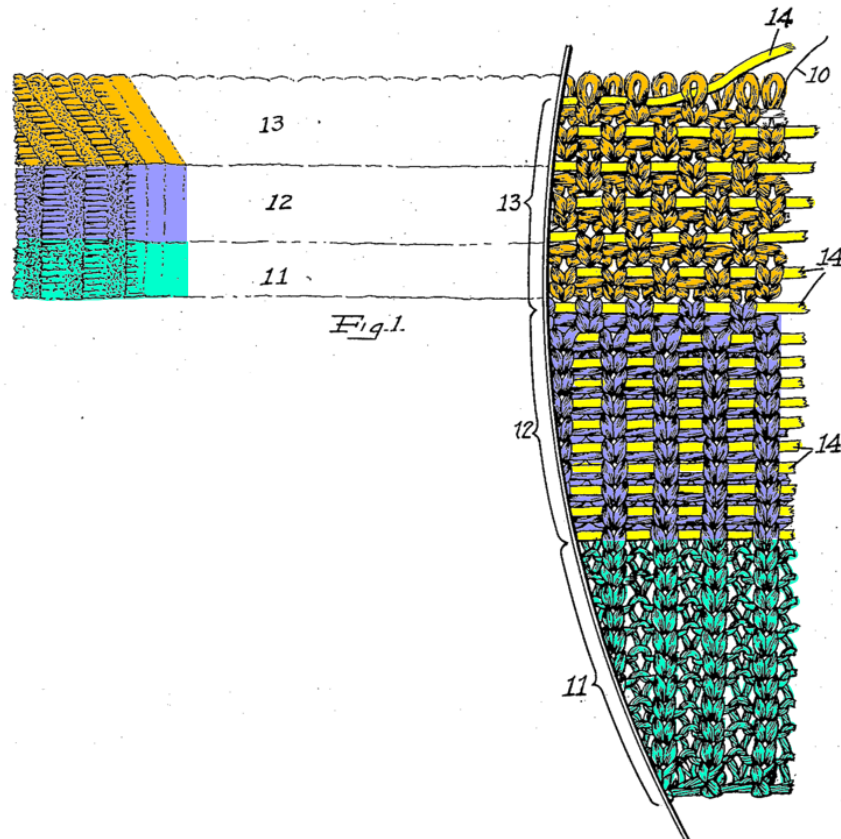
69. In particular, flat knitting techniques can produce flat knit edges, including curved edges, when, for example, knitting a textile element to shape. Knitting to shape in this way eliminates any need to cut a textile element from surrounding textile structure that would be present in a textile element that has not been knit to shape. *See* EX1050 (Spencer), 45 (“A *selvedged fabric* is one having a ‘*self-edge*’ to it and can only be produced on a straight machine whose yarn carrier reciprocates backwards and forwards across the needle bed...”), 83 (“Shaping of flat garment panels is either in the form of cut edges or in the form of knitted selvedges (in the case of reciprocating knitting on a flat machine).”). Such techniques are employed to further an industry goal of reducing waste in knitting processes. For example, European Patent Application EP 1,338,690 A1 (EX1014 (“Cusinato”)), discussed in further detail below, explains that the invention’s “aim is to obtain a fabric in one piece from which it is possible to directly make the stocking or footwear,” which serves the purpose of “avoiding waste,” as well as avoiding drawbacks in prior approaches that do not knit textiles to shape. EX1014, [0007]-[0013]; *see also* EX1050 (Spencer), 185 (The advantages of flat knitting include that “[t]he firm, fashioned selvedge edges can be . . . seamed together, without the need for cutting . . . involving loss of expensive fabric”). As Spencer and Cusinato both show, and as I explain in detail below, flat knit textile elements can be knit so that one or more edges are curved.

70. As discussed above, knitting technologies can create textile elements with a plurality of knit strips adjacent to one another. These strips may each have different textures, stitches, yarns, or other properties. These designs are ubiquitous in textiles generally and in footwear. Indeed, knit strips are among the oldest and simplest of all machine-knitted patterns. Such strips may be created through the use of different knit constructions or structures (*i.e.*, stitches) using the same yarn, which forms strips with different textures, patterns, or other characteristics like elasticity, thickness, or strength. Knit strips may also be created using different yarns in the same knit structure to form strips with varying levels of elasticity, strength, biodegradability, moisture absorption, insulation, durability, and hydrophobicity, among other characteristics.

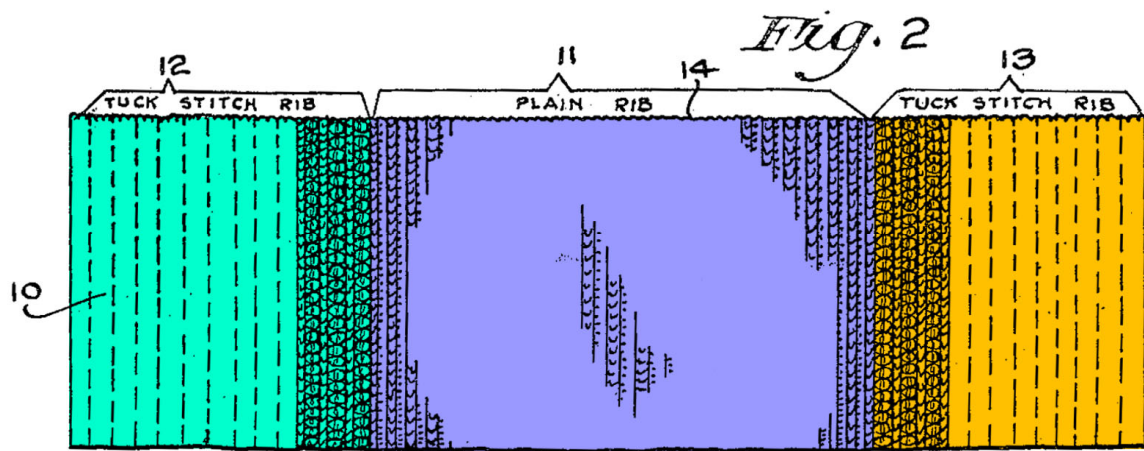
71. For example, U.S. Patent No. 2,440,393 (“Clark”) depicts an “upper” for an article of footwear (a shoe). EX1015, 1:18-25. Clark’s upper is made of a “knitted fabric,” *id.*, 3:14-17, and has three sections, as shown in the annotated version of Figure 2, below (section 11 in green, section 12 in purple, section 13 in orange). These sections run longitudinally along the upper, and form knit strips.



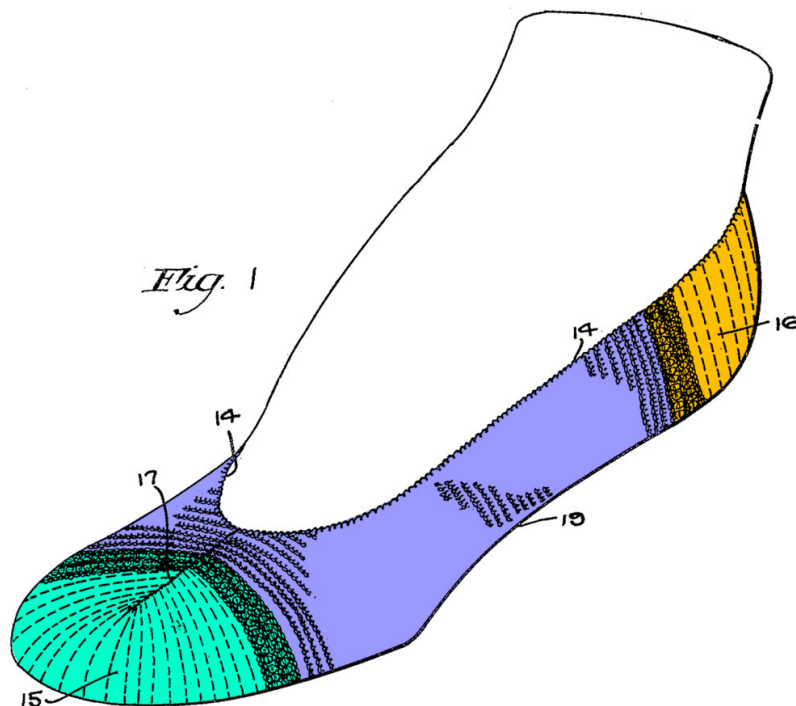
72. Clark's Figure 1, which also shows an annotated version of sections 11, 12, and 13, demonstrates that each of these sections has different properties. For example, different yarns are used in different sections: vinyon 14 (yellow) is used in sections 12 (purple) and 13 (orange), but not in section 11 (green). Clark's sections also include various textures, stitches, and levels of elasticity. *See, e.g.,* EX1015, 3:1-54.



73. As another example, U.S. Patent No. 2,400,692 (EX1016 (“Herbert”)), which was filed in 1943 and issued in 1946, discloses a “seamless knitted fabric,” *id.*, 1:36, that may be formed with a “plain rib” strip (11) (purple) and “tuck stitch rib” strips (12 and 13) (green and orange, respectively), each with different textures, stitches, and levels of elasticity, as shown in Figure 2 of that patent:



74. This workpiece is assembled into a “slipper foot covering,” which is shown in an annotated version of Figure 1, below, with a strip of “plain ribs” (purple) between two strips of “tuck stitch ribs” (green and orange). As Figure 1 demonstrates, this results in a knit strip of “plain ribs” situated between two differently textured ribs formed of “tuck stitch ribs.”



75. Finally, wide ribs, which are familiar to any person of skill in the art of knitting, can themselves form alternating strips of different textures and/or knit stitches. As one example, I have provided below an image of a ribbed, knitted sweater which comprises strips having various textures and stitches, exemplifying knitting concepts that were generally known in the art. *See supra* Section V.A-V.B. Such designs are and have been well-known and commonplace:



EX1019, 1. As another example, the sock below also shows a wide rib pattern:



76. The construction of wide rib knits, which comprise knit strips of various textures and stitches, is described in Spencer and was well-known in the art. *See, e.g.* EX1050 (Spencer), 103, 186, 193; *infra* Section VII.C. Furthermore, as I will discuss in detail below, it was well-known in the art at the time of the '511 patent's invention to create adjacent knitted strips having a variety of textures or other properties, and knitting machines at the time of the invention (the early 2000s) were readily capable of being programmed to manufacture knitted textile elements with these patterns and variations.

VI. THE '511 PATENT

A. Effective Filing Date

77. The application that resulted in the '511 patent (EX1001) is U.S. Patent Application Serial No. 15/664,587, filed on July 31, 2017. The '511 patent claims priority back to U.S. Patent No. 7,347,011, filed on March 3, 2004. All of the prior art that I rely upon below predates March 2004, and thus, for now, I assume that the claims of the '511 patent have an effective filing date of March 3, 2004, regardless of whether there is actually support in the provisional application for all of the claim limitations.

B. Person of Ordinary Skill in the Art

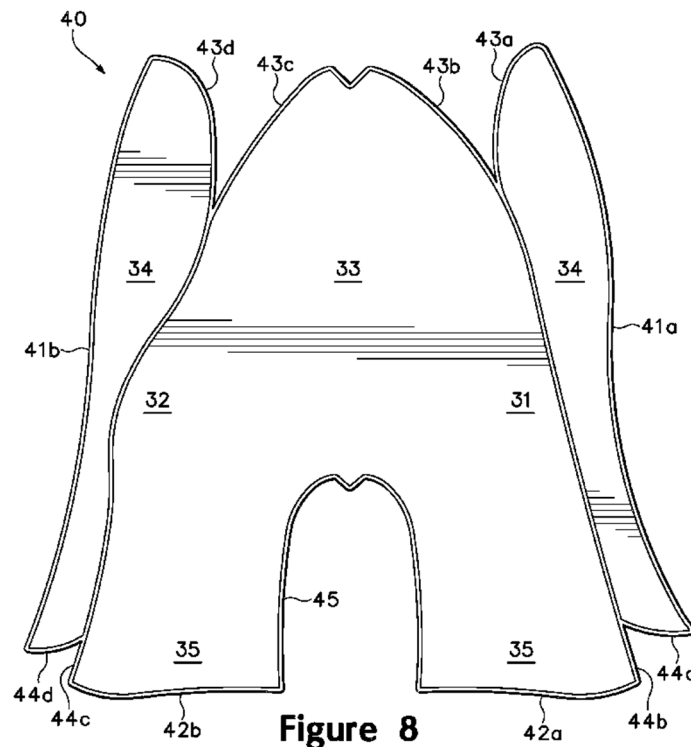
78. Based upon my experience in the field and the information discussed below, I believe a person of ordinary skill in the art in the field of the '511 patent in March 2004 would have been someone with at least a few years of experience in knit materials and knitting methods and machines that can be used in making footwear, or a bachelor's degree in textile-related sciences, engineering, or industrial product design, or equivalent academic or work experience, including in the footwear industry. Such a person of ordinary skill would have at least a general understanding of general construction processes and materials used in the manufacturing process of fabric-based articles. For individuals with a lower educational level, a person could still be of ordinary skill in the art provided that

person's working experience compensates for any such lower educational level, or vice versa. My opinions regarding the level of ordinary skill in the art are based on, among other things, my years of experience in the above field of art, my understanding of the fundamental qualifications that would be relevant to a person tasked with constructing fabric-based articles, including manufacturing footwear that incorporates knitted components, and my familiarity with the backgrounds of colleagues and coworkers, both past and present. Although my qualifications and experience exceed those of the hypothetical person having ordinary skill in the art defined above, my analysis and opinions regarding the '511 patent have been based on the perspective of a POSITA, as described above, as of the relevant time for the '511 patent (March 2004).

C. Overview of the '511 Patent

79. The '511 patent discloses an article of footwear with an upper that comprises a "flat knit textile element" with at least one "curved flat knit edge." The article of footwear further includes a plurality of knit strips having different "properties." These "different properties" may, according to the claims of the '511 patent, include, for example, differences in textures (*e.g.*, claim 8 ("smooth texture" vs "rough texture")), stitches (*e.g.*, claim 7 ("knit construction")), degree of stretch (*e.g.*, claim 10), as well as biodegradability, moisture absorption, insulation, durability and/or hydrophobicity (*e.g.*, claim 13). *See* EX1001. The '511 patent

specification does not discuss or define the term “curved flat knit edge[s],” but claims 1 and 15 recite that “the flat knit edges are not surrounded by textile structure from which the textile element must be removed, at least one flat knit edge being a curved flat knit edge,” as purportedly shown, for example, in Fig. 8 below:



Id., Fig. 8.

80. Claims 1 and 15 also recite a “first knit strip having a first property and a second knit strip having a second property that is different from the first property.”

Id., claims 1, 15. As with “flat knit edges,” the specification does not discuss or define the “first knit strip” and “second knit strip” anywhere, though it does disclose that a “first [smooth] texture 46”...has the configuration of various strips that extends [sic] laterally across areas corresponding with lateral region 31, medial

region 32, and instep region 33.” *Id.*, 9:61-64. The specification also states that “[v]arious portions of textile element 40” also include a second texture 47”...[and] the area of textile element 40” corresponding with instep region 33 includes a third texture 48.”” *Id.*, 9:64-10:1. These three textures are illustrated in Figure 11 of the patent, with the smooth first texture 46” shown in gray, second texture 47” shown in green, and third texture 48” shown in blue:

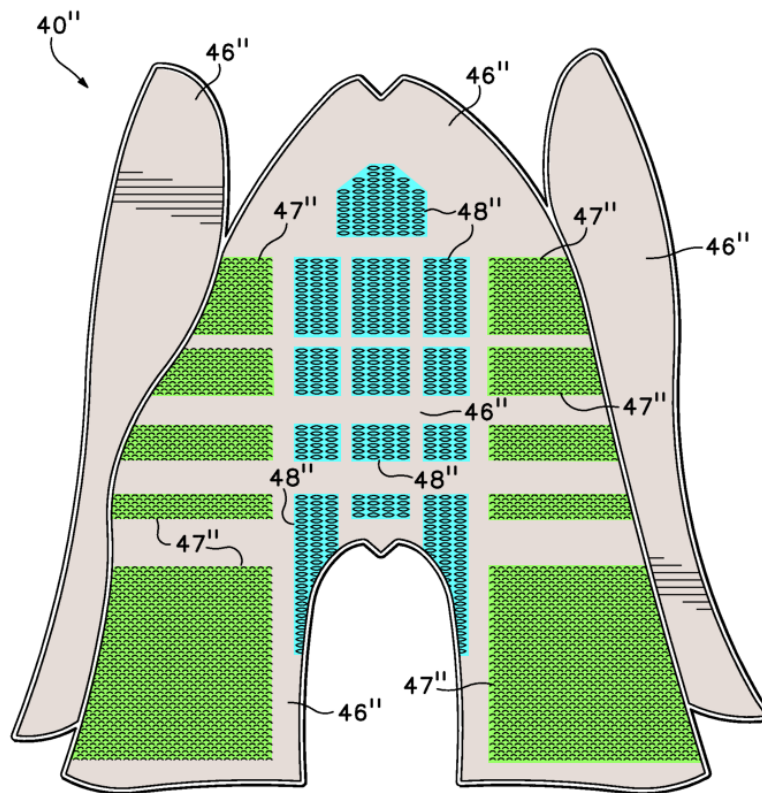


Figure 11

Id., Fig. 11.

81. The specification explains that the three textures “are formed by merely varying the type of stitch formed by the wide-tube circular knitting machine at each location of textile element 40”. Textures 46”-48” may exhibit aesthetic differences,

or the differences may be structural.” *Id.*, 10:1-5. “Various warp knitting or weft knitting processes may be utilized to form textile element 40,” such that “various stitches may be incorporated into specific locations of textile element 40 to modify the physical properties or aesthetics of textile element 40.” *Id.*, 11:26-31.

82. While one of the passages above refers to wide-tube circular knitting machines, the specification specifically acknowledges that “[a] variety of knitting processes may be utilized to form textile element 40,” and that “other types of knitting, such as flat knitting, may be utilized within the scope of the present invention to impart various textures, different properties, or different yarn types to the textile element.” *Id.*, 11:41-63. As the specification also explains, “[t]he types of knitting that may be utilized to form different zones with different properties (*e.g.*, yarn characteristics, textures, etc.) may vary significantly to include [widely used and well-recognized] various warp knitting and weft knitting processes,...such as tricot, raschel, double needle-bar raschel, circular knitting, and flat knitting, for example.” *Id.*, 10:30-36.

83. Crucially, only dependent claims 10-11 and 13-14 require that the claimed knit strips serve any functional purpose. This is demonstrated by the ’511 patent’s specification, which confirms that two of the claimed “properties,” textures and stitches, may serve purely aesthetic purposes. *See id.*, 10:4-5 (“Textures...may exhibit aesthetic differences....”), 10:15-19 (“[S]titches...may be utilized to vary

the...aesthetics of footwear”). The remaining claims recite a variety of design configurations and arrangements of strips (Claims 2-8, 16-20), as well as the use of different yarns (Claims 12-13, 16), and the presence of apertures (Claim 9).

84. Moreover, I understand that Patent Owner has served infringement contentions in the related district court litigation which purport to show shoes made by Petitioner that allegedly infringe one or more claims of the ’511 patent. *See* EX1011. In my opinion, these allegations confirm that the knit strips recited in 16 of the 20 claims in the ’511 patent can be present solely for aesthetic, rather than functional, purposes.

85. For example, the presence and number of knit strips, the textures of those strips, the knit stitches used in those strips, the locations of the strips, the patterns of the strips (which alternate in certain claims), and even the type of yarn used to fabricate the strips need not serve any functional or structural purpose whatsoever, and may be present solely for aesthetic purposes.

86. I have reviewed Patent Owner’s infringement contentions relating to the ’511 patent, which confirm that the “different properties” described in the ’511 patent can merely constitute different-looking textures. To take just one example from Patent Owner’s contentions, the Skechers shoe below, which I understand is called “Slip-Ins: Ultra Flex 3.0 – Colory Wild,” is alleged by Patent Owner to have different properties (Claim 1), different knit constructions, (Claim 7), different

textures (Claim 8), and even different degrees of stretch (claim 10). *See* EX1011, 84-95 (Claim 1), 273-83 (Claim 7), 300-310 (Claim 8), 361-72 (Claim 10). I note that Claim 10 is one of the '511 patent's few functional limitations relating to the use of different textures or stitches. The red boxes in the image below are annotations added by Patent Owner which identify different-looking textures in the shoe upper as meeting each of these limitations:



Id., 95, 283, 310, 372.

D. The Prosecution History

87. I have reviewed the U.S. file history of the '511 patent, and note that the Examiner initially rejected all of the originally-filed claims. EX1013, 85-88. The pending claims that were then numbered 35-40 were rejected as obvious in view of U.S. Patent Nos. 1,841,518 ("Bellak") and U.S. Patent No. 1,910,251 ("Joha"). *Id.*,

86. Following a September 21, 2017 interview in which the Examiner “suggested amending the claims to include language directed towards the location/orientation of the strips to be vertically extending from the sole to the instep area or similar language directed towards the location/orientation shown in figure 11,” *id.*, 97, the Applicant provided the following summary:

During the interview, Applicant's representative and Examiner Bays discussed the...Joha reference, and Examiner Bays agreed that the reference does not teach or suggest curved flat knit edges, which are disclosed in the pending Application.

Id., 726.

88. In the same response, which was filed on December 12, 2017, the applicant amended the claims that would ultimately issue as Claims 1 and 15 to add the following language: “, at least one flat knit edge being a curved flat knit edge.” *Id.*, 722. The applicant also argued that these amendments overcame the examiner’s obviousness rejection with reference to Bellak in view of Joha. *Id.*, 727-29. Crucially, it should be noted that Patent Owner does not claim to have invented flat knit edges, curved edges, textured strips, or any techniques for fabricating these. Rather, as demonstrated by Patent Owner’s statements, curved edges and flat knit edges are made using existing techniques (which are not disclosed in the ’511 patent), and textured knit strips are created simply by varying the stitches used.

89. The claims were then allowed as amended on February 6, 2018. *Id.*, 745. The Examiner did not provide further comment.

E. The Claims of the '511 Patent

90. This declaration addresses the patentability of all claims (1-20) of the '511 patent.

F. Construction of Terms Used in the Claims of the '511 Patent

Article of Footwear

91. I understand that in a parallel litigation, Petitioner has proposed that the term “article of footwear,” which appears in the independent claims of the '511 patent and several dependent claims, should be construed as “any foot covering in the form of shoes, boots, slippers, or hose (*e.g.*, socks) used for utility and/or dress wear. Not necessarily synonymous with shoes, which are simply one category of footwear.” This construction is consistent with the specification of the '511 patent, which indicates that the addition of a sole is optional. EX1001, Abstract (“The footwear may include an upper and a sole structure.”).

92. I understand that this construction is taken nearly verbatim from and is consistent with a definition from *The Complete Footwear Dictionary*, with the additional clarification (also from the *Footwear Dictionary*) that “hose” includes socks, and is not limited to, for example, panty hose. EX1022, 67, 88. It is also consistent with U.S. Patent No. 2,675,631 (“Doughty”), which is part of the prosecution history of the '511 patent. EX1053, 4:55-58. Doughty explains that the invention claimed therein “is generally applicable to knitted footwear of all types,

e.g., hose, golf hose, three-quarter hose, half-hose and socks.” *Id.* My opinions in this declaration reflect this construction of the term “article of footwear.” I understand that Patent Owner has proposed in the related district court litigation that this term should be given its ordinary and customary meaning as understood by one of ordinary skill in the art in view of the patent and its file history, with no further construction required. *See* EX1007, 6-7. I also understand that Patent Owner has argued that this means an article of footwear must include both an upper and a sole structure. *Id.* In my opinion the references discussed in the Grounds below would meet all claim limitations of the ’511 patent under Patent Owner’s proposed construction as well.

a flat knit textile element having: (1) flat knit edges free of surrounding textile structure such that the flat knit edges are not surrounded by textile structure from which the textile element must be removed

93. Furthermore, I understand that Petitioner has proposed in the parallel litigation that the term “a flat knit textile element having: (1) flat knit edges free of surrounding textile structure such that the flat knit edges are not surrounded by textile structure from which the textile element must be removed” should be construed as “a textile element that has only flat knit edges, where a flat knit edge is itself flat knit, *e.g.*, not formed by cutting from a flat knit textile element or by otherwise removing the textile element from a larger textile material.” My opinions in this declaration reflect this construction.

94. I also understand that Patent Owner proposed in the district court that this term should be given its ordinary and customary meaning, with no further construction required. EX1007, 9-10. In my opinion, the references discussed in the Grounds below would meet all claim limitations of the '511 patent under 35 U.S.C. § 103, even applying Patent Owner's proposed construction, as discussed below.

Strips

95. I also understand that, during claim construction in the related district court litigation, neither party raised any dispute regarding the meaning of the word "strips," as that term is used in the '511 patent. However, I have provided excerpts of the infringement contentions that I understand Patent Owner has served in the district court litigation in order to provide context in the event that Patent Owner asserts a claim construction argument in response to the Petition related to the meaning of "strips."

96. Specifically, as discussed above, Patent Owner's infringement contentions include red box-shaped annotations that are apparently used to identify different-looking textures in Skechers shoes that Patent Owner has accused of infringing the '511 patent. According to those contentions, each texture is a "different property," (corresponding to the claim language "a second property that is different from the first property." *See, e.g.*, EX1011, 84-95.

97. I note that Patent Owner does not assert in these infringement contentions that the strips must have any particular size, width, length, shape, orientation, or location. Rather, I understand that Patent Owner has identified as infringing a wide variety of textured areas having disparate sizes, widths, lengths, shapes, orientations, and locations, as shown in the images below from Patent Owner's infringement contentions in the related litigation:







EX1011, 84, 91, 95, 97, 102, 103.

98. Therefore, my opinions in this declaration reflect the same breadth for the term “strips” as Patent Owner applies in its infringement contentions in the related district court litigation.

Other Terms

99. Furthermore, I understand that, when not otherwise construed, claim terms should be given their ordinary and customary meaning as understood by one of ordinary skill in the art in view of the patent and its file history, to the extent such a meaning exists. Therefore, except for the terms discussed above, I have used what I believe to be the ordinary and customary meaning of the claim terms as understood by one of ordinary skill in the art in view of the '511 patent and its file history.

VII. OVERVIEW OF THE PRIOR ART

A. European Patent Application EP 1,338,690 A1 (“Cusinato”) (EX1014)

100. European Patent Application EP 1,338,690 A1 is entitled “Process for making a knitted fabric and its product,” and was published on August 27, 2003 (EX1014 (“Cusinato”)). EX1014, 1.

101. Cusinato discloses “a process for making a knitted fabric and a product obtained with this process.” *Id.*, [0001]. “The knitting manufacturing is made by using knitting machines or looms in which a support, called a needle bar, houses several needles placed side by side and parallel to each other, in order to pass over the stitches of the new row with the stitches of the previous row.” *Id.*, [0005].

102. Cusinato also teaches:

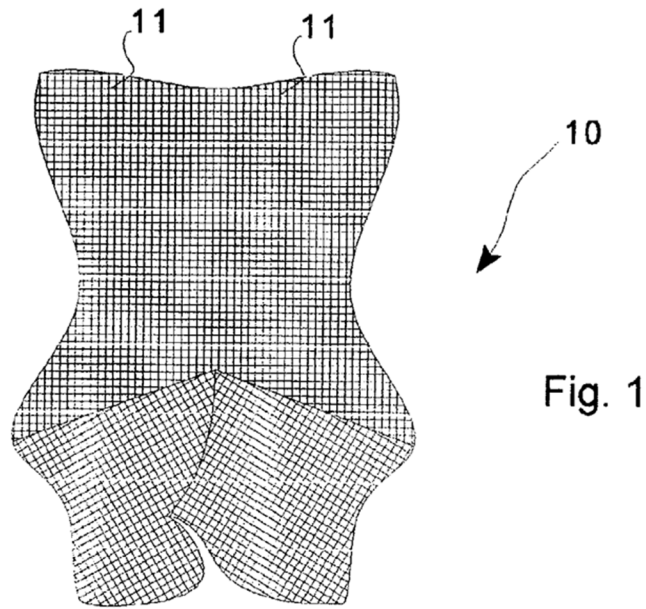
[I]t is also possible to generate a decrease or an increase of the fabric, namely it is possible to obtain shaped fabrics. For example, it is possible to widen a fabric (called

“increase”) by inserting other needles which are placed side by side to those placed at the ends; similarly, it is possible to reduce the fabric (called “decrease”) by removing the needles which are placed at the ends.

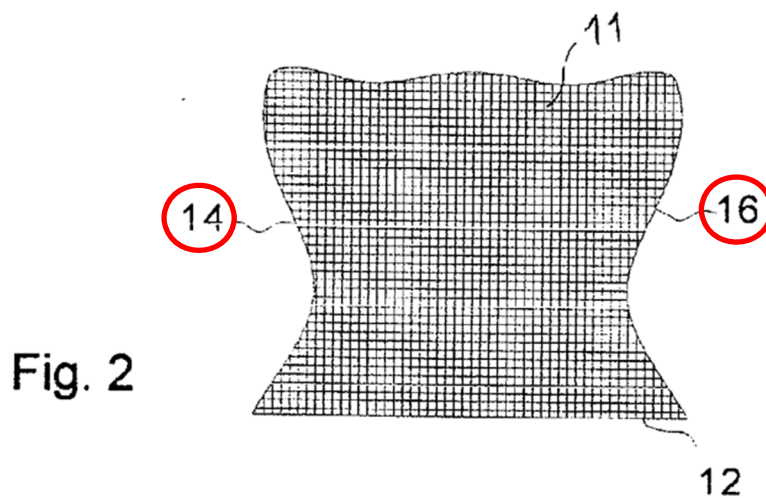
Id., [0006].

103. As Cusinato explains, this process of “increasing” and “decreasing” the fabric during knitting makes it “possible to produce a one-piece fabric which has suitably shaped side edges (by increasing or decreasing the fabric).” *Id.*, [0015]. Then, “the stocking or footwear is directly obtained by wrapping the fabric in a boot-like manner and carrying out a simple sewing in order to join the two side edges.” *Id.* Thus, “the fabric, so obtained, can be made into a stocking or a footwear which is form-fitting to the foot or the leg of a person.” *Id.*, [0018].

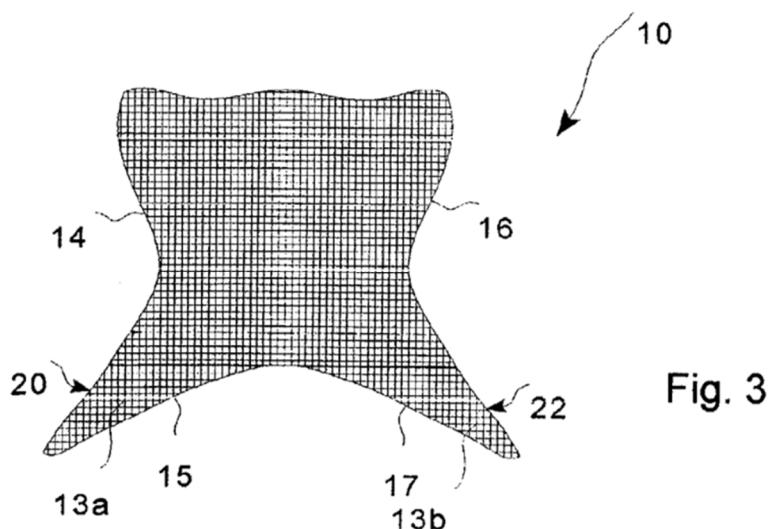
104. Figure 1 of Cusinato, which is reproduced below, “illustrate[s] a fabric 10 in order to obtain a stocking or a footwear with the process of the present invention.” *Id.*, [0020]. As Figure 1 clearly shows, fabric 10 has curved edges.



105. Figures 2 through 5 of Cusinato then “illustrate[] the various phases of the process in order to produce the fabric 10 [shown in Fig. 1], starting from the top of the stocking or the upper part of the footwear.” *Id.*, [0020]. This process, “wherein decreases and increases operations have been made,” forms a “boot-leg, which is defined by a left side edge 14 and a right side edge 16,” as shown in Figure 2 below. *Id.*, [0021] (red circles added to indicate left and right side edges 14 and 16).



106. In subsequent steps, second and third threads 13a and 13b are used to form left rows 20 and right rows 22, respectively, creating two “V” shapes in fabric 10, as shown in Figure 3:



107. Cusinato explains that, “[i]n practice, since the stitches are blocked by the straight needle bar of the [knitting] machine, the fabric in progress is arranged as shown in figure 4, wherein the stitches of the two ‘V’ sides, that is the first 15 and the second 17 central edge define the last row of stitches arranged in a straight line which is identified in figure [4] with reference 24.” *Id.*, [0029].

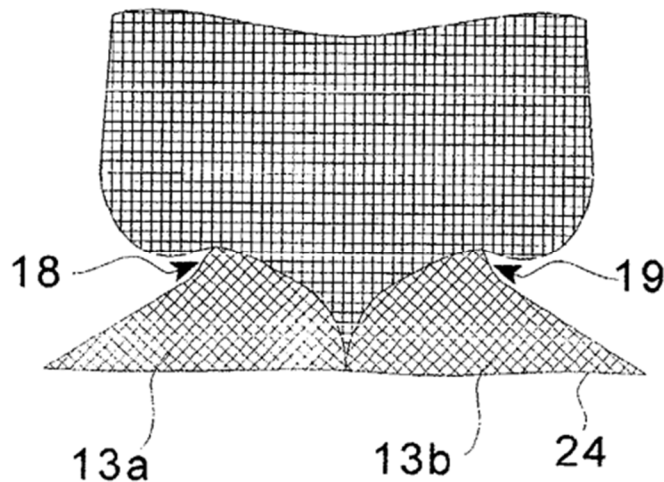


Fig. 4

108. “Finally, the stitches of the last row 24 are passed over with a sole thread,” and “first thread 11...starts again and, as previously described, forms subsequent rows of stitches. The fabric 10 depicted in figure 5 is so obtained.” *Id.*, [0031].

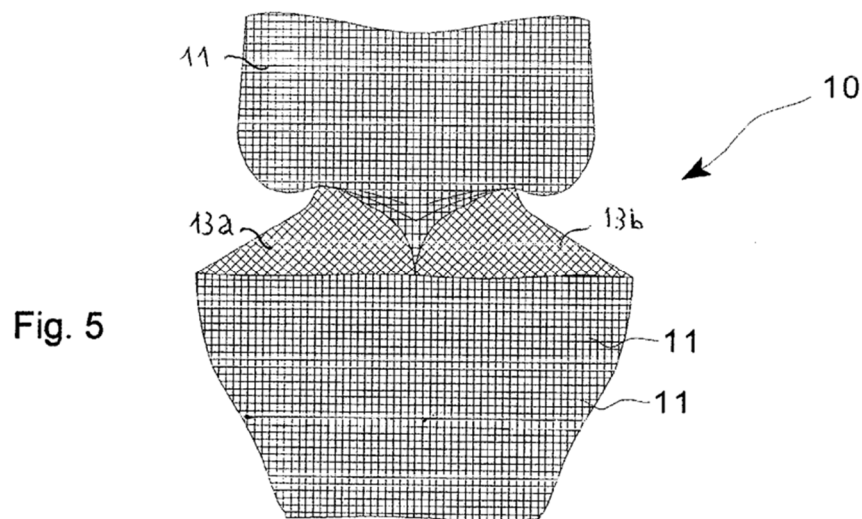


Fig. 5

B. U.S. Patent No. 2,440,393 (“Clark”) (EX1015)

109. U.S. Patent No. 2,440,393 is entitled “Process of making last-fitting fabric uppers,” and issued on April 27, 1948 (EX1015 (“Clark”)). EX1015, 1.

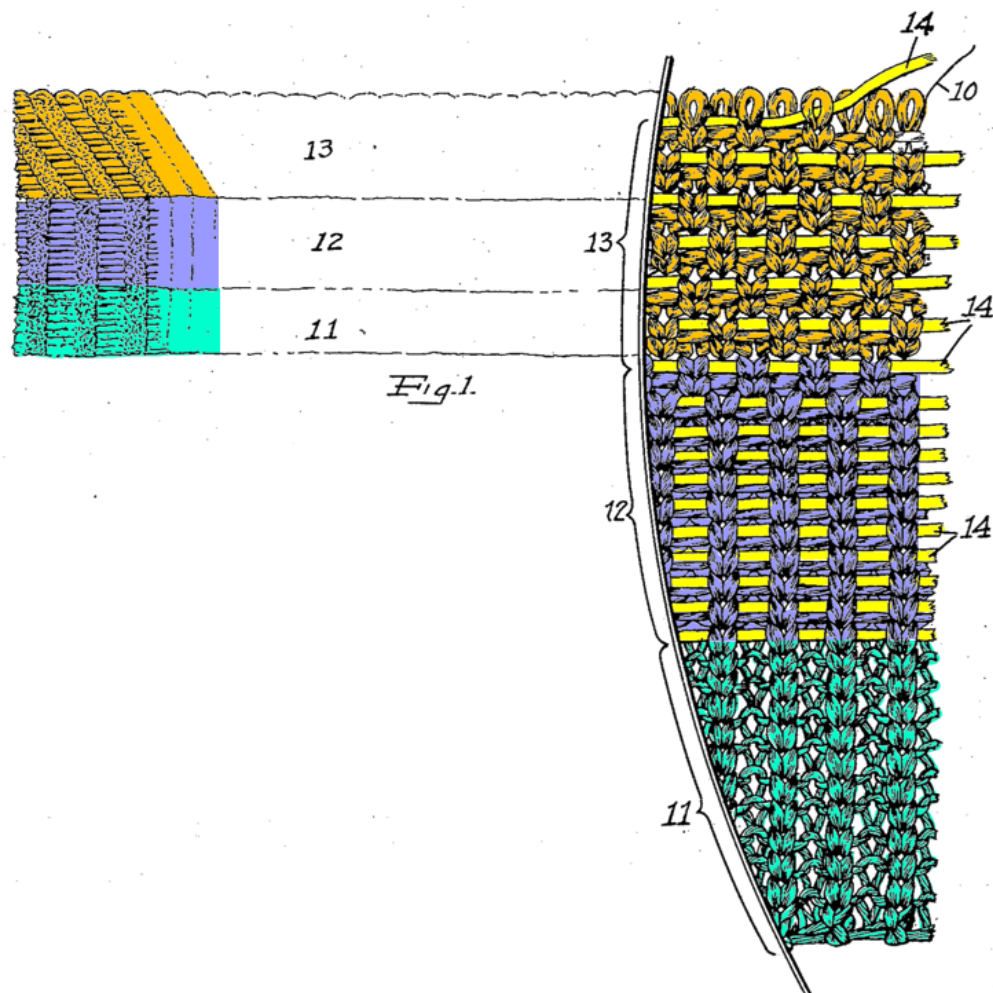
110. Clark “relates primarily to shoemaking and consists in a novel process of making of textile material a last-fitting upper which, as a resilient, self-sustaining article, exactly reproduces the contour of the last upon which it is fashioned and preserves or maintains that contour in wear.” *Id.*, 1:1-7. Clark discloses creating said upper “by properly distributing relatively coarse strands of certain thermoplastic material¹ in a knitted fabric and then shrinking these strands in the fabric upon the last . . . to secure a stiff resilient self-sustaining upper in which the shape of the last is accurately reproduced and permanently sustained.” *Id.*, 1:18-25; *see also* 3:32-35.

111. Clark further teaches that “the body of the upper may be knitted of any yarn suitable for machine knitting,” and “[f]rom time to time during the knitting operation relatively coarse or heavy strands of vinyon yarn are laid in place so that they lie in parallel longitudinal courses in the knitted band or web and are substantially straight throughout their length.” *Id.*, 1:41-50. “The fabric may be knitted as a strip in a flat bed knitting machine and formed into a continuous band by having its ends joined, or it may be knitted as a seamless band in a circular knitting machine.” *Id.*, 2:13-17. I note that, while Clark does disclose “strips” like those claimed in the ’511 patent, Clark uses the word “strip” to refer to the textile

¹ Clark explains that “[v]inyl yarn suitable for the purposes of [the] invention is available in the market as Vinyon HST,” EX1015, 1:25-27, but that “any thermoplastic strand having substantially the same characteristics as vinyon may be employed within the scope of the invention.” *Id.*, 3:32-35.

element as a whole (“fabric may be knitted as a strip”), rather than individual features of the textile element (as in the ’511 patent).

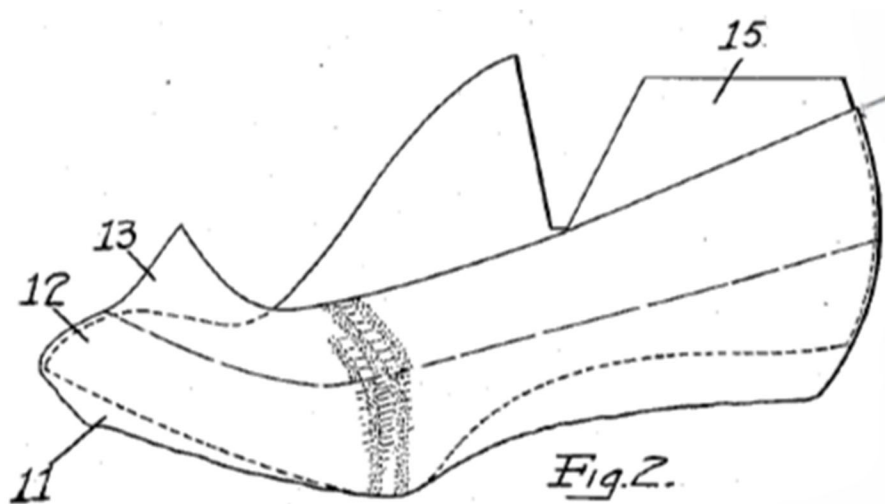
112. Clark discloses a “band” that is “knit with a rib stitch upon a flat bed machine from chenille yarn having a plastic strand 10 twisted into it.” *Id.*, 3:1-3. An annotated version of Figure 1 below shows this band, which is formed of three sections 11 (green), 12 (purple), and 13 (orange):



113. Section 11 “is first woven from the chenille yarn alone or from a woolen yarn if preferred.” *Id.*, 3:3-6. In forming each course of section 12, “a relatively thick

heavy strand of vinyon 14 is laid or placed between the needles so that in the ensuing course the strand is enmeshed in the knitted fabric.” *Id.*, 3:14-17. Finally, “for the formation of the third or uppermost section 13...the heavy vinyon strands 14 are laid between the needles in every alternate course.” *Id.*, 3:36-40. Clark teaches that any “convenient” or “desired” knitting stitch may be used in forming sections 12 and 13; for example, Figure 1 depicts a rib stitch for section 12 and a “popcorn stitch” for section 13. *Id.*, 3:27-54.

114. Next, the knitted band shown above in Figure 1 is “worked over a last 15,” *id.*, 3:68, a form as shown in Figure 2, forming a shoe upper:



115. The upper is heat treated on the last “in order to first soften and then contract the thermoplastic elements of the upper,” for example “in a steamer such as shown in Fig. 3,” below. *Id.*, 3:6-11.

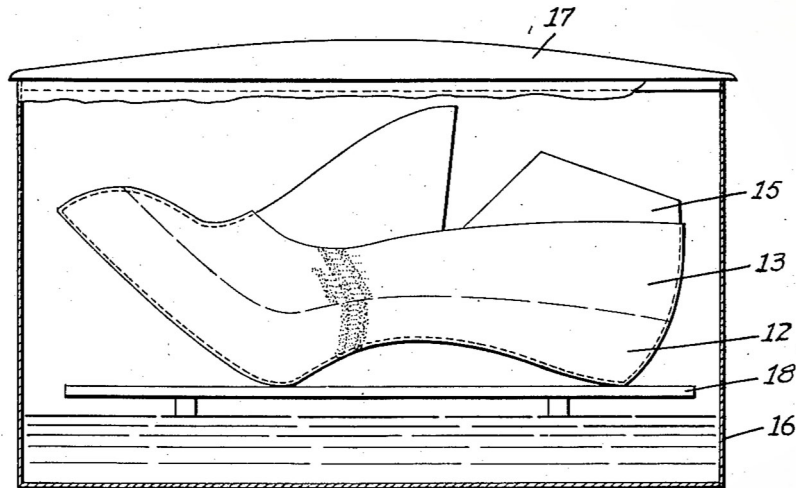


Fig. 3.

116. Finally, Clark teaches that the process it teaches results in “a complete last-fitting upper which will maintain the shape of the last, yieldingly resist a distorting pressure, and immediately return to its normal last form when such pressure is removed.” *Id.*, 4:75-5:4.

C. *Knitting Technology, A Comprehensive Handbook and Practical Guide*, by David J. Spencer (Third Edition) (“Spencer”) (EX1050)

117. The Third Edition of Spencer’s *Knitting Technology* (EX1050 (“Spencer”)) was published in 2001. Spencer is a well-known and widely recognized authoritative text in the field of knitting.

118. Spencer describes a variety of techniques that can be used to create knit strips, and discloses numerous potential configurations for those strips. Several examples are shown below:

- Knit strips having different colors, patterns, and textures. EX1050, 103 (Fig. 10.3) (below).



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

- Strips in the form of horizontal stripes made using different yarns of different colors. *Id.*, 101 (Fig. 10.1)



Fig. 10.1 An attractive use of horizontal striping [International Institute for Cotton].

- Knit ribs with alternating strips of texture and stitches. *Id.*, 185-87 (Figs. 16.9 and 16.10).

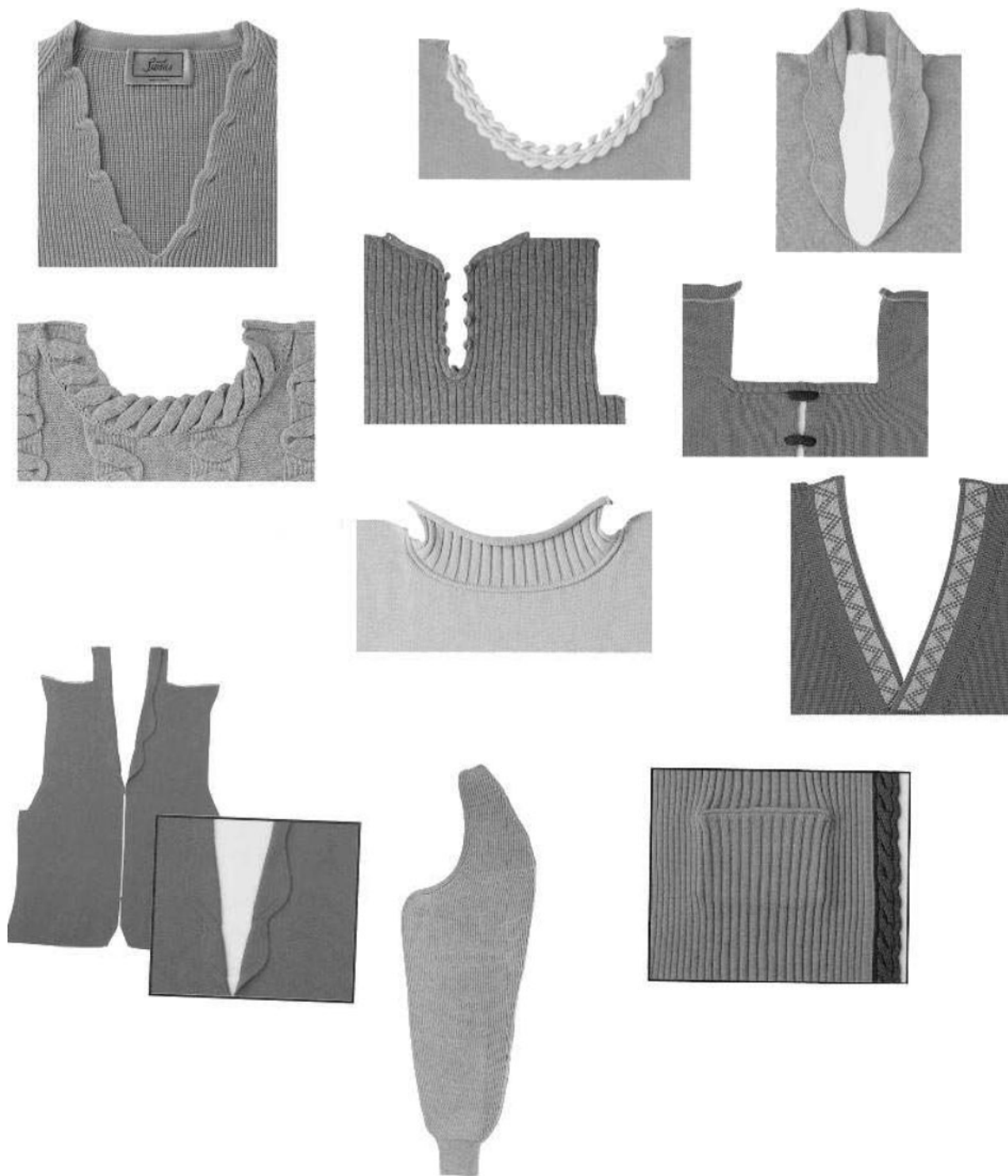
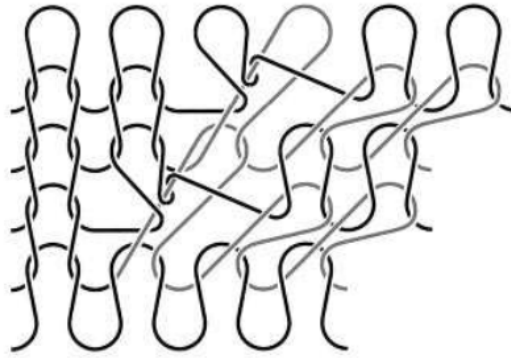


Fig. 16.9 Integrally shaped rib garment pieces. The machine has an additional bed containing the transfer points [Shima Seiki].



Widening with split-stitch (latch-type needle)

- Strips of knit material with different textures, stitches (as shown below), and elasticities. *Id.*, 195 (Fig. 16.13).

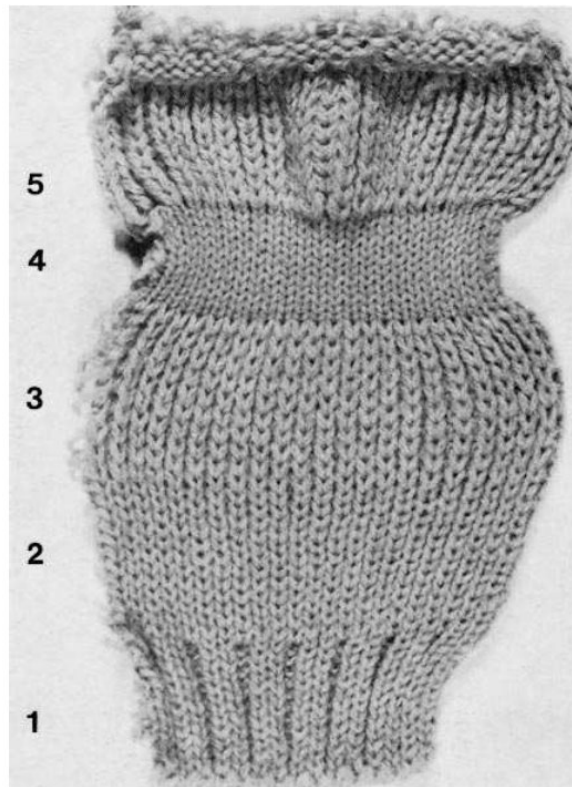


Fig. 16.13 Stitch shaping (1 = 2×2 rib; 2 = 1×1 rib; 3 = half-cardigan; 4 = tubular courses; 5 = full cardigan).

119. Moreover, with respect to knit ribs, Spencer teaches that there are numerous rib “set-outs” apart from the 1x1 rib, including 2/1 and 3/1, with the first figure “indicat[ing] the number of adjacent plain wales and the second figure the number of adjacent rib wales.” *Id.*, 69. As Spencer explains, “[s]ingle or simple ribs have more than one plain wale but only one rib wale, such as 2/1, 3/1, etc.” *Id.* By alternating the number of adjacent plain and rib wales, a knitting machine operator can create ribs with “ridges” having a wide variety of appearances. As one example, the 6/3 Derby Rib has six adjacent plain wales and three adjacent rib wales, resulting in a much wider knit strip and overall pattern than, for example, a 1x1 rib. Spencer therefore teaches knit patterns that alternate between a first texture and a second, different texture by using different numbers and different types of stitches to produce different patterns.

120. As I explained above in Section V, Spencer also demonstrates that adjacent strips which have different textures and/or patterns are both commonplace and obvious aesthetic design elements, and are used across a variety of knitted garments:



Fig. 19.6 Multi-gauge technique garment.

Id., 235.

121. Moreover, Spencer discloses use of different yarns within the same knitted textile element (or workpiece). As one example, Spencer teaches the “use of Lycra or other elastane yarns...at every course or at alternate courses....” *Id.*, 260.

122. As another example, Spencer explains that “precisely placed spliced areas of elastane yarns” can be used “to give selective comfort support whilst saving expensive yarn.” *Id.*, 264.

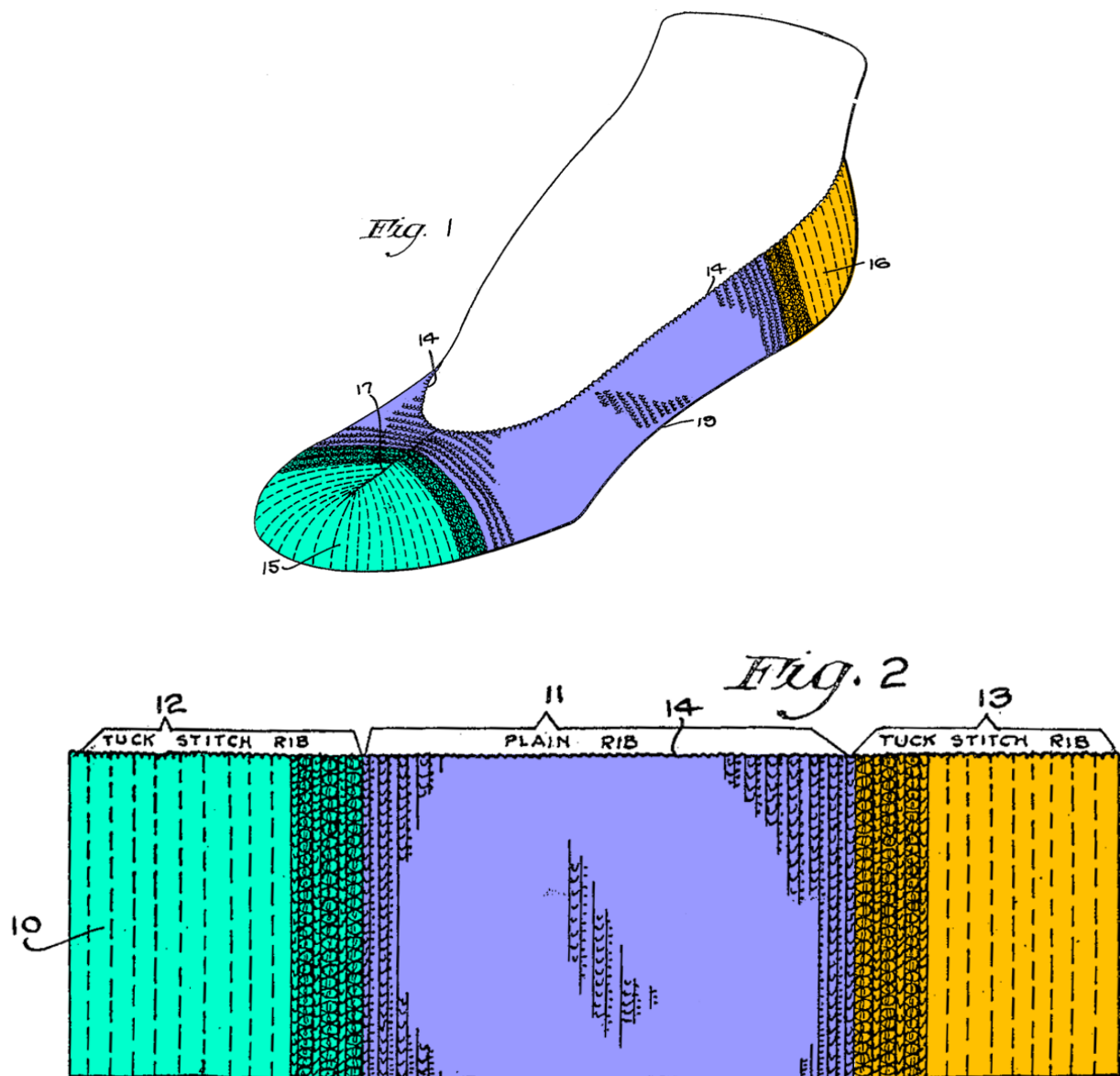
123. Finally, Spencer discloses the use of flat knit machines to knit “selvedged fabric,” or fabric having a “self-edge” that prevents unraveling. *Id.*, 45. Selvedge edges can also be “seamed together, without the need for cutting,” which helps to prevent “loss of expensive fabric.” *Id.*, 185. Spencer also teaches that “weft knitting provides unique opportunities for width-wise shaping during knitting,” including by “varying the number of needles in action in the knitting width.” *Id.*, 184. For example, “[i]n *needle selection shaping*, the selvedge needle(s) is introduced or withdrawn from the knitting width by means of needle selection.” *Id.*, 188.

D. U.S. Patent No. 2,400,692 (“Herbert”) (EX1016)

124. U.S. Patent No. 2,400,692 (EX1016 (“Herbert”)) is entitled “Foot covering.” EX1016, 1. Herbert’s application was filed on March 24, 1943 and issued on May 21, 1946.

125. Herbert “relates to knitted foot coverings and more particularly to the slipper type.” *Id.*, 1:4-5. Herbert’s foot covering is made up of “rib knitted fabric” (or “rib fabric”). *Id.*, 2:9-19.

126. Herbert discloses a “slipper foot covering” (annotated Figure 1) that may be formed with “plain rib[s]” 11 and “tuck stitch rib[s]” 12 and 13 (annotated Figure 2). As can be seen in Figures 1 and 2 below, and as I explained above in Section V.C, this results in a knit strip of “plain ribs” situated between two differently textured ribs formed of “tuck stitch ribs”:



127. Herbert also teaches that “one edge” of this circular knit seamless tube “has a selvage, this edge forming the upper finished edge of the slipper foot covering....” *Id.*, 2:36-38. “The inherent selvage edge 14 made in the knitting of the tubular section 10 provides a finished edge for the article of apparel without any further operations.” *Id.*, 4:14-17.

128. Herbert describes a circular knit embodiment, but is not limited to that type of knitting technique or machine. *Id.*, 1:48-55. For example, Herbert discloses that “[s]o far as the feature of the invention relating to the courses extending lengthwise of the foot is concerned, it is obvious that a seamless tube is not essential to the same and that cut and sewn flat rib knitted fabric may be employed without departing from the spirit of the invention....” *Id.*, 2:5-10.

129. While these statements accurately reflect the capabilities of circular knitting machines at the time of Herbert’s invention (the early 1940s), a POSITA in possession of Herbert at the time of the ’511 patent’s critical date would recognize that a number of other types of knitting machines, including flat knitting machines, could also be used without undue complexity or expense, and would be capable of producing such a “selvage” (or “selvedge”) construction. Flat knitting machines are suitable to produce selvedges on both sides of the knitted fabric. Since the knitting head in a flat knitting machine reciprocates from one side of the machine to the other side, the edges need to be self-supported and therefore resistant to raveling. “A

selvedged fabric is one having a ‘self-edge’ to it and can only be produced on a straight machine whose yarn carrier reciprocates backwards and forwards across the needle bed so that a selvedged edge is formed as the yarn rises up to the next course at either edge of the fabric.” EX1050 (Spencer), 45. Flat knitting machines are straight machines.

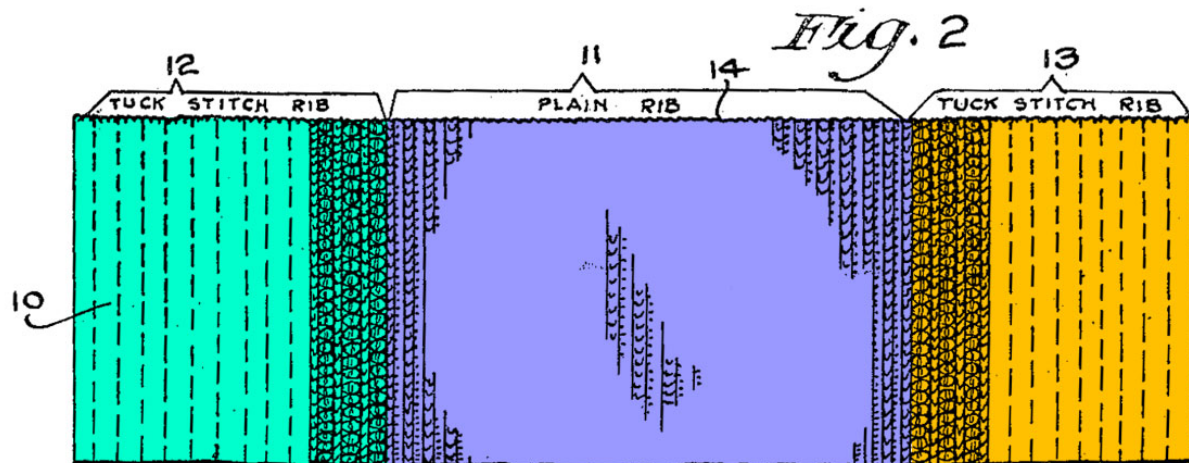
130. Herbert also teaches that, while “rib rather than plain fabric is used” in the preferred embodiment “as the former has a greater stretch or elasticity than the latter,” plain fabric “may be used if desired.” EX1016, 2:16-19. The specification goes on to explain how “the stitch structure of the heel and toe may be varied” within the single textile element to achieve different properties in different parts of the article of footwear, thereby creating knit strips with different properties:

The true rib fabric may be used throughout the slipper foot, but if less stretch is desired in the heel and toe areas, as when the sole section has sufficient elasticity, then the stitch structure of the heel and the toe may be varied over the true rib stitch structure to reduce the elasticity of the same, such a variation in stitch structure being obtained, for example, by knitting the heel and the toe sections of tuck stitch rib, transferred stitches or even plain jersey fabric.

Id., 2:19-29.

131. An annotated version of Figure 2 of Herbert, below, which is “a side view of a tubular section of seamless knitted fabric,” *id.*, 1:35-36, illustrates how the

plain ribs and tuck stitch ribs disclosed in Herbert constitute knit strips (indicated in green, purple, and orange), as the '511 patent appears to use this term:



132. As Figure 2 shows, area 11 comprises “plain rib,” and areas 12 and 13 comprise “tuck stitch rib,” *id.*, 2:41-47, though “areas 12 and 13 may contain other stitch variations that the tuck stitches, such, for example, as transferred stitches or they may be made of plain jersey fabric, the purpose in all such cases being to reduce the elasticity of the heel and toe portions of the foot covering....” *Id.*, 3:1-6.

E. U.S. Patent No. 2,147,197 (“Glidden”) (EX1017)

133. U.S. Patent No. 2,147,197 (EX1017 (“Glidden”)) is entitled “Article of footwear,” and was published on February 14, 1939. EX1017, 1.

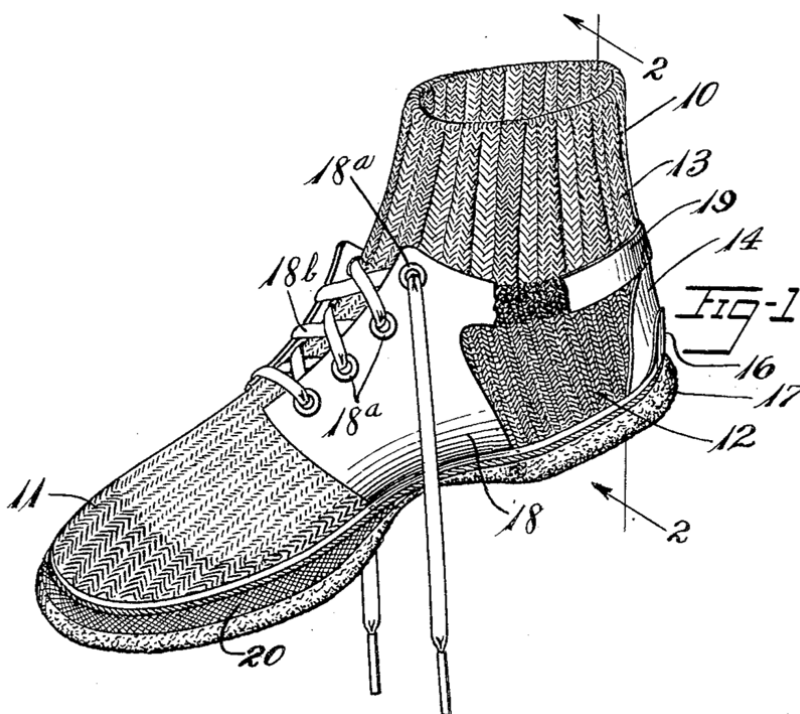
134. Glidden “relates to articles of footwear and to methods of making the same, and is especially useful in the manufacture of shoes having textile uppers.” *Id.*, 1:1-4.

135. Glidden discloses fabricating different areas of an upper having different properties:

In fabricating the unitary upper, as by knitting, areas thereof which are normally subjected to greater wear and in which a lower degree of elasticity is desired, such as the toe 11 [colored in teal] and the heel portion 12 [colored in purple], may be more densely fabricated to provide therein heavier weight and less extensibility than in the other parts of the upper, as by changing the type of stitch or amount of thickness of the yarn in the knitting. Other areas, such as the ankle portion 13 [colored in orange], are preferably made so as to provide softness and elasticity, as by making them of ribbed construction, as shown.

Id., 2:19-44.

136. Figure 1 shows Glidden's article of footwear, which has areas of varying textures, thicknesses, and densities:



F. Combination of Cusinato With Clark and, If Necessary, Spencer

137. At the time of the '511 patent's invention, a POSITA would have been motivated to combine the teachings of Cusinato, Clark and/or Spencer, and would have had a reasonable expectation of success in doing so.

138. Both Cusinato and Clark teach techniques for using flat knitting machine technologies to create an upper for an article of footwear. *See, e.g.*, EX1014, [0005]; EX1015, 3:1-3 (“The band shown in Fig. 1 is knit with a rib stitch upon a flat bed machine from chenille yarn....”). Moreover, both Cusinato and Clark employ a sewing operation after the flat knitting is complete in order to join the edges of their respective flat knit textile elements to form a footwear-shaped workpiece. EX1014, [0015] (“[C]arrying out a simple sewing in order to join the two side edges...”); EX1015, 3:55-65 (“[The two ends of the strip...are united by stitching or binding corresponding to the back seam usually found in uppers.”). Thus, applying Cusinato’s teachings to make Clark’s upper would have yielded predictable results, would have constituted a simple substitution or application of modern knitting techniques for older ones, and would have been obvious to try, with a reasonable expectation of success, as explained herein.

139. A POSITA would have been particularly motivated to look to the teachings of Clark, because its techniques of using various knit stitches and laying-in other yarns could be used to provide varying degrees of stretch, stiffness,

recovery, or resilience to the textile element of Cusinato, which otherwise would lack these varied properties. Thus, Clark’s teachings could be used to improve the stiffness, durability, and resiliency of regions of Cusinato’s upper. For example, it is common knowledge that certain areas of footwear—for example, the toe and heel regions—must be stiffer, more durable, and/or more resilient than others (such as the leg of Cusinato’s boot, where less stiffness would be desirable). In particular, Clark’s teachings, including the use of different types of stitches and inlaid yarn, have been known in the art for decades, if not longer, and its simple and well-recognized techniques could be employed to impart different properties to different areas of Cusinato’s knitted textile upper—such as a stiffer and more resilient toe or heel region.

140. Furthermore, a person of skill in the art of knitting in possession of Cusinato would have been motivated to further improve or create variations in the appearance of Cusinato’s knitted footwear by combining or substituting Cusinato’s pattern with a wider range of variations in stitching, textures, and yarns, as taught by Clark. *See, e.g.*, EX1015, 3:1-54. Indeed, Clark explains that, at the time of that invention in the 1940s, there existed an “urgent demand in women’s shoes for a great variety of ornamental and different color effects.” *Id.*, 1:12-14. It is common knowledge that such demand continues to this day, not only for women’s shoes but for footwear generally. *See supra* Section V.

141. Clark depicts the use of different stitches (and visual textures) in Figure 1, as shown above. *See supra* Section VII.B. Clark also teaches that “any convenient knitting stitch” or “any desired form of knitting stitch may be employed,” which, as I explained above, would give rise to different textures. EX1015, 3:27-54. Finally, Clark discloses the possibility of using chenille yarn of different colors and weights. *Id.*, 1:41-45. In light of these teachings, it is clear that Clark also teaches the use of different textures, stitches, and different yarns for ornamental, or aesthetic, purposes. In the fashion industry, of which footwear and textiles are a part, the motivation to employ different techniques and materials to create different aesthetic effects is commonplace, if not ubiquitous. *See supra* Section V. Therefore, in attempting to create Cusinato’s knitted footwear, a skilled artisan in the field of knitting and textiles would investigate and consider incorporating aesthetic aspects of design elements from other footwear designs such as Clark, and would have had a reasonable expectation of success in implementing such aesthetic design changes.

142. A person of skill in possession of Cusinato and/or Clark would have been motivated to improve the manufacturing efficiency, functionality, and/or appearance of the knitted footwear claimed therein, and would have consulted Spencer for guidance in doing so. As explained, for example, in Sections V and VII.C, and as discussed throughout this declaration, Spencer would teach how to use or substitute known methods to yield predictable results, how to apply known

techniques to improve a known method or product, which techniques would be obvious to try—and would have a reasonable expectation of success, given Spencer’s status as a knitting reference—and the use of other teachings, suggestions, and motivations to combine.

143. Moreover, much of the information provided in Spencer is common knowledge to those of skill in the art of knitting, and as such Spencer is not only a combinable prior art reference, but also provides evidence of what information was known in the knitting field as of the critical date of the ’511 patent, as well as what was inherent in prior art knit textiles, structures, and machines.

144. Finally, in the fashion industry, the consideration and possible use of (1) at least two different textures in different strips on the same knitted textile or footwear; (2) at least two different stitches in different strips on the same knitted textile or footwear; (3) at least two different yarns in different strips on the same knitted textile or footwear; (4) at least two different physical properties in different strips on the same knitted textile or footwear; (5) varying patterns of the strips; (6) differently shaped elements in the pattern; (7) different orientations of elements in patterns; and (8) different locations of elements in patterns, among other things, are a long-standing and integral part of fashion design, including knitted fashion design, and would have been obvious or obvious to try from the perspective of a POSITA familiar with either footwear or textiles, including because available knitting

machines before the time of the invention were readily programmable to implement the known knitting techniques that would produce such patterns and variations, as I explained in the Technical Background. *See supra* Section V. For ease of reference, I will hereinafter refer to these as the “Obvious Design Choices.”

145. Indeed, as I have explained above in Section V, having strips of (1) different textures, (2) different stitches, and (3) different yarns in knitted textile or footwear is among the simplest and most ubiquitous of a limited number of aesthetic elements in knit fabrics and in footwear, and their use and success is predictable. Realizing (4) different physical properties using variations in textures, stitches, and/or yarns is also both simple and ubiquitous in knit fabrics and in footwear, and their use and success is predictable. Therefore, at the time of the invention of the ’511 patent, a POSITA would have been motivated to combine the teachings of Cusinato, Clark, Spencer, or any combination thereof with the eight elements listed above, and would have had a reasonable expectation of success in doing so, insofar as aesthetic changes and implementation of different physical properties in knit textiles was well-known. *See supra* Section V. Furthermore, at the time of the invention, it would have been obvious to a POSITA, or obvious to try, modifying Cusinato, Clark, or any combination thereof to add elements (1), (2), (3), (4), (5), (6), (7), and/or (8) above. Insofar as such changes are well-known functional or aesthetic changes, a POSITA would have had a reasonable expectation of success.

G. Combination of Herbert With Glidden and Cusinato and, If Necessary, Spencer

146. At the time of the '511 patent's invention, a POSITA would have been motivated to combine the teachings of Herbert with Glidden, Cusinato, and/or Spencer, and would have had a reasonable expectation of success in doing so.

147. First, Herbert and Cusinato relate to the design and manufacture of footwear using knitting, and flat knitting in particular. *See* EX1016, 2:8-10 ("cut and sewn flat rib knitted fabric may be employed"); EX1014, [0015] (disclosing a flat textile element that is sewn to assemble an upper for an article of footwear). A person of skill in the art would be motivated to implement such a combination in light of Herbert's disclosure that flat knitting can be used in that invention, and Cusinato's teaching of a shaped, flat knit textile element, which could be employed to reduce waste and simplify manufacturing by eliminating cutting steps.

148. This is consistent with the similar goal taught by Herbert, which discloses a "method of making the finished product...simpler and less expensive." EX1016, 2:14-15. Herbert and Cusinato are also consistent with the aim of Glidden, which is to create footwear "fabricated without substantial waste to the desired shape to accommodate the foot without uncomfortable wrin[k]les." EX1017, 2:3-10.

149. As I also explained for example in Section VII.D, Herbert discloses the use of a "selvage" (or selvedge) edge, which Cusinato also clearly teaches, having all finished edges. Creating a textile element with all finished edges would

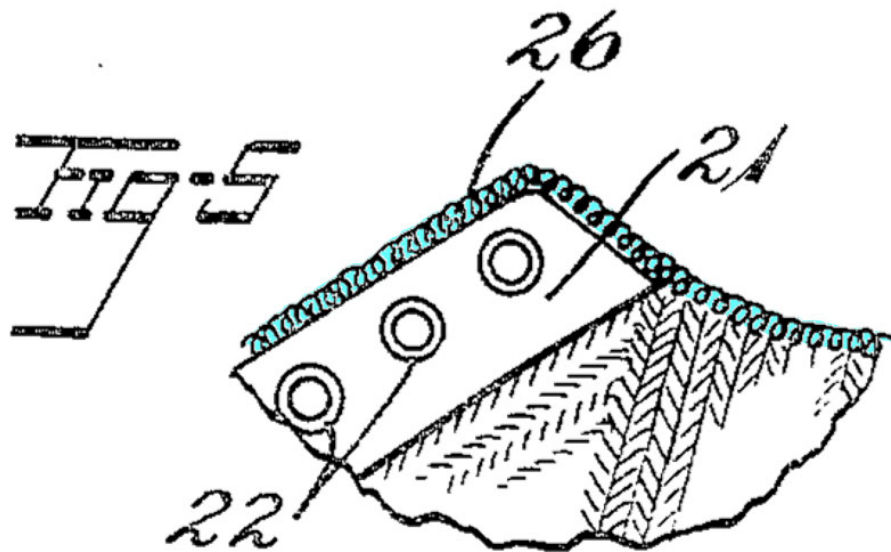
necessarily eliminate the need for cutting operations, thus rendering Herbert's claimed method "simpler and less expensive." EX1016, 2:15. Therefore, employing the flat knit technology disclosed in Cusinato to create Herbert's ribbed slipper would have yielded predictable results, would require only a simple substitution or application of a more modern knitting technique for an older one, and would have been obvious to try, with a reasonable expectation of success.

150. Moreover, Herbert discloses the use of different stitches, as well as both ribbed and non-ribbed textures to achieve varying levels of elasticity in different regions of the claimed slipper. *See, e.g.*, EX1016, 2:16-29; *see also supra* Section VII.D. Glidden also teaches employing different stitches, along with ribbed and non-ribbed textures, to impart various physical properties, including varying levels of elasticity, in different regions of a shoe upper. *See, e.g.*, EX1017, 2:19-44; *see also supra* Section VII.E.

151. A POSITA in possession of Herbert would have been motivated to create a shoe with an upper more rugged and robust than Herbert's knit slipper, would have looked to combine Herbert with Glidden's teachings of using different stitches to impart desired properties like greater durability and wear resistance, with a reasonable expectation of success.

152. While Glidden appears to generally relate to circular knit technology, both flat knit and circular knit machines have been used to create uppers for

footwear, including shoes. *See supra* Section V. A POSITA would have readily recognized that one could substitute the flat knit techniques disclosed in Cusinato and/or Herbert for Glidden's knit technology, and would have further recognized that this substitution would have yielded predictable results, would have constituted simple substitution or application of a more modern knitting technique for an older one, and would have been obvious to try, with a reasonable expectation of success. In fact, this substitution would simplify the process disclosed in Glidden by obviating any need for use of the overcast stitch disclosed in Glidden (used to finish "raw textile edges"), *see* EX1017, 3:56-64; Fig. 5, further demonstrating that such a solution would have been obvious to try.



153. A person of skill in possession of Herbert, Glidden, and/or Cusinato would have been motivated to improve the manufacturing efficiency, functionality,

and/or appearance of the knitted footwear claimed therein, and would have consulted Spencer for guidance in doing so. As explained, for example, in Sections V and VII.C, and as discussed throughout this declaration, Spencer would teach how to use or substitute known methods to yield predictable results, how to apply known techniques to improve a known method or product, which techniques would be obvious to try—and would have a reasonable expectation of success, given Spencer’s status as a knitting reference—and the use of other teachings, suggestions, and motivations to combine.

154. Moreover, much of the information provided in Spencer is common knowledge to those of skill in the art of knitting, and as such Spencer is not only a combinable prior art reference, but also provides evidence of what information was known in the knitting field as of the critical date of the ’511 patent, as well as what was inherent in prior art knit textiles, structures, and machines.

155. Finally, in the fashion industry, the consideration and possible use of (1) at least two different textures in different strips on the same knitted textile or footwear; (2) at least two different stitches in different strips on the same knitted textile or footwear; (3) at least two different yarns in different strips on the same knitted textile or footwear; (4) at least two different physical properties in different strips on the same knitted textile or footwear; (5) varying patterns of the strips; (6) differently shaped elements in the pattern; (7) different orientations of elements in

patterns; and (8) different locations of elements in patterns (the Obvious Design Choices), among other things, are a long-standing and integral part of fashion design, including knitted fashion design, and would have been obvious or obvious to try from the perspective of a POSITA familiar with either footwear or textiles, including because available knitting machines before the time of the invention were readily programmable to implement the known knitting techniques that would produce such patterns and variations, as I explained in the Technical Background. *See supra* Section V.

156. Indeed, as I have explained above in Section V, having strips of (1) different textures, (2) different stitches, and (3) different yarns in knitted textile or footwear is among the simplest and most ubiquitous of a limited number of aesthetic elements in knit fabrics and in footwear, and their use and success is predictable. Realizing (4) different physical properties using variations in textures, stitches, and/or yarns is also both simple and ubiquitous in knit fabrics and in footwear, and their use and success is predictable. Therefore, at the time of the invention of the '511 patent, a POSITA would have been motivated to combine the teachings of Herbert, Glidden, Cusinato, Spencer, or any combination thereof with the eight elements listed above, and would have had a reasonable expectation of success in that combination, insofar as aesthetic changes and implementation of different physical properties in knit textiles was well-known. *See supra* Section V.

Furthermore, at the time of the invention, it would have been obvious to a POSITA, or obvious to try, modifying Herbert, Glidden, Cusinato, Spencer, or any combination thereof to add elements (1), (2), (3), (4), (5), (6), (7), and/or (8) above. Insofar as such changes are well-known functional or aesthetic changes, a POSITA would have had a reasonable expectation of success.

VIII. CLAIMS 1-20 ARE OBVIOUS OVER CUSINATO IN VIEW OF CLARK AND, IF NECESSARY, SPENCER (GROUND 1)

A. Claim 1

1. Element 1[pre]: “An upper for an article of footwear, the upper comprising:”

157. Cusinato and Clark each disclose an upper for an article of footwear, a term for which I have applied the construction “any foot covering in the form of shoes, boots, slippers, or hose (*e.g.*, socks),” as discussed above in Section VI.F.

158. First, Cusinato discloses that the invention’s “aim is to obtain a fabric in one piece from which it is possible to directly make the stocking or footwear, namely a fabric which has the necessary geometrical characteristics so that, once it has been folded, it directly forms the stocking or footwear.” EX1014, [0013]. Cusinato’s fabric forms a “boot-like shape.” *Id.*, [0010].

159. Second, Clark’s invention “relates primarily to shoemaking and consists in a novel process of making of textile material a last-fitting upper which, as a resilient, self-sustaining article, exactly reproduces the contour of the last upon

which it is fashioned and preserves or maintains that contour in wear.” EX1015, 1:1-7.

160. As I explained above in Section VI.F, “footwear” should not be construed to require the inclusion of a sole. However, in the event Patent Owner argues that “footwear” must include a sole, Clark discloses a “shoe bottom,” *id.*, 3:10, and it would be obvious to add a sole to Cusinato’s “boot-like” form to provide cushioning and protection.

161. Therefore, Cusinato in view of Clark satisfies Element 1[pre].

2. **Element 1[a1]: “a flat knit textile element comprising (1) flat knit edges free of surrounding textile structure such that the flat knit edges are not surrounded by textile structure from which the textile element must be removed, at least one flat knit edge being a curved flat knit edge,”**

Flat Knit Textile Element

162. Cusinato teaches a “flat knit textile element” having “flat knit edges,” as a POSITA would understand that term, under either of the proposed constructions discussed above. *See supra* Section VI.F.

163. First, Cusinato refers to “the different parts or shapes of the stocking or footwear” as “flat parts,” which is consistent with the use of a flat knitting machine. EX1014, [0009]. Cusinato therefore discloses “flat knit textile elements.”

164. Furthermore, Cusinato teaches using a flat knitting machine to create a knitted textile upper through its disclosure that the claimed “process is carried out

conveniently using a knitting machine and, in particular, a machine with a straight needle bar,” which would produce flat textile parts. *See id.*, [0041]. Cusinato’s description of the claimed knitting process is also consistent with understanding its “straight needle bar” as corresponding to a straight needle bed, a row of independently operable needles used in flat weft knitting machines. A flat (or “straight”) knitting machine produces a generally flat piece of fabric with finished edges so that the yarn does not ravel in an integrated structure. As Spencer explains, “[s]haping of flat garment panels is ... in the form of knitted selvages (in the case of reciprocating knitting on a flat machine).” EX1050 (Spencer), 83. Straight needle beds have long been associated with flat knitting, and circular weft knitting techniques, by definition, cannot use straight needle beds (instead using a “needle cylinder” that produces fabric “in tubular form”). *Id.*, 63; *see also* 87 (“The term ‘circular’ covers all those weft knitting machines whose needle beds are arranged in circular cylinders and/or dials....”). “The typical flat machine,” by contrast, “has two stationary beds arranged in an inverted V formation. Latch needles and other elements slide in the tricks during the knitting action.” A cam system “is attached to the underside of a carriage that, with its selected yarn carriers, traverses in a reciprocating manner across the machine width,” *i.e.*, in a straight line. *Id.*, 86.

165. For example, Cusinato describes “using knitting machines or looms in which a support, called a needle bar, houses several needles placed side by side and

parallel to each other, in order to pass over the stitches of the new row with the stitches of the previous row,” which is consistent with, if not an exact description of, the operation of a flat knitting machine. EX1014, [0005]; *see also* [0014], [0021]-[0031] (describing the claimed process of forming a knitted textile element with “subsequent rows of stitches”).

166. Cusinato also teaches that the claimed invention “extends also to the use of any machine in order to carry out the above process.” *Id.*, [0042]. Thus, to the extent the discussions in Cusinato above do not expressly disclose the use of a flat knitting machine, Cusinato nevertheless makes clear that flat knitting can be used in accordance with the claimed invention. In addition, a POSITA would recognize that the versatility of a flat knitting machine would be well-suited to carrying out the process taught by Cusinato, particularly because of flat knitting machines’ suitability for creating “shaped” fabrics:

The flat machine is the most versatile of the weft knitting machines; its stitch potential includes needle selection on one or both beds, racked stitches, needle-out designs, striping, tubular knitting, changes of knitting width, and loop transfer; a wide range of yarn counts may be knitted for each machine gauge, including a number of ends of yarn at each knitting system; the stitch length range is also wide; and there is the possibility of changing the machine gauge.

...

Articles knitted on flat machines range from trimmings, edgings and collars, to shaped panels, integrally-knitted

garment pieces, integrally-knitted complete garments and other articles.

EX1050 (Spencer), 87.

Curved Flat Knit Edges

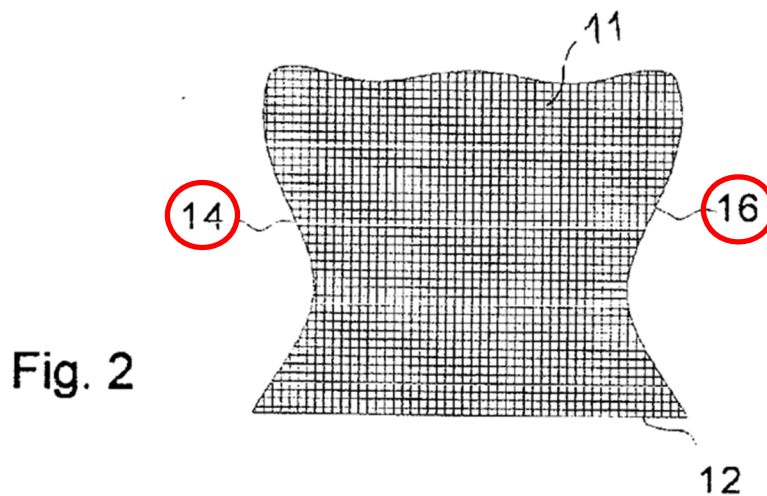
167. Second, Cusinato discloses curved flat knit edges, as that term is used in the '511 patent. For example, Cusinato explains that well-known knitting machines at the time of the invention made it “possible to generate a decrease or an increase of the fabric, namely it is possible to obtain shaped fabrics.” EX1014, [0006]. Cusinato describes a process whereby such machines are used to “widen a fabric (called ‘increase’) by inserting other needles which are placed side by side to those placed at the ends,” and that “it is possible to reduce the fabric (called ‘decrease’) by removing the needles which are placed at the ends.” *Id.*, [0005]-[0007].

168. As Cusinato teaches, and as a POSITA would readily recognize, “[t]he number of needles” used to knit a row (or “course”) of stitches “is, obviously, equal to the number of stitches per row.” *Id.*, [0005]. In a flat knitting machine, these needles are “placed side by side and parallel to each other, in order to pass over the stitches of the new row with the stitches of the previous row,” as described in Cusinato. *Id.*

169. As Spencer explains, a flat knit textile element may be knit directly to its final shape (which need not be a rectangular sheet and need not have straight

edges) by adjusting the number of needles used to knit each row, which changes the number of stitches per row. *See* EX1050, 184 (“weft knitting provides unique opportunities for width-wise shaping during knitting,” including by “varying the number of needles in action in the knitting width”), 188 (“In *needle selection shaping*, the selvedge needle(s) is introduced or withdrawn from the knitting width by means of needle selection.”).

170. Thus, carrying out Cusinato’s teaching of “increases” and “decreases” operations results in a shaped textile element with curved flat knit edges, as shown in Cusinato’s Figure 2:



EX1014, Fig. 2 (red annotations added to indicate “suitably shaped side edges [14 and 16] (by increasing or decreasing the fabric)”); *see also id.*, [0015].

171. Claims 2 and 3 of Cusinato describe this same process of increasing and decreasing stitches “so as to obtain an increased [or decreased] fabric”:

- Claim 2: Process according to claim 1, characterized in that as the rank of the left rows (20) and the right rows (22) increases, new stitches are added at the left end of the left row (20), thus moving said left side edge (14) towards the left and, at the same time, new stitches are added at the right end of the right row (22), thus moving said right side edge (16) towards the right, so as to obtain an increased fabric.
- Claim 3: Process according to claim 1, characterized in that as the rank of the left rows (20) and the right rows (22) increases, the stitches on the left end of the left row (20) are decreased, thus moving said left side edge (14) towards the right and, at the same time, the stitches on the right end of the right row (22) are decreased, thus moving said right side edge (16) towards the left, so as to obtain a decreased fabric.

EX1014, Claims 2-3.

172. In fact, such curved flat knit edges would be a natural, and indeed obvious, result of increasing or decreasing the number of needles in operation (and therefore, the number of stitches created) from row to row during the knitting process. After several subsequent knitting steps are carried out, as I described in further detail in Section VII.A above, a finished textile element with curved flat knit edges is created, as shown in Figure 5:

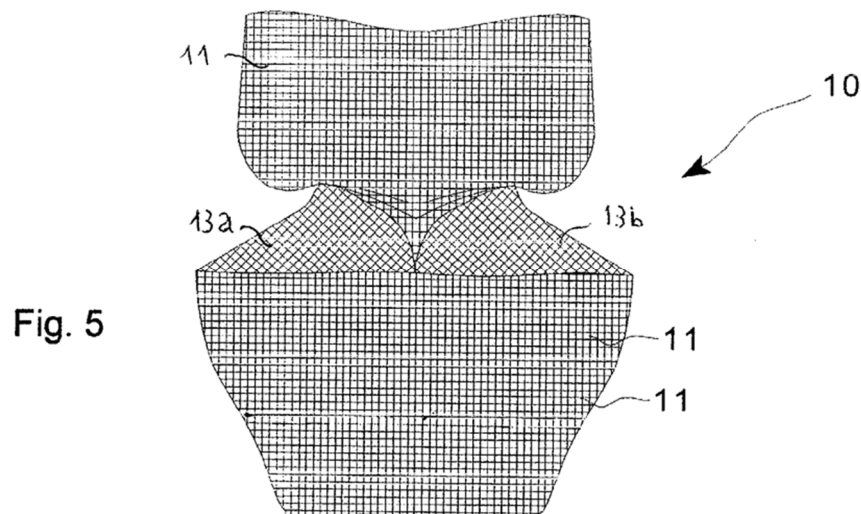


Fig. 5

Free of Surrounding Textile Structure

173. Third, Cusinato discloses that its flat knit edges are free of surrounding textile structure from which the textile element must be removed. As Figure 2, above, shows, the edges of the textile element (for example, left side edge 14 and right side edge 16 in Figure 2) may be curved flat knit edges, which eliminate any need for cutting because the element is already knit to its final shape. Thus, there is no need for any further cutting of Cusinato's textile element before its edges are sewn to form a "boot-like" article of footwear, and Cusinato does not disclose any such cutting of its "shaped fabric." In fact, Cusinato expressly distinguishes "the increase and decrease technique" from methods in which "the different parts or shapes of the stocking or footwear...may be obtained starting from a rectangular fabric and cutting from it the component parts of the stocking or footwear." EX1014, [0007]-[0008]. In those well-known, conventional approaches, "it is necessary to build the different parts or shapes of the stocking or footwear and, then, to join them together by sewing" after they have been cut from the surrounding material. *Id.*, [0007]. As Cusinato explains, this conventional approach "produc[es] scraps," whereas the "increase and decrease technique...avoid[s] wastage." *Id.*, [0008].

174. Moreover, Cusinato teaches creating a "fabric" (textile element) that is knit as a single piece with "the necessary geometrical characteristics so that, once it

has been folded, it directly forms the stocking or footwear.” *Id.*, [0013]. This process “produce[s] a one-piece fabric which has suitably shaped side edges (by increasing or decreasing the fabric),” and which includes “an amount of fabric in excess” in certain areas of the textile element so that “the stocking or footwear is directly obtained by wrapping the fabric in a bootlike manner and carrying out a simple sewing in order to join the two side edges.” *Id.*, [0015]. This method results in a textile element that is knit to shape, so that “the cutting and sewing operations for each different parts [sic] of the stocking or footwear are avoided, and also the subsequent stretching operation” that might otherwise be necessary to form a flat knitted textile element into a piece useful as an upper. *Id.*, [0016]; *see also id.* at [0010]. Cusinato includes further detailed discussions of the process used to form a flat knit textile element comprising flat knit edges free of surrounding textile structure by increasing or decreasing the number of stitches from row to row. For example, Cusinato explains how threads are used in the knitting machine to form consecutive rows of stitches, *id.*, [0021]-[0031], and teaches, “[w]hen the knitting operation is ended, it is sufficient to put the left side edge 14 in contact with the right side edge 16 and joining them by sewing, thus obtaining a stocking or a footwear with a perfect and uniform shape.” *Id.*, [0032].

175. In sum, Cusinato’s consistent references to “shaped” textile elements and statements distinguishing prior art techniques that utilized cutting (for example,

removing “different parts or shapes of the stocking or footwear...from a rectangular fabric”) confirm that the flat knit textile element disclosed in Cusinato comprises flat knit edges free of surrounding textile structure from which the textile element must be removed, as claimed in the ’511 patent.

176. Finally, to the extent Cusinato alone does not disclose a flat knit textile element, it would have been obvious to use flat knitting, which is expressly taught in both Clark and Spencer, and a POSITA would have had a reasonable expectation of success in doing so. For example, Clark expressly discloses that the textile element created for that invention “may be knitted as a strip in a flat bed knitting machine.” EX1015, 2:13-14. As I explained above, Spencer teaches that a flat (or “straight”) knitting machine produces a generally flat piece of fabric with finished edges so that the yarn does not ravel in an integrated structure. As Spencer explains, “[s]haping of flat garment panels is ... in the form of knitted selvages (in the case of reciprocating knitting on a flat machine).” EX1050, 83. Spencer also explains that “[t]he typical flat machine has two stationary beds arranged in an inverted V formation. Latch needles and other elements slide in the tricks during the knitting action.” A cam system “is attached to the underside of a carriage that, with its selected yarn carriers, traverses in a reciprocating manner across the machine width,” *i.e.*, in a straight line. *Id.*, 86.

177. Therefore, Cusinato in view of Clark and Spencer satisfies Element 1[a1].

3. Element 1[a2]: “and (2) a first knit strip having a first property and a second knit strip having a second property that is different from the first property;”

178. As I explained above in Section VI.C, the specification of the ’511 Patent includes almost no definition, discussion, or explanation of the “knit strips” described in this claim element. However, it does explain that different types of yarns and knit stitches may be used to impart various broadly-defined “properties” to the claimed textile element. For example, the specification suggests the use of “a yarn that incorporates an elastane fiber” to “provide the stretch and recovery properties to upper 30.” EX1001, 8:59-61. The specification also describes other yarns, including cotton, rayon, wool, nylon, polyester, and polytetrafluoroethylene coatings, as providing various other “physical properties to textile element 40...includ[ing], for example, strength, support, stiffness, recovery, fit, and form.” *Id.*, 9:3-22.

179. These different properties can include differences in stitches, textures, yarns, degree of stretch, and/or several other properties. Crucially, as I explained above in Section VI.C, only dependent claims 10-11 and 13-14 require the knit strips to serve any functional purpose. This is demonstrated by the ’511 patent’s specification, which confirms that two of the claimed “properties,” textures and

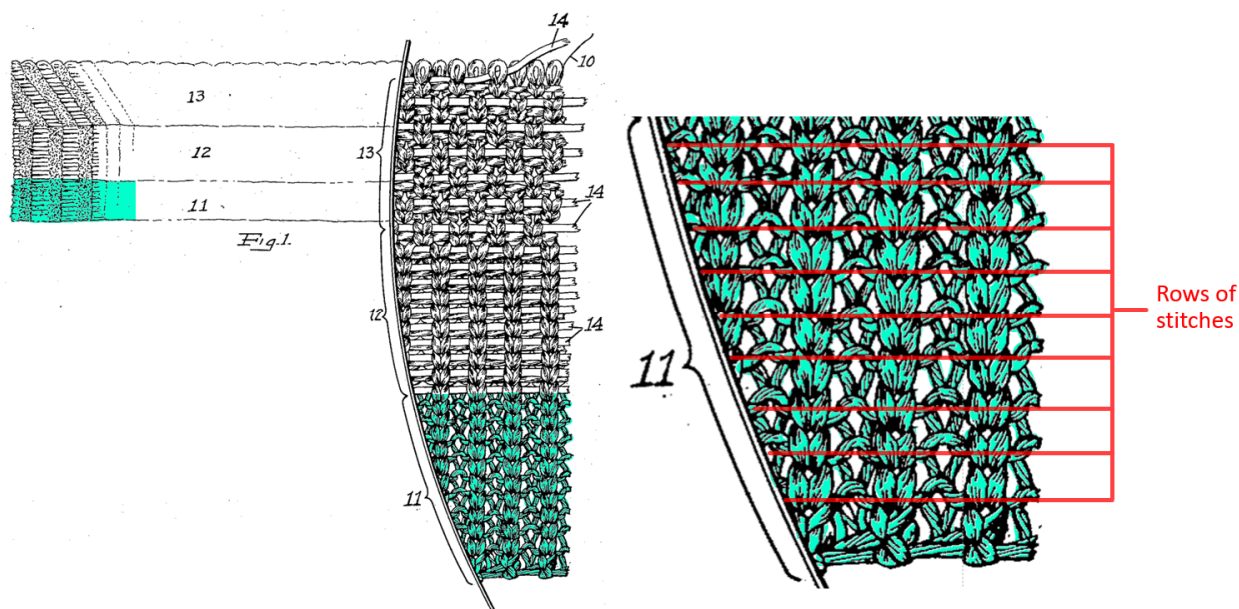
stitches, may serve purely aesthetic purposes. *See* EX1011, 10:4-5 (“Textures...may exhibit aesthetic differences...”), 10:15-19 (“[S]titches...may be utilized to vary the...aesthetics of footwear”).

180. Clark discloses a first knit strip having a first property and a second knit strip having a second property that is different from the first property.

181. Clark’s specification describes using a variety of types and arrangements of knit stitches (a *first* type of “property” in the ’511 patent) to knit three distinct sections of its claimed knit upper, each of which has the general shape of a strip, as discussed below.

As herein shown, the welt section 11 may comprise approximately nine courses ... Any convenient knitting stitch can be employed in section 12, but as herein shown I have employed the same stitch as that used in the welt ... In forming the section 13 any desired form of knitting stitch may be employed, although as shown in Fig. 1 I have employed the well-known popcorn stitch...

Id., 3:6-53. Furthermore, Clark’s sections 11, 12, and 13 comprise three different knit strips, because, as shown in the annotated version of Figure 1 below, in which section 11 has been magnified and annotated, each section comprises multiple rows, or courses, of stitches:



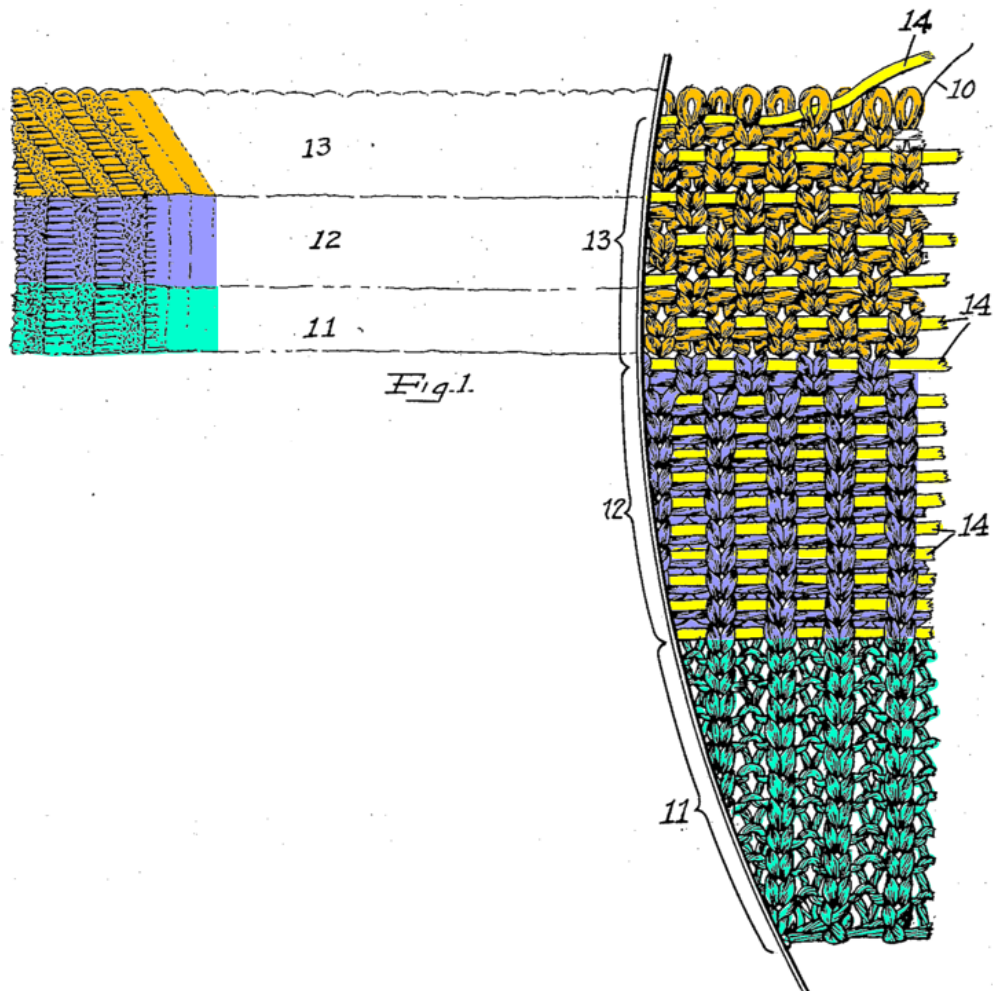
Id., Fig. 1; *id.*, 3:6-10 (“As herein shown, the walt section 11 may comprise approximately nine courses”).

182. These knit strips may also produce different textures (a *second* type of “property” in the ’511 patent), for example, when different stitches are used. These differences in texture are apparent in the annotated version of Figure 1 immediately above.

183. I note that Clark discusses the use of a variety of knit stitches within the same textile element not as a novel feature of the invention (which it is not, as this was a recognized capability of knitting machines even at the time of Clark’s invention in the 1940s), but by way of background. *Id.*, 3:1-54. Rather, as I discussed above in Section VII.B, Clark’s invention relates to the use of different yarns (a *third* type of “property” in the ’511 patent) in different knit strips. In particular, Clark discloses “properly distributing relatively coarse strands of certain thermoplastic

material in a knitted fabric and then shrinking these strands in the fabric upon the last ... to secure a stiff resilient self-sustaining upper....” *Id.* at 1:18-23. These thermoplastic strands (which Clark generally refers to as “vinyon” yarn, a type of thermoplastic yarn) are “laid or placed between the needles [of a knitting machine] so that in the ensuing course the strand is enmeshed in the knitted fabric.” *Id.*, 3:14-17. This technique, which is known as “laying-in,” is a well-known practice in the field of knitting and “consists of a ground structure of knitted or overlapped (warp knitted) threads that hold in position other non-knitted threads which were incorporated (laid-in) into the structure during the same knitting cycle.” EX1050 (Spencer), 54. As Spencer explains, and as a POSITA would readily recognize, laying-in may be used to affect the properties of a knitted textile element, including the fabric’s “stability, elastic stretch and recovery, handle, weight, surface ‘interest’, and visual appearance.” *Id.*, 55.

184. Clark’s Figure 1 depicts a “composite knitted strip” of material that is used to form Clark’s claimed knit upper. An annotated version of Figure 1 is reproduced below, with sections 11, 12, and 13 shown in green, purple, and orange, respectively, and vinyon strands 14 shown in yellow:



185. As shown in Figure 1, no vinyon strands 14 are laid in section 11, which is intended “to cover the marginal portion of the last bottom and to be incorporated eventually in the shoe bottom.” EX1015, 3:8-10, 3:55. “[I]n forming each course of [section 12] a relatively thick heavy strand of vinyon 14 is laid or placed between the needles so that in the ensuing course the strand is enmeshed in the knitted fabric. *Id.*, 3:13-17. “The knitting operation then proceeds for the formation of the third or uppermost section 13 and in forming each course of this section the heavy vinyon strands 14 are laid between the needles in every alternate course, that is to say, with

approximately twice the spacing of the vinyon strands 14 in the section 12.” *Id.*, 3:36-42.

186. After heat treatment, “the vinyon strands have increased in diameter and have contracted with the fabric in which they are embodied so that the vinyon strands and the fabric fits skin tight upon the last.... Moreover in cooling, the vinyon elements of the fabric have become stiff and extremely resilient, being set in the shape imparted to them by the last and tending resiliently to reassume that shape if temporarily distorted.” *Id.*, 4:22-31. Therefore, Clark’s sections 11, 12, and 13 form knit strips with different degrees of stretch, stiffness, and recovery (*fourth*, *fifth*, and *sixth* “properties” in the ’511 patent). EX1001, 9:20-22 (“physical properties” of textile element 40 may include “strength, stretch, support, stiffness, recovery, fit, and form”). Clark’s sections 11, 12, and 13 are knit strips with different properties corresponding to each of the six properties identified in the preceding paragraphs. Specifically, each knit strip is formed using (1) a knit stitch that may vary from stitches used in an adjacent strip, (2) resulting in a different texture from adjacent strips. The strips (3) comprise different yarns, with or without inlaid vinyon strands. *See* Clark, 3:1-54. Finally, after heat treatment, Clark’s knitted upper has different physical properties in different adjacent strips due to the vinyon strands, which affect (4) stretch, (5) stiffness, and (6) recovery.

187. Spencer also teaches that varying the type of knit stitch used within a single textile element to impart different properties to different areas or regions of that element has been a recognized technique in the knitting field for decades, if not longer. For example, as I explained in Section V.A, Spencer discusses four primary or “base structures from which all weft knitted fabrics and garments are derived.” EX1050, 60. These include “plain, rib, interlock and purl,” and can be used to build a wide variety of knitted structures. More specifically, “[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.” *Id.*, 52; *see also id.*, 105.

188. I have provided two examples from Spencer below (which I also discussed in Section VII.C), which show differences in stitching and textures. These distinctions would also lead to different levels of elasticity in the knitted elements:

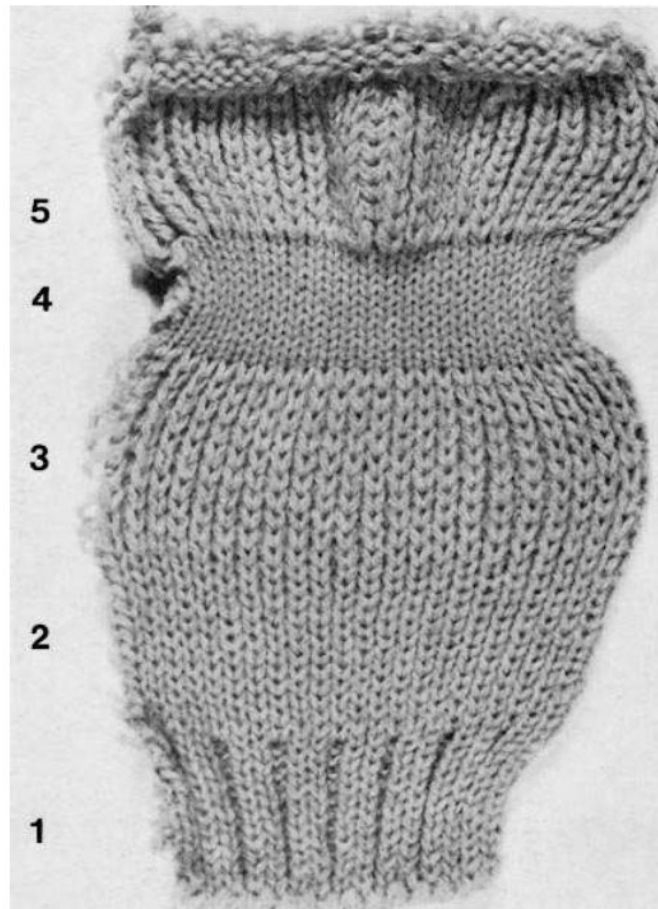


Fig. 16.13 Stitch shaping (1 = 2×2 rib; 2 = 1×1 rib; 3 = half-cardigan; 4 = tubular courses; 5 = full cardigan).

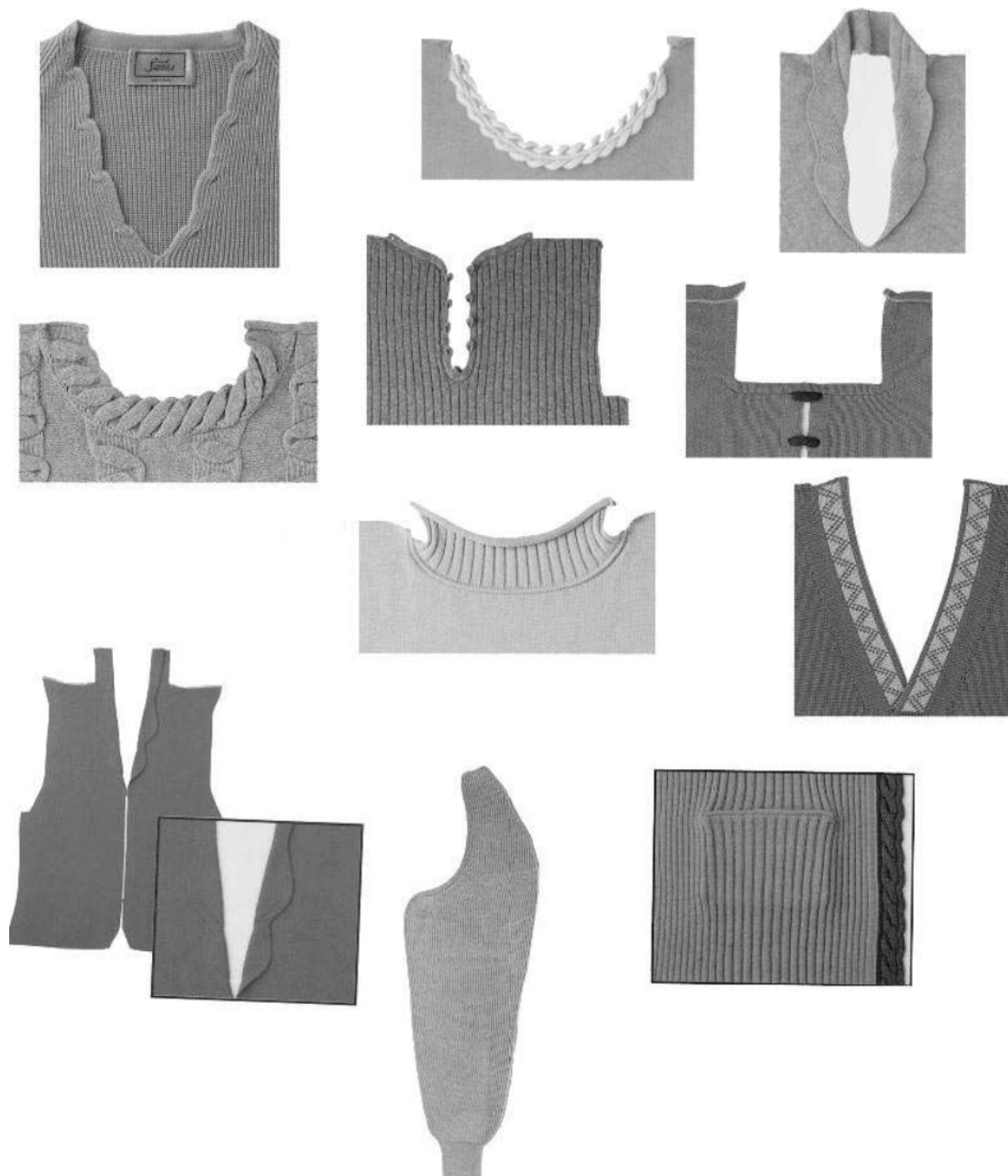


Fig. 16.9 Integrally shaped rib garment pieces. The machine has an additional bed containing the transfer points [Shima Seiki].

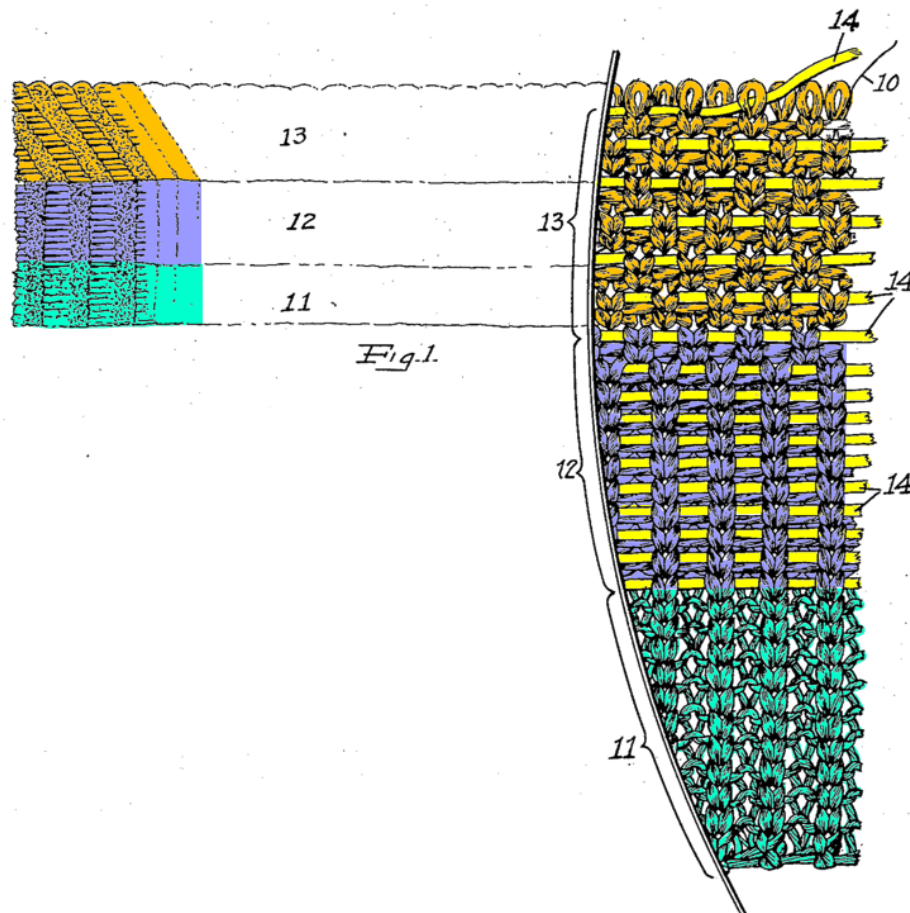
EX1050, 191, 186.

189. Therefore, Cusinato in view of Clark and/or Spencer satisfies Element 1[a2].

4. Element 1[b]: “wherein the first knit strip and the second knit strip are positioned adjacent to each other along one or more of a lateral side and a medial side of the upper.”

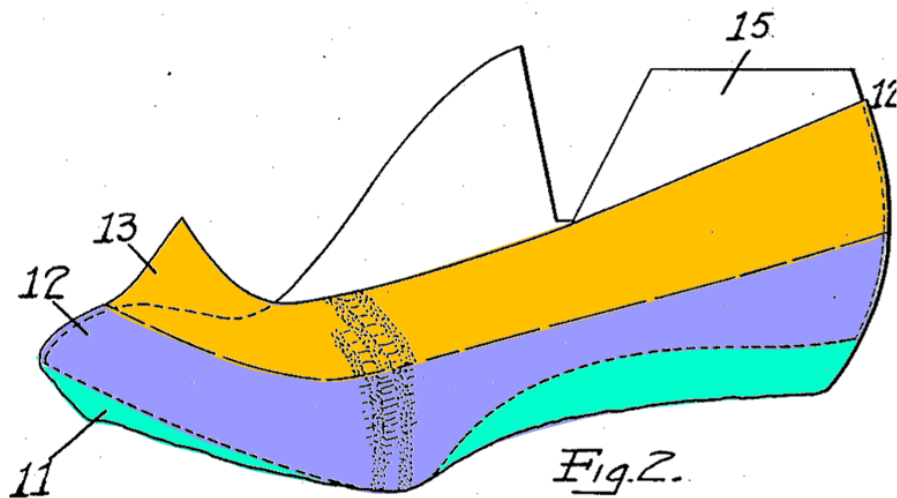
190. Cusinato in view of Clark discloses a first knit strip and a second knit strip positioned adjacent to one another along one or more of a lateral side and a medial side of the upper.

191. As I explained above, Clark discloses multiple knit strips adjacent to one another, as shown in Figure 1 (sections 11, 12, and 13):



EX1015, Fig. 1.

192. When the band of fabric shown in Figure 1 is worked over a last (a form in the shape of a foot), at least sections 12 and 13 are positioned adjacent to one another along one or more of a lateral side and a medial side of the upper, as shown in Figure 2 of Clark, which depicts a side view of the upper on a last:



EX1015, Fig. 2.

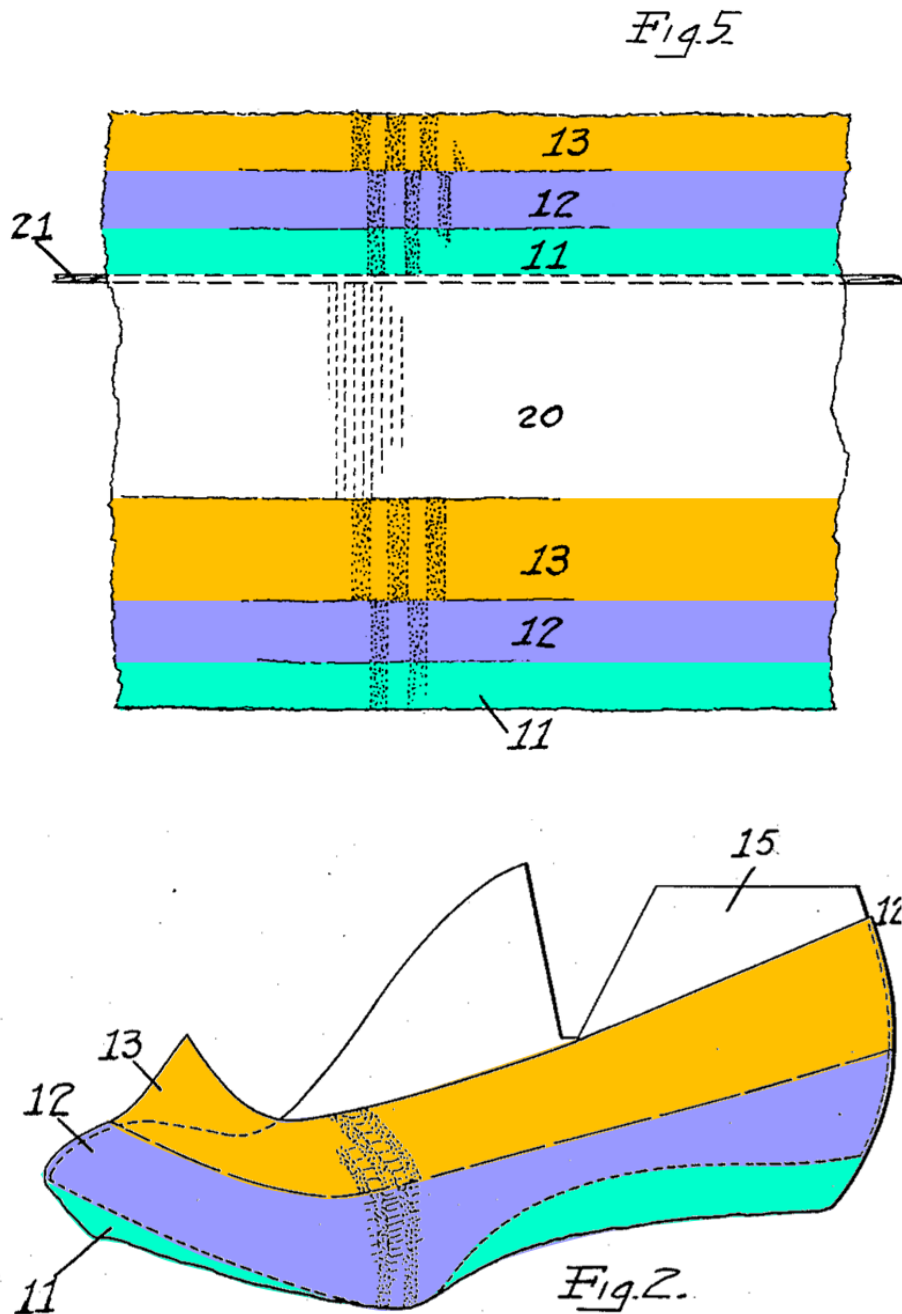
193. Therefore, Cusinato in view of Clark and/or Spencer satisfies Element 1[b].

B. Claim 2

“The upper of claim 1, wherein one or both of the first knit strip and the second knit strip comprises a plurality of knit strips.”

194. As I explained above with respect to Elements 1[a2] and 1[b], Clark’s sections 11, 12, and 13 disclose one or both of the first knit strip and the second knit strip comprising a plurality of knit strips.

195. Specifically, Clark illustrates two strips each of sections 11, 12, and 13 in its knitted textile element, which is then assembled into an upper with those strips on both the lateral and medial sides, as shown in Figure 5 and Figure 2 below, which have been annotated to show sections 11, 12, and 13:



EX1015, Figs. 5, 2.

196. Moreover, the aesthetic design described in Claim 2 would have been an obvious design choice. In particular, the number, location, and arrangement of these knit strips may be selected solely for aesthetic purposes, and it would have been obvious to use the textured strips of Clark (sections 11, 12, and 13) for aesthetic purposes in Cusinato, but to arrange them in accordance with the limitations of Claim 2. Such a design choice would be obvious or obvious to try in the fashion industry, of which footwear and textiles are a part, and a POSITA would have had a reasonable expectation of success. *See* the Obvious Design Choices, *supra* VII.F. Indeed, as I have explained throughout this declaration, strips are among the simplest and most ubiquitous of a set of finite number of aesthetic design elements in footwear, and in knit fabrics generally. Moreover, any design choices creating strips, shaping strips, orienting strips, or locating strips would be easily implemented using programmable knitting machines available in the early 2000s. *See supra* Section V.

197. As such, Claim 2 is obvious over Cusinato in view of Clark.

C. Claim 3

“The upper of claim 2, wherein the first and second knit strips alternate with one another along one or more of the lateral side and the medial side of the upper.”

198. Claim 3 imposes an additional aesthetic limitation for the upper of Claim 2, and it would have been obvious in light of Cusinato, Clark, and/or Spencer

to create the upper of Claim 2 “wherein the first and second knit strips alternate with one another along one or more of the lateral side and the medial side of the upper” for the same reasons described with respect to Elements 1[a2] and 1[b], as well as Claim 2.

199. Spencer discloses alternating patterns, as shown in the following examples:

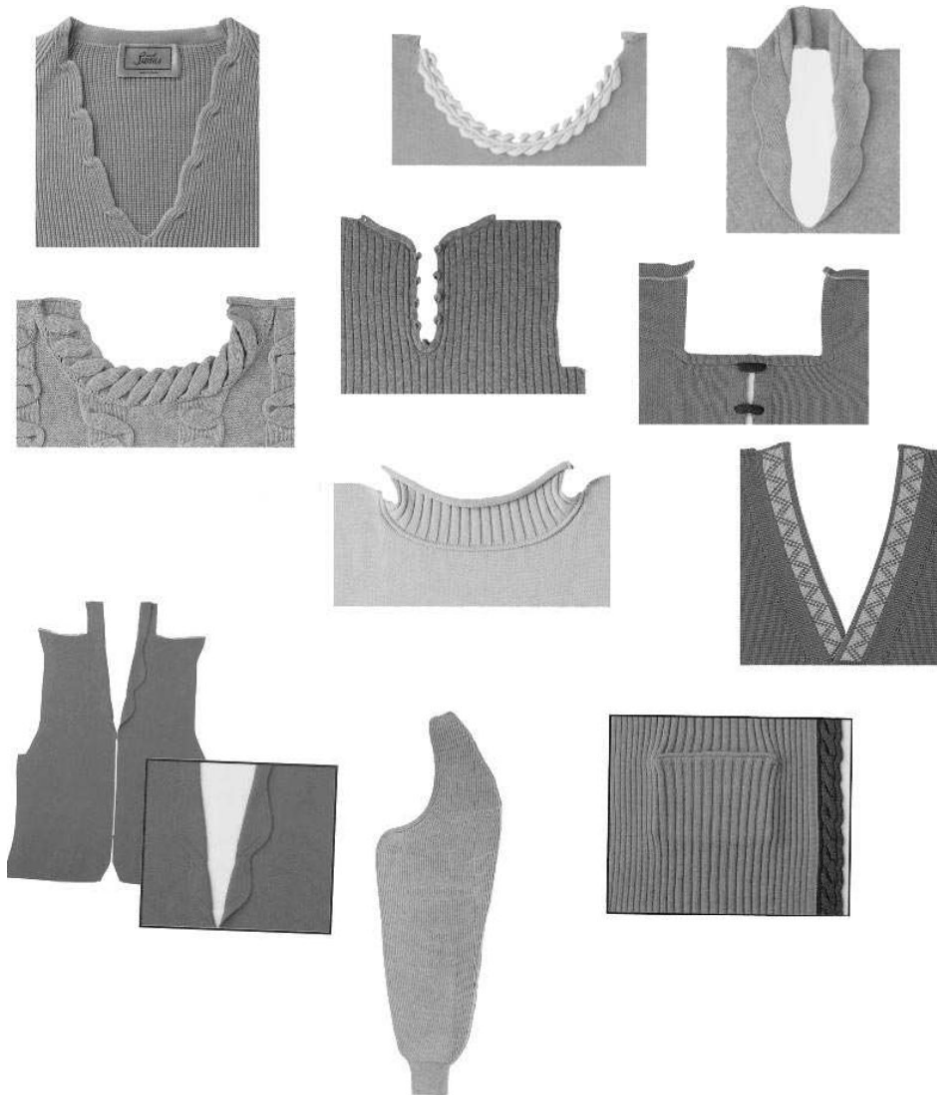


Fig. 16.9 Integrally shaped rib garment pieces. The machine has an additional bed containing the transfer points [Shima Seiki].

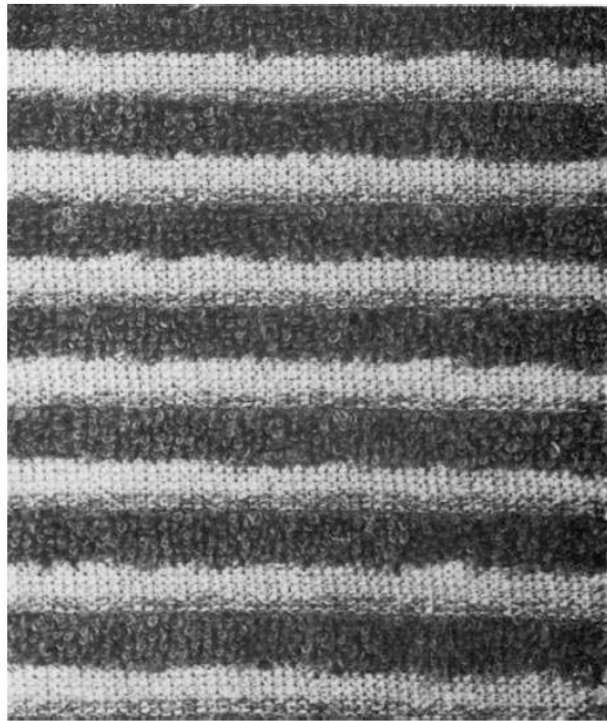


Fig. 14.4 Horizontal ribs with an ottoman effect on two-tone towelling [Alwin Wild, Switzerland].

EX1050, 186, 165.

200. Moreover, this aesthetic design choice, which relates to the location and spacing of knit strips, would have been obvious or obvious to try. In particular, the number, location, and arrangement of these knit strips may be selected solely for aesthetic purposes, and it would have been obvious to use the textured strips of Clark for aesthetic purposes in Cusinato, but to arrange them in accordance with the limitations of Claim 3. Such a design choice would be obvious or obvious to try in the fashion industry, of which footwear and textiles are a part, and a POSITA would have had a reasonable expectation of success. *See the Obvious Design Choices,*

supra Section VII.F. Indeed, as I have explained throughout this declaration, strips are among the simplest and most ubiquitous of a set of finite number of aesthetic design elements in footwear, and in knit fabrics generally. Moreover, any design choices creating strips, shaping strips, orienting strips, or locating strips would be easily implemented using programmable knitting machines available in the early 2000s. *See supra* Section V.

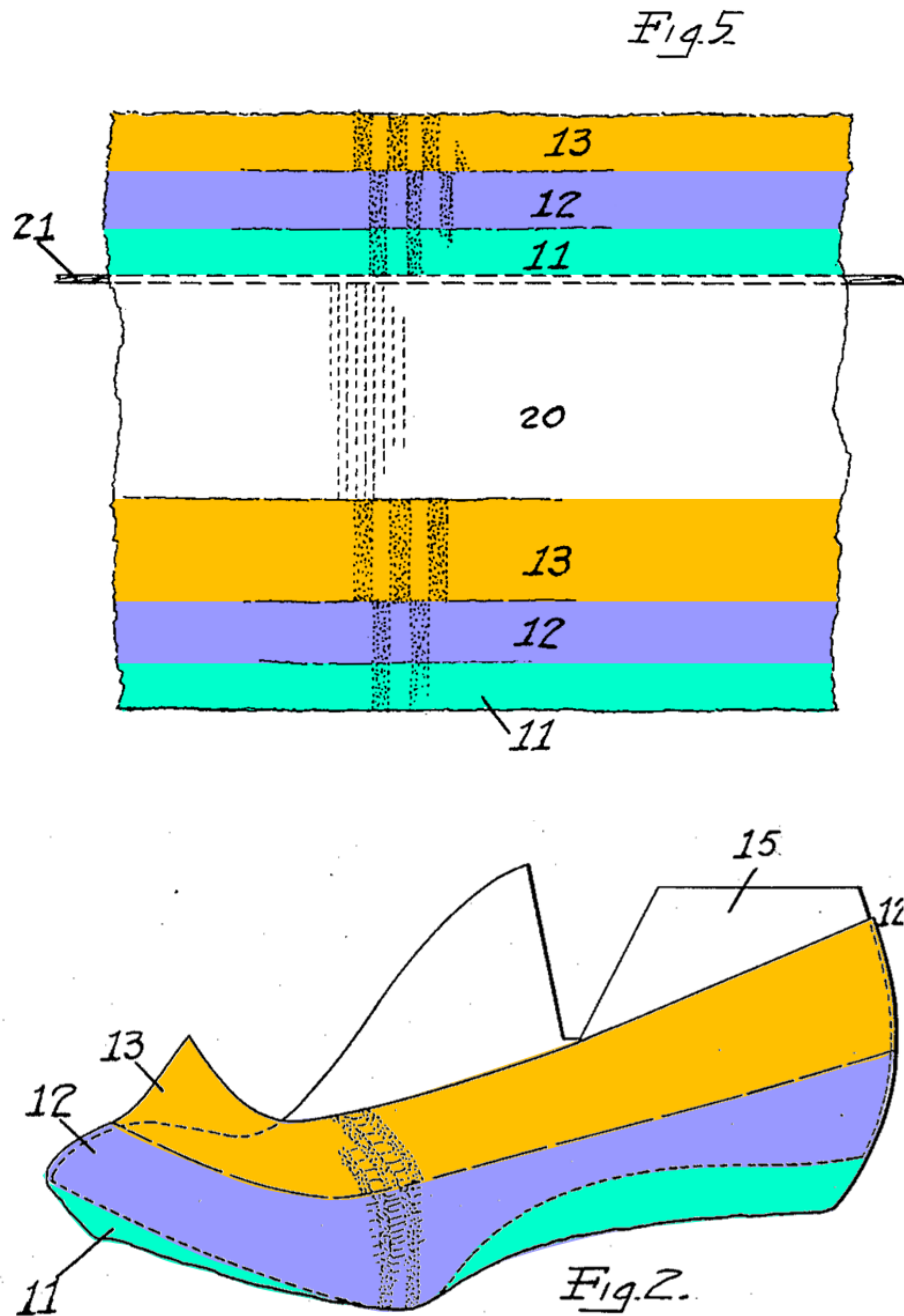
201. As such, Claim 3 is obvious over Cusinato in view of Clark and/or Spencer.

D. Claim 4

“The upper of claim 2, wherein the flat knit textile element comprises at least two first knit strips and at least two second knit strips.”

202. Claim 4 would have been obvious in light of Cusinato, Clark, and/or Spencer for the same reasons described with respect to Claim 2, and simply adds the limitation that the first and second knit strips are created a second time.

203. As I explained above with respect to Claim 2, Figure 5 of Clark depicts two each of sections 11, 12, and 13 in a single workpiece, one for each side of the upper, as illustrated in Figure 2:



EX1015, Figs. 5, 2.

204. And, as I explained with respect to Claim 3, Spencer discloses multiple pairs of knit strips:

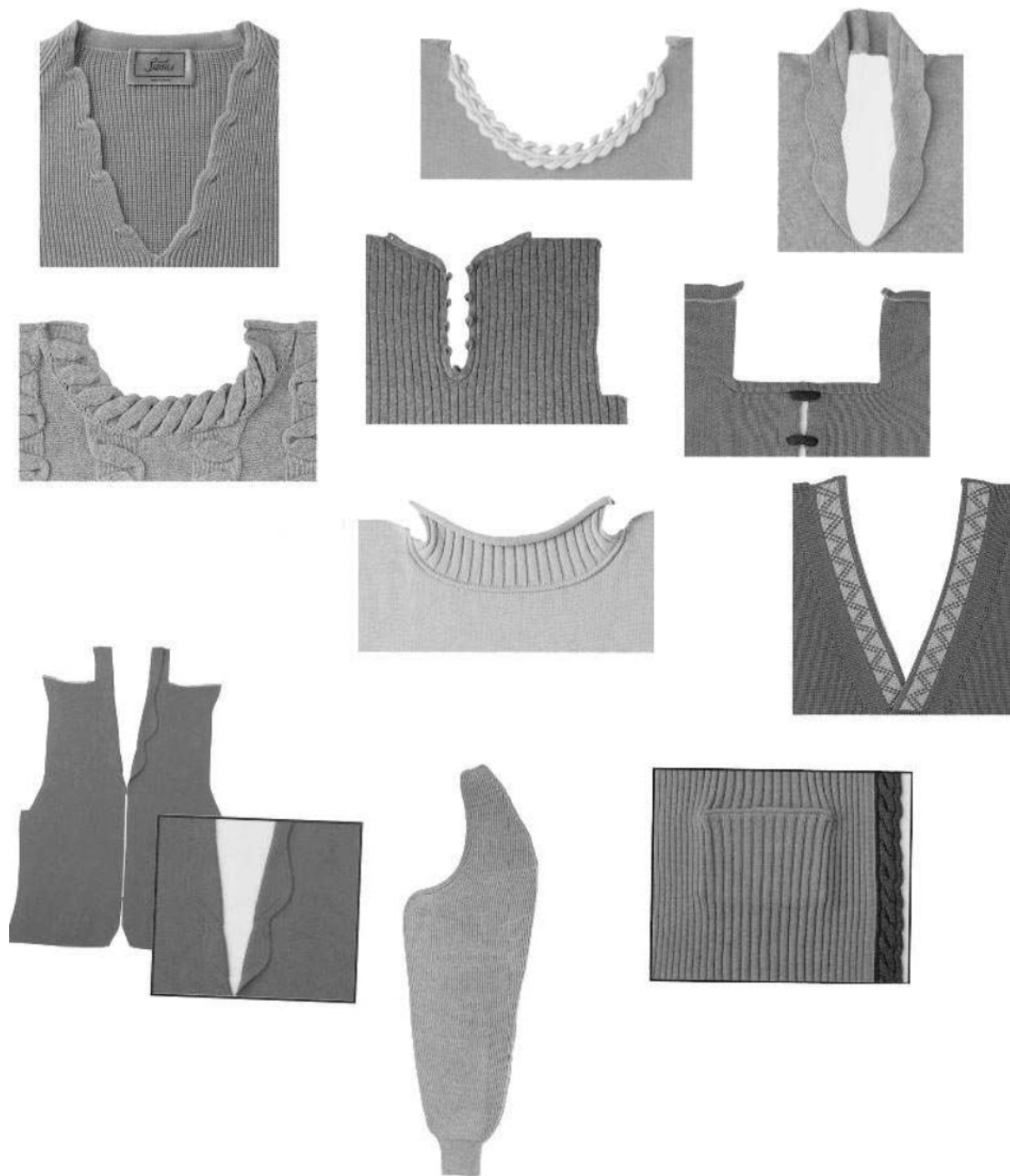


Fig. 16.9 Integrally shaped rib garment pieces. The machine has an additional bed containing the transfer points [Shima Seiki].

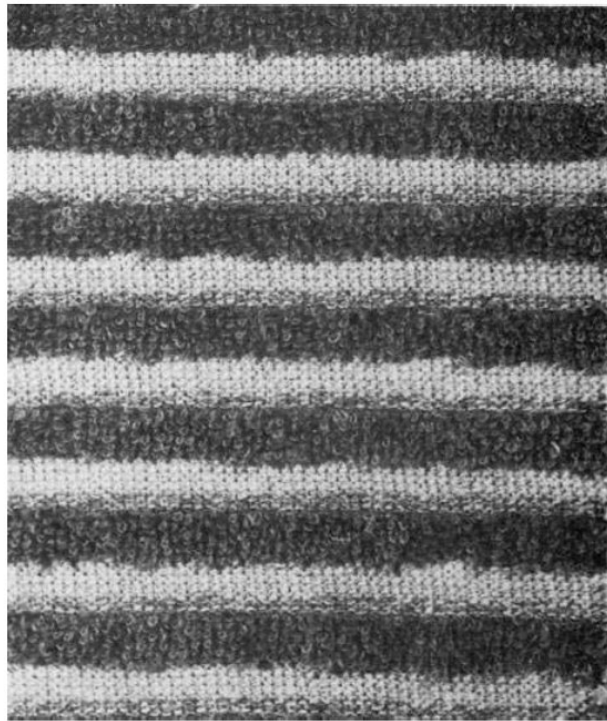


Fig. 14.4 Horizontal ribs with an ottoman effect on two-tone towelling [Alwin Wild, Switzerland].

EX1050, 186, 165.

205. Moreover, this aesthetic design choice, which relates to the number, location and arrangement of knit strips, would have been obvious or obvious to try for the same reasons I discussed with respect to Claims 2 (“wherein one or both of the first knit strip and the second knit strip comprises a plurality of knit strips”) and 3 (“wherein the first and second knit strips alternate with one another along one or more of the lateral side and the medial side of the upper”). *See* the Obvious Design Choices, *supra* Section VII.F.

206. As such, Claim 4 is obvious over Cusinato in view of Clark and/or Spencer.

E. Claim 5

“The upper of claim 1, wherein the first knit strip and the second knit strip extend along the lateral side of the upper from an instep region of the upper to an area proximate to a lower region of the upper.”

207. Claim 5 imposes an additional aesthetic limitation for the upper of Claim 1. For the same reasons I discussed above with respect to Claims 3 and 4, it would have been obvious to create the upper of Claim 1, wherein the first knit strip and the second knit strip extend along the lateral side of the upper from an instep region of the upper to an area proximate to a lower region of the upper, because the strips are on both sides of the upper.

208. Moreover, this aesthetic design choice, which relates to the size, location, and orientation of knit strips, would have been obvious or obvious to try. In particular, the number, location, and arrangement of these knit strips may be selected solely for aesthetic purposes, and it would have been obvious to use the textured strips of Clark for aesthetic purposes in Cusinato, but to arrange them in accordance with the limitations of Claim 5. Such a design choice would be obvious or obvious to try in the fashion industry, of which footwear and textiles are a part, and a POSITA would have had a reasonable expectation of success. *See the Obvious Design Choices, supra* Section VII.F.

209. As such, Claim 5 is obvious over Cusinato in view of Clark and/or Spencer.

F. Claim 6

“The upper of claim 1, wherein the first knit strip and the second knit strip extend along the medial side of the upper from an instep region of the upper to an area proximate to a lower region of the upper.”

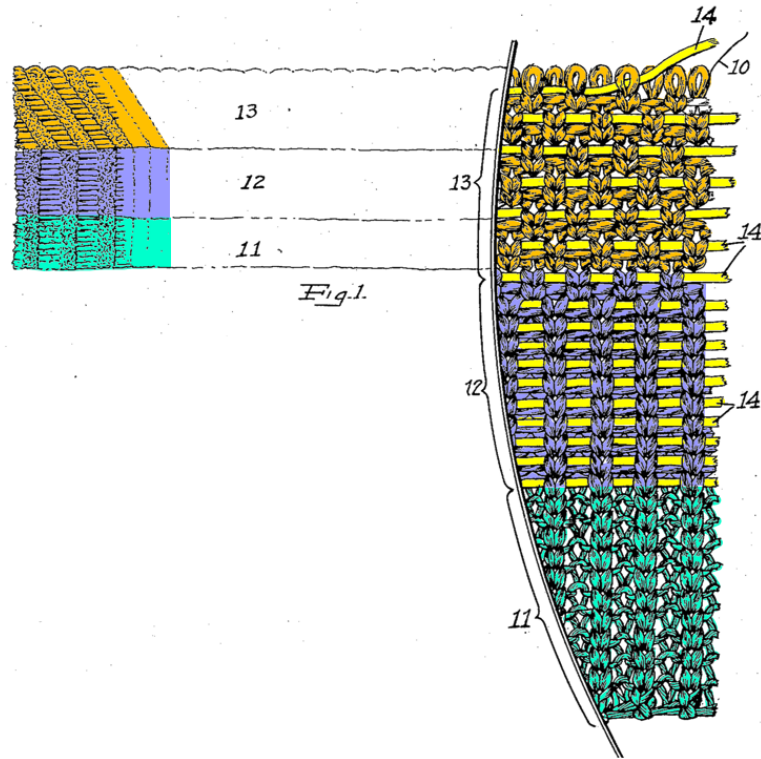
210. While Claim 5 refers to knit strips extending “along the lateral side of the upper,” Claim 6 refers to the “medial side of the upper.” This is the only difference between the two claims.

211. Therefore, Claim 6 would have been obvious for the same reasons discussed above with respect to Claim 5, because the strips are on both sides of the upper.

G. Claim 7

“The upper of claim 1, wherein the first property comprises a first knit construction and the second property comprises a second knit construction.”

212. As I explained above with reference to Element 1[a2] and as shown below in the annotated version of Figure 1, Cusinato in view of Clark and/or Spencer discloses a first knit strip (section 11) and a second knit strip (section 12), each with different properties that comprise a knit construction (*i.e.*, stitches and the first of the six properties I enumerated in Section VIII.A.3):



213. Spencer also explains that different knit stitches form different knit constructions, as I described above in Section V. I have provided two examples below, which I have also utilized in preceding sections of this declaration:

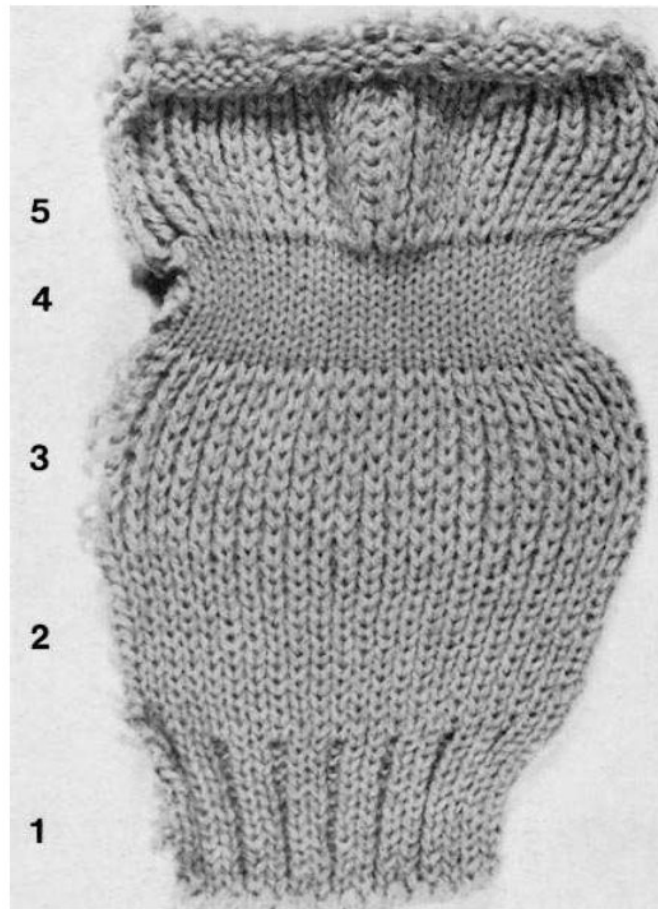


Fig. 16.13 Stitch shaping (1 = 2×2 rib; 2 = 1×1 rib; 3 = half-cardigan; 4 = tubular courses; 5 = full cardigan).

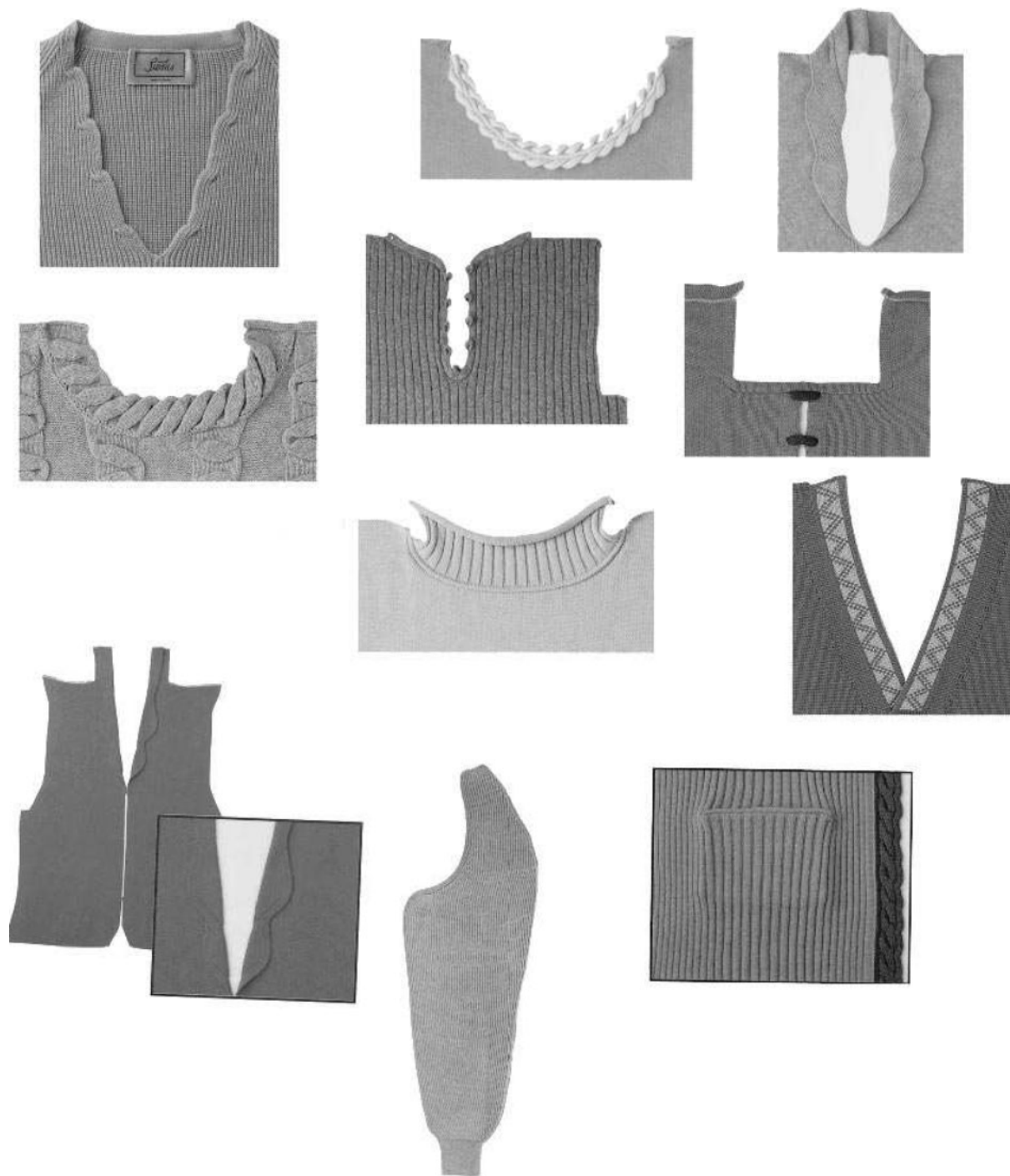


Fig. 16.9 Integrally shaped rib garment pieces. The machine has an additional bed containing the transfer points [Shima Seiki].

EX1050, 186, 165.

214. Moreover, this aesthetic design choice would have been obvious or obvious to try. In particular, the textures of these knit strips may be selected solely for aesthetic purposes, and it would have been obvious to use the textured strips of Clark for aesthetic purposes in Cusinato, but to vary the stitches in order to create different textures. Such a design choice would be obvious or obvious to try in the fashion industry, of which footwear and textiles are a part, and a POSITA would have had a reasonable expectation of success. *See* the Obvious Design Choices, *supra* Section VII.F.

215. As I explained above in Section VIII.A.3, Clark describes and depicts using different knit stitches, or “knit constructions,” in sections 11, 12, and 13. *See* Clark, 3:1-53, Fig. 1. It would have been obvious to apply these teachings to Cusinato because it is well known that a variety of knit stitches and constructions can be used in a single textile element to impart different properties to different areas of that element.

216. As such, Claim 7 is obvious over Cusinato, Clark, and/or Spencer.

H. Claim 8

“The upper of claim 1, wherein the first property of the first knit strip comprises a smooth texture, and the second property of the second knit strip comprises a rough texture.”

217. Cusinato in view of Clark and/or Spencer renders obvious the upper of Claim 1, “wherein the first property of the first knit strip comprises a smooth texture, and the second property of the second knit strip comprises a rough texture.”

218. As I noted above, I understand that Patent Owner has served infringement contentions in the related district court litigation, which purport to assert that certain Skechers shoes infringe one or more claims of the ’511 patent.

219. Among other shoes, Patent Owner has accused the shoes pictured below of infringing Claim 8, and has identified them as having both “a smooth texture” and a “rough texture”:





EX1011, 88, 95.

220. As I explained previously, the red boxes are annotations added by Patent Owner to indicate different “textures.” Patent Owner’s annotations indicate that it views the terms “smooth texture” and “rough texture” as matters of degree, and not as any precise numerical definition or limit.

221. As I explained above with regard to Claim 7, Clark describes the use of different knit stitches in its sections 11, 12, and 13. Clark’s sections can be formed with different stitch types, and will thus have different properties, some smoother and some rougher. Indeed, one stitch type would necessarily be smoother (or rougher) than a different stitch type, as the ’511 patent recognizes. *See* EX1001, 9:65-66 (first texture has “a generally smooth, non-varied stitch configuration,” while second texture “is generally rough in comparison with first texture”).

222. And as I explained with respect to Element 1[a2], Spencer clearly discloses the use of different stitch and yarn types to form different textures. *See supra* Section VIII.A.3. I have provided two examples below, which show the differences in stitching as well as smoother and rougher textures:

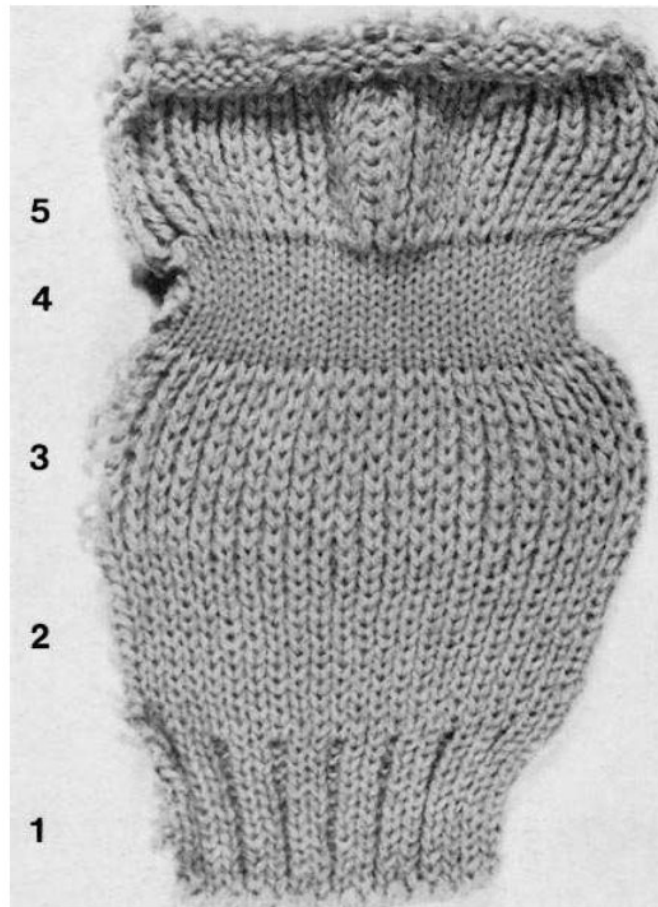


Fig. 16.13 Stitch shaping (1 = 2×2 rib; 2 = 1×1 rib; 3 = half-cardigan; 4 = tubular courses; 5 = full cardigan).

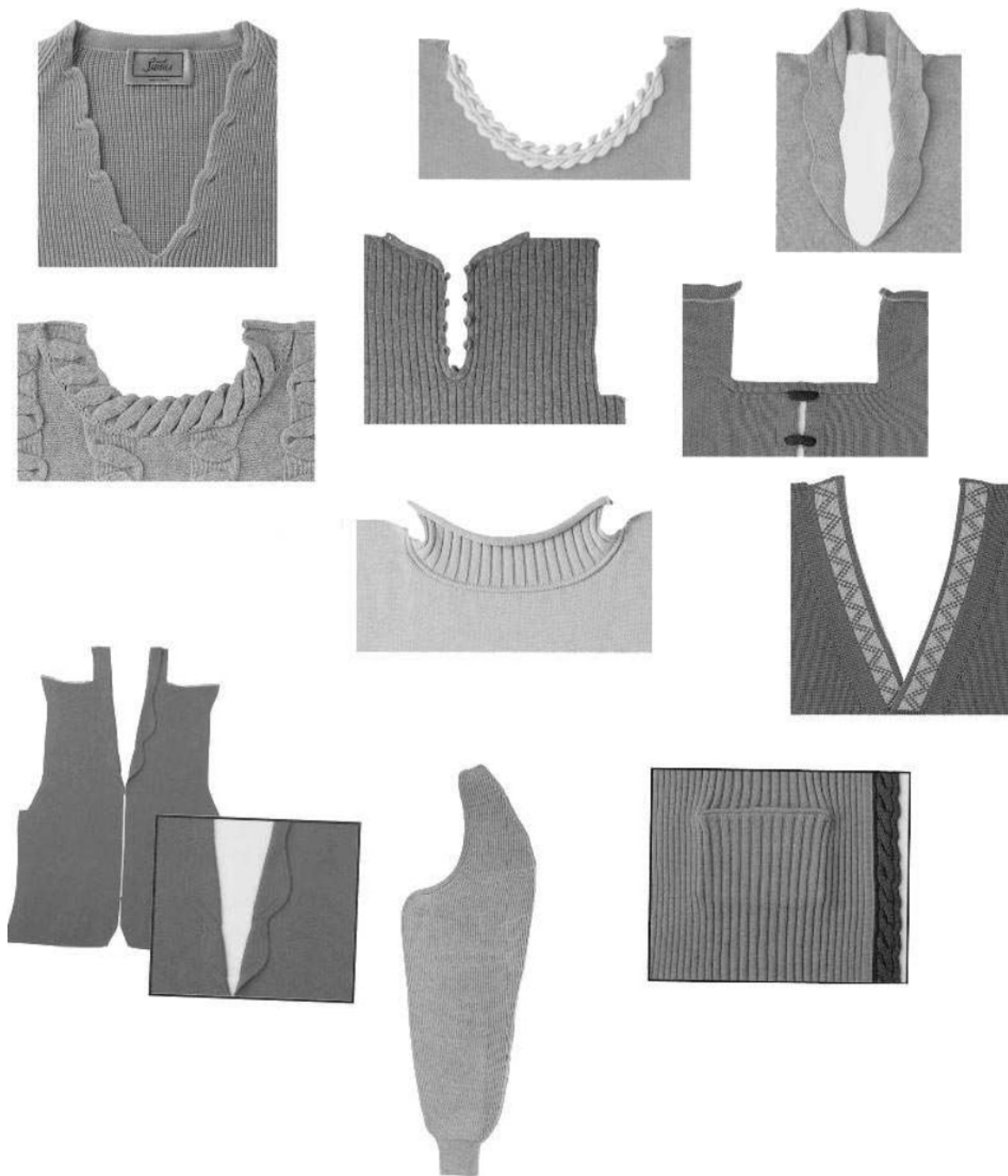


Fig. 16.9 Integrally shaped rib garment pieces. The machine has an additional bed containing the transfer points [Shima Seiki].

EX1050, 191, 186.

223. Moreover, this aesthetic design choice would have been obvious or obvious to try. In particular, the textures of these knit strips may be selected solely for aesthetic purposes, and it would have been obvious to use the textured strips of Clark for aesthetic purposes in Cusinato, but to vary the stitches in order to create smoother and rougher textures, as desired. Such a design choice would be obvious or obvious to try in the fashion industry, of which footwear and textiles are a part, and a POSITA would have had a reasonable expectation of success. *See the Obvious Design Choices, supra* Section VII.F.

224. As such, Claim 8 is obvious over Cusinato in view of Clark and/or Spencer for the same reasons discussed with respect to Claim 7.

I. Claim 9

“The upper of claim 1, wherein the flat knit textile element further comprises a plurality of apertures in an instep region of the upper.”

225. Cusinato in view of Clark and/or Spencer discloses the upper of claim 1, “wherein the flat knit textile element further comprises a plurality of apertures in an instep region of the upper” for essentially the same reasons I described above with respect to Element 1[a2] and Claim 7.

226. As I explained above with respect to that claim, Clark describes using different knit stitches within the same textile element. *See supra* Section VIII.A.3. Different stitches, including those that produce apertures as a result of their structure,

can be used to produce a knit upper with a plurality of apertures in an instep region of the upper.

227. Spencer also teaches the use of multiple stitch types in the same textile element. *See, e.g., supra* Sections VII.C, VIII.A.3. Moreover, Spencer discloses how so-called “open-work structures” can be used to form “apertures” in a textile element: “Knitting is noted for its production of open-work as well as close structures.... An *open-work structure* has normal securely-intermeshed loops but it contain areas where certain adjacent wales are not as directly joined to each other.... The unbalanced tension causes them to move apart, producing apertures at these points.” Spencer, 57.

228. In addition, utilizing apertures would have been obvious or obvious to try, because of the importance of ventilation in footwear. The apertures described in this claim may be present solely for aesthetic purposes, but can also serve a functional purpose of providing ventilation, a well-known need in footwear that had long been solved using apertures in prior art shoes. As just one of many examples, Patent Owner Nike produced the “Air Jordan 1” shoe in 1985, which has apertures in an instep region of the upper, exemplifying design concepts that were generally known (*See supra* Section V):



EX1018, 1.

229. It also would have been obvious to include apertures for either aesthetic or functional purposes in footwear with knitted uppers. Like knit strips, apertures are a simple and very common aesthetic and functional design element both in knitting and footwear, as the language from Spencer and example Nike shoe above explain. Moreover, any design choices creating apertures would be easily implemented using programmable knitting machines available in the early 2000s. *See supra* Section V. Finally, different knit stitches, including stitches that produce apertures, could be used to produce a knitted upper with a plurality of apertures in an instep region of the upper.

230. Therefore, Claim 9 would have been obvious for the same reasons discussed above with respect to Element 1[a2] and Claim 7.

J. Claim 10

“The upper of claim 1, wherein the first property of the first knit strip comprises a higher degree of stretch than the second property of the second knit strip.”

231. Cusinato in view of Clark and/or Spencer renders obvious the upper of Claim 1, “wherein the first property of the first knit strip comprises a higher degree of stretch than the second property of the second knit strip.” Clark teaches the use of knit strips having “non-stretchable” vinyon and strips without vinyon, in order to achieve different degrees of stretch, both before and after the heat treatment process. EX1015, 1:27-40 (“In the original condition the vinyon yarn is exceedingly strong, tough and non-stretchable....[After heating it] tends to contract as much as 50% in length when permitted to do so and then to thicken and stiffen into a hard, tough, resilient condition.”).

232. Cusinato discloses that the threads used in the construction of its textile element “are preferably elastic threads which may be either of natural material like latex, or synthetic material like lycra.” EX1014, [0033]. Claims 12 and 13 of Cusinato also claim the use of “elastic” and “latex or lycra” threads, respectively. *Id.*, Claims 12-13. These types of elastic threads or yarns are generally used when a greater degree of stretch is desired in certain areas of a textile element (such as an upper for an article of footwear), and it would have been obvious to use a yarn with a higher degree of elasticity in such areas (*i.e.*, a first knit strip) and a yarn with a

lower degree of elasticity in other areas where a lower degree of stretch may be desirable (*i.e.*, a second knit strip). Fibers and therefore yarns have different elasticities. *See, e.g.*, EX1062, 564-75 (describing properties of fibers).

233. Moreover, as I explained in Section V.A, and with respect to Element 1[a2] above, there are a wide variety of knit stitches that may be used in a single textile element, each of which has distinct properties, including varying degrees of stretch or elasticity. For example, rib stitch “structures are elastic, form-fitting, and retain warmth better than plain structures.” EX1050, 68; *see also id.*, 78 (describing elastic properties of purl structures). As discussed with respect to Element 1[a2], Clark also discloses the use of different types of knit stitches in different areas (or knit strips) of an upper. EX1015, 3:6-53.

234. Therefore, Claim 10 would have been obvious in view of Cusinato, Clark, and/or Spencer.

K. Claim 11

“The upper of claim 1, wherein the second property of the second knit strip comprises a higher degree of stretch than the first property of the first knit strip.”

235. I note that Claim 11 simply reverses which of the two knit strips described in Claim 1 has the higher degree of stretch: in Claim 10 the first knit strip has the higher degree of stretch, and in Claim 11 the second knit strip has the higher degree of stretch.

236. Therefore, for the same reasons I discussed above with respect to Claim 10, Claim 11 is obvious over Cusinato in view of Clark and/or Spencer.

L. Claim 12

“The upper of claim 1, wherein the first property comprises a first yarn type and the second property comprises a second yarn type.”

237. Cusinato in view of Clark and/or Spencer renders obvious the upper of Claim 1, “wherein the first property comprises a first yarn type and the second property comprises a second yarn type.”

238. Cusinato recognizes that multiple types of yarn or threads may be used to knit a single textile element. *See* EX1014, [0022] (disclosing the use of multiple threads in the same piece of knitted fabric), [0033] (disclosing “elastic threads”), Claims 12-13 (same).

239. Spencer also teaches that this is a common, well-known technique in the field of knitting: “The properties of more than one type of fibre may be incorporated into a fabric as the result of blending the fibres during spinning, or by knitting two or more types of yarn.” EX1050, 4.

240. Clark also clearly discloses the use of multiple types of yarn in an upper for an article of footwear. For example, Clark teaches that “the body of the upper may be knitted of any yarn suitable for machine knitting,” and provides the example of “chenille yarn which is readily available in a great variety of colors and weights.”

EX1015, 1:41-45. Clark also explains that, during the knitting process, “relatively coarse or heavy strands of vinyon yarn are laid in place so that they lie in parallel longitudinal courses in the knitted band or web....” *Id.*, 1:46-49. As I explained above in Section VII.B, and as Clark teaches, vinyon is a type of thermoplastic yarn with properties that change in response to the application of heat treatment. Specifically, Clark teaches the use of knit strips having “non-stretchable” vinyon and strips without vinyon, in order to achieve different degrees of stretch, both before and after the heat treatment process. EX1015, 1:27-40 (“In the original condition the vinyon yarn is exceedingly strong, tough and non-stretchable....[After heating it] tends to contract as much as 50% in length when permitted to do so and then to thicken and stiffen into a hard, tough, resilient condition.”). Thus, a POSITA would recognize that, in the combination of Cusinato, Clark, and/or Spencer, a first yarn type could be used to create a first property in a first knitted strip, and that a second yarn type could be used to create a second property in a second knitted strip.

241. Therefore, Claim 12 is obvious over Cusinato in view of Clark and/or Spencer.

M. Claim 13

“The upper of claim 12, wherein the first yarn type of the first knit strip comprises at least one of a higher biodegradability, moisture absorption, insulation, durability, and/or hydrophobicity than the second yarn type of the second knit strip.”

242. Cusinato in view of Clark and/or Spencer discloses the upper of claim 1, “wherein the first yarn type of the first knit strip comprises at least one of a higher biodegradability, moisture absorption, insulation, durability, and/or hydrophobicity than the second yarn type of the second knit strip” for essentially the same reasons I described above with respect to Claim 12.

243. As I explained in my discussion of Claim 12 above, Cusinato, Clark, and Spencer all recognize that different types of yarn may be used to knit a textile element.

244. Moreover, different types of yarn have different degrees of biodegradability, moisture absorption, insulation, durability, and hydrophobicity. As just one example, natural fibers, including cotton and wool, generally provide greater absorption and biodegradability than synthetic fibers like rayon, which in turn provide greater hydrophobicity than natural fibers. *See* EX1050, 279 (discussing “hydrophilic fibres such as wool and cotton”), 376 (describing the use of “[y]arns with good moisture transportation properties” in spacer fabrics). Different fibers, yarns and fabrics have different properties. *See, e.g.*, EX1062, 555-648 (describing

properties). Clark also teaches the use of knit strips having “non-stretchable” vinyon and strips without vinyon, in order to achieve different degrees of stretch, both before and after the heat treatment process. EX1015, 1:27-40 (“In the original condition the vinyon yarn is exceedingly strong, tough and non-stretchable....[After heating it] tends to contract as much as 50% in length when permitted to do so and then to thicken and stiffen into a hard, tough, resilient condition.”).

245. In sum, it would have been obvious in light of the teachings of Cusinato, Clark, and Spencer, as well as common knowledge in the field of knitting, to create an upper with a first knit strip made up of yarn with a higher degree of biodegradability, moisture absorption, insulation, durability, and/or hydrophobicity than a yarn used for the second knit strip, and a POSITA would have had a reasonable expectation of success in creating such an upper.

246. Therefore, Claim 13 is obvious over Cusinato in view of Clark and/or Spencer.

N. Claim 14

“The upper of claim 12, wherein the first yarn type of the first knit strip comprises at least one of a higher strength, support, stiffness, recovery, fit and/or form than the second yarn type of the second knit strip.”

247. I note that Claim 14 is substantially the same as Claim 13, except that it recites different common properties of various types of yarn (“strength, support, stiffness, recovery, fit and/or form” rather than “biodegradability, moisture

absorption, insulation, durability, and/or hydrophobicity”). It is therefore obvious for the same reasons I explained with respect to Claim 13.

248. In addition, Clark expressly teaches using “vinyon yarn” (or threads) because of vinyon’s tendency, after heat treatment, to “become stiff and extremely resilient, being set in the shape imparted to them by the last and tending resiliently to reassume that shape if temporarily distorted.” EX1015, 4:27-31; *see also id.*, 1:28-30 (“In the original condition the vinyon yarn is exceedingly strong, tough and non-stretchable”); 1:39-40 (“[B]y suitable heat treatment, converted into the desired resilient last-fitting form.”). Clark also teaches that, after the heat treatment process, “the vinyon strands and the fabric fits skin tight upon the last conforming accurately to every curve in its contour.” *Id.*, 4:24-27.

249. Therefore, for the same reasons I discussed above with respect to Claim 13, Claim 14 is obvious over Cusinato in view of Clark and/or Spencer.

O. Claim 15

250. I note that Claim 15 is substantially similar to Claim 1, with an additional limitation of “a sole structure secured to the upper” (Element 15[c]). Therefore, Cusinato in view of Clark and/or Spencer satisfies all limitations of Claim 15 for the same reasons I explained with respect to Claim 1.

1. Element 15[pre]

251. For the same reasons I discussed above with respect to Element 1[pre], Cusinato in view of Clark and/or Spencer satisfies Element 15[pre].

2. Element 15[a1]

252. For the same reasons I discussed above with respect to Element 1[a1], Cusinato in view of Clark and/or Spencer satisfies Element 15[a1].

3. Element 15[a2]

253. For the same reasons I discussed above with respect to Element 1[a2], Cusinato in view of Clark and/or Spencer satisfies Element 15[a2].

4. Element 15[b]

254. For the same reasons I discussed above with respect to Element 1[b], Cusinato in view of Clark and/or Spencer satisfies Element 15[b].

5. Element 15[c]: “a sole structure secured to the upper.”

255. Cusinato in view of Clark and/or Spencer discloses or renders obvious “a sole structure secured to the upper.”

256. As one example, Cusinato discloses a “boot.” EX1014, [0010], [0015]. As another example, Clark’s section 11 (which I described in detail above with respect to Claim 1) is intended “to cover the marginal portion of the last bottom and to be incorporated eventually in the shoe bottom,” which a POSITA would recognize as a sole structure. EX1015, 3:6-10.

257. Furthermore, it would have been obvious to a person of skill in the art, as well as a matter of common sense, to incorporate an upper for an article of footwear into an article of footwear with a sole structure in order to provide, for example, additional cushioning, protection, and traction to the wearer of the article of footwear.

P. Claim 16

“The article of footwear of claim 15, wherein the first property comprises one or more of a first knit construction and a first yarn type and wherein the second property comprises one or more of a first knit construction and a second yarn type.”

258. Claim 16 is substantially similar to Claims 7 and 12, and this limitation would be obvious for the same reasons I explained above with respect to Claims 7 and 12.

Q. Claim 17

“The article of footwear of claim 15, wherein the flat knit textile element comprises a plurality of first knit strips extending along the lateral side and the medial side of the upper and a plurality of second knit strips extending along the lateral side and the medial side of the upper.”

259. Claim 17 is substantially similar to Claims 2 and 4 through 6, and this limitation would be obvious for the same reasons I explained above with respect to Claims 2 and 4 through 6.

R. Claim 18

“The article of footwear of claim 15, wherein the first knit strip is parallel to the second knit strip.”

260. Claim 18 is substantially similar to Claim 3 (“the first and second knit strips alternate with one another...”), and it would be obvious to arrange the first and second knit strips parallel to one another in the article of footwear of claim 15 for the same reasons that apply to Claim 3.

261. Therefore, for similar reasons to those I discussed above with respect to Claim 3, Claim 18 is obvious over Cusinato in view of Clark and/or Spencer.

S. Claim 19

“The article of footwear of claim 15, wherein the first knit strip and the second knit strip extend along the lateral side of the upper from an instep region of the upper to an area proximate to the sole structure.”

262. Claim 19 is substantially similar to Claim 5, but recites “...to an area proximate to the sole structure” rather than “...to an area proximate to a lower region of the upper.”

263. This slight variation in claim language does not make Claim 19 any more inventive than Claim 5, because there is no meaningful difference between them. An “area proximate to the sole structure” of an assembled article of footwear with a sole is the same thing as an “area proximate to a lower region of the upper,” as the “lower region of the upper” would occupy the same space as a “sole structure” in an assembled article of footwear with a sole (as described in Claim 15).

T. Claim 20

“The article of footwear of claim 15, wherein the first knit strip and the second knit strip extend along the medial side of the upper from an instep region of the upper to an area proximate to the sole structure.”

264. Claim 20 is substantially the same as Claim 19, but refers to the “medial side” of the upper rather than the “lateral side.” It is also substantially the same as Claim 6, which, as I noted above in Section VIII.F, is simply a slight variation on Claim 5.

265. Therefore, Claim 20 would be obvious for the same reasons discussed above with respect to Claims 5, 6, and 19.

IX. CLAIMS 1-20 ARE OBVIOUS OVER HERBERT IN VIEW OF GLIDDEN AND CUSINATO AND, IF NECESSARY, SPENCER (GROUND 2)

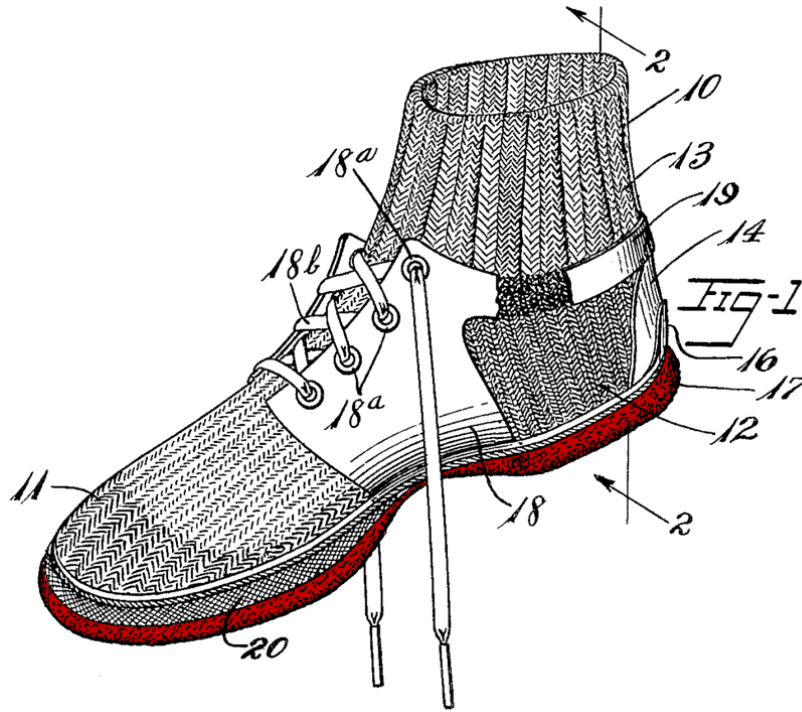
A. Claim 1

1. Element 1[pre]: “An upper for an article of footwear, the upper comprising:”

266. Herbert, Glidden, and Cusinato each disclose an upper for an article of footwear, a term for which I have applied the construction “any foot covering in the form of shoes, boots, slippers, or hose (*e.g.*, socks),” as discussed above in Section VI.F.

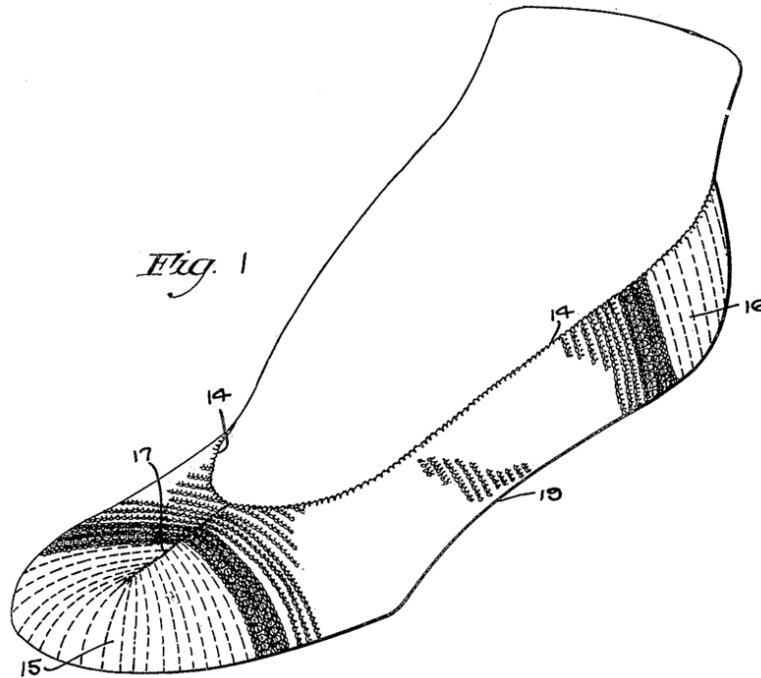
267. Glidden teaches that the claimed “invention relates to articles of footwear and to methods of making the same, and is especially useful in the

manufacture of shoes having textile uppers.” EX1017, 1:1-4, Fig. 1 (annotated below to show outsole 17).



EX1017, Fig. 1.

268. Herbert also discloses a “slipper foot covering,” which includes a “bottom or sole portion 19,” both consistent with an article of footwear (in the event Patent Owner asserts that Herbert discloses only a sock). EX1016, 1:48, 3:17. This portion can be seen in Figure 1:



EX1016, Fig. 1.

269. Finally, Cusinato discloses “a fabric in one piece from which it is possible to directly make the stocking or footwear,” EX1014, [0013], which forms a “boot.” *Id.*, [0010]. It would also be obvious to add a sole to Herbert’s “slipper” or Cusinato’s “boot-like” form to provide cushioning and protection.

270. Therefore, Herbert in view of Glidden and Cusinato satisfies Element 1[pre].

2. **Element 1[a1]: “a flat knit textile element comprising (1) flat knit edges free of surrounding textile structure such that the flat knit edges are not surrounded by textile structure from which the textile element must be removed, at least one flat knit edge being a curved flat knit edge,”**

271. Herbert in view of Glidden, Cusinato and, if necessary, Spencer, teaches a flat knit textile element comprising “flat knit edges,” as a POSITA would

understand that term, under either of the parties' proposed constructions discussed above. *See supra* Section VI.F.

Flat Knit Textile Element With Flat Knit Edges

272. Herbert clearly explains that “cut and sewn flat rib knitted fabric may be employed” to create its slipper-type foot covering “without departing from the spirit of the invention,” thereby disclosing a flat knit textile element. EX1016, 2:8-10. In addition, Herbert discloses flat knit edges in the form of its “inherent selvage edge 14,” which “provides a finished edge for the article of apparel without any further operations.” *Id.*, 4:14-17.

273. As I explained previously, Cusinato also teaches a flat knit textile element comprising “flat knit edges free of surrounding textile structure such that the flat knit edges are not surrounded by textile structure from which the textile element must be removed” under either of the parties' proposed constructions, as I explained above in Section VIII.A.2.

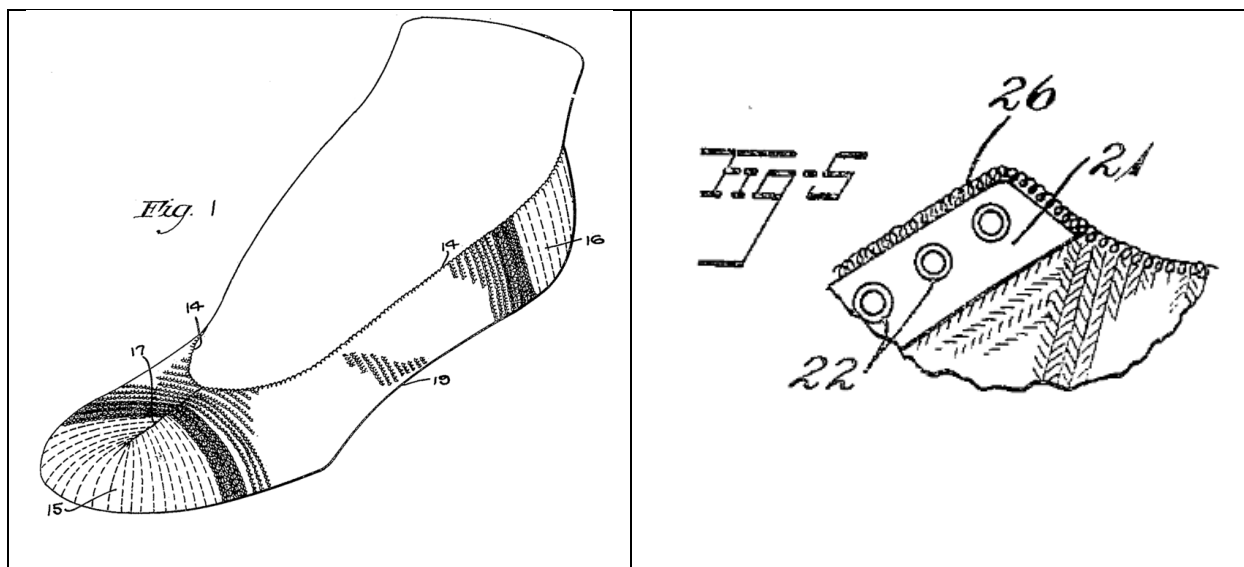
274. To the extent these references do not disclose flat knit edges, Spencer also discloses the use of flat knitting machines to create curved flat knit edges, including for the reasons discussed above in Section VIII.A.2. In addition, Spencer teaches that ribs, such as those disclosed in Herbert, are among the “[t]ypical structures knitted on flat machines,” as a POSITA would readily recognize. EX1050, 218. Spencer's discussions of the advantages of flat knitting are also consistent with

disclosures in Cusinato and Glidden. For example, Spencer explains that these advantages include that “[t]he fashioned selvedge edges can be point or cup-seamed together, without the need for cutting...involving loss of expensive fabric.” *Id.*, 185.

Curved Flat Knit Edges

275. As I explained above with respect to Ground 1, Cusinato expressly discloses curved flat knit edges. *See supra* Section VIII.A.2; *see also, e.g.*, EX1014, [0005]-[0009], [0015]-[0016], Claims 2-3, Figs. 2-5 (discussed above in Section VIII.A.2).

276. Moreover, due to the nature and basic structure of articles of footwear, curved edge structures would be especially useful. For example, Figure 1 of Herbert and Figure 5 of Glidden depict articles of footwear that have curved edges:



EX1016, Fig. 1; EX1017, Fig. 5.

277. In addition, Spencer expressly discloses the use of flat knitting to create a textile element with at least one curved, flat knit edge, as I explained above in Section VIII.A.2; *see also, e.g.*, EX1050, 184 (“weft knitting provides unique opportunities for width-wise shaping during knitting,” including by “varying the number of needles in action in the knitting width”), 188 (“In *needle selection shaping*, the selvedge needle(s) is introduced or withdrawn from the knitting width by means of needle selection.”).

278. Moreover, Herbert in view of Glidden could be combined with the teachings of Cusinato and, if necessary, Spencer, and a POSITA would have been motivated to make this combination and would have had a reasonable expectation of success in doing so. *See supra* Section VII.G.

Free of Surrounding Textile Structure

279. As I explained in detail in Section VIII.A.2, Cusinato teaches that the flat knit edges in that invention are “free of surrounding textile structure . . . from which the textile element must be removed.” *See* EX1014, [0007]-[0008]; Fig. 2. Similarly, Herbert explains that selvedging “provides a finished edge for the article of apparel without any further operations.” EX1016, 4:16-17. Spencer also discloses “selvedge edges...without the need for cutting,” as explained above. EX1050, 185.

280. Taken together, a POSITA would be motivated to combine Glidden’s teachings with those of Cusinato and/or Spencer in order to form a flat knit textile

element with flat knit edges (at least one of which is curved) free of surrounding textile structure.

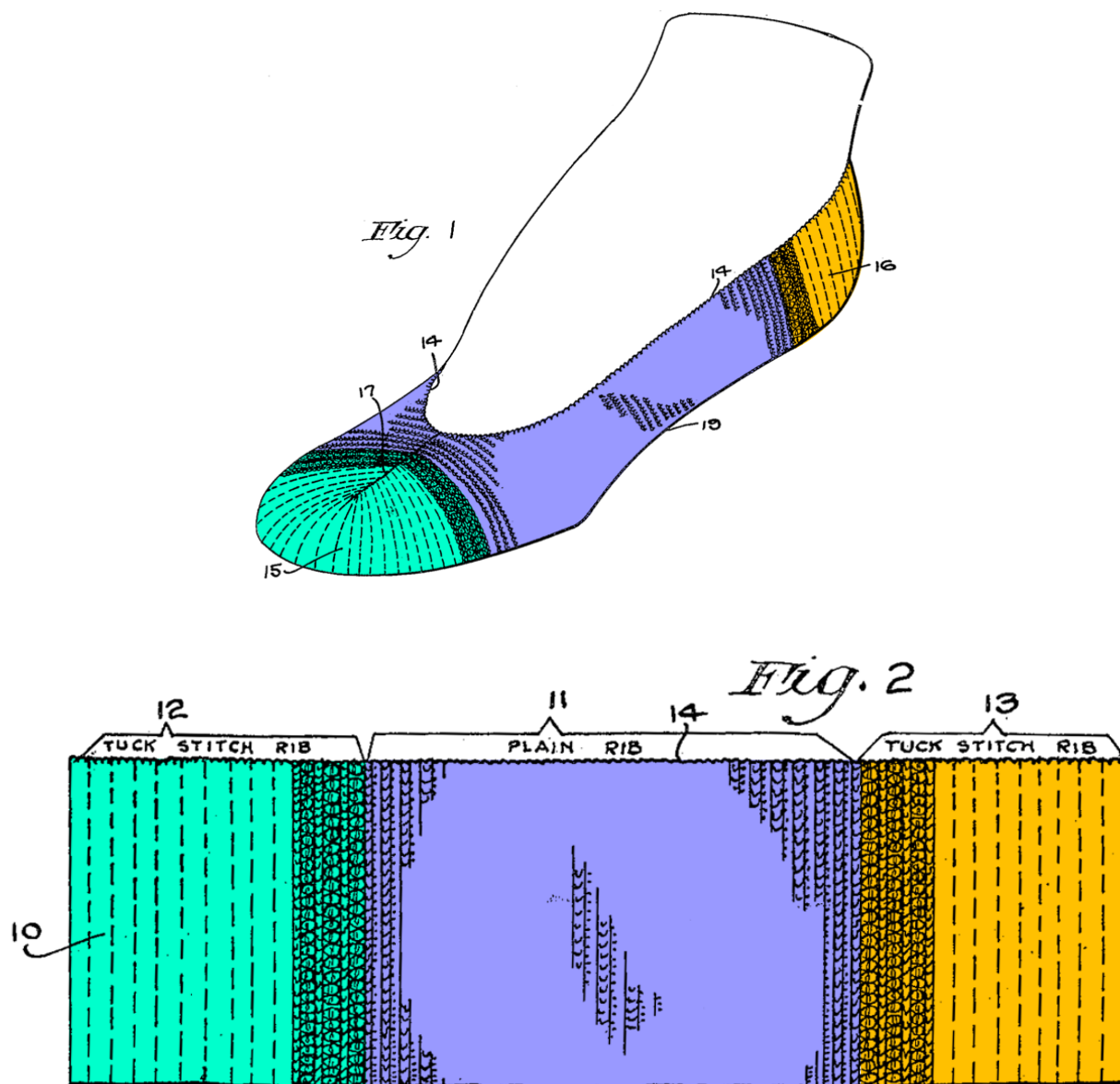
281. Therefore, Herbert in view of Glidden, Cusinato and/or Spencer satisfies Element 1[a1].

3. Element 1[a2]: “and (2) a first knit strip having a first property and a second knit strip having a second property that is different from the first property;”

282. Crucially, as I explained above in Sections VI.C and VIII.A.3, only dependent claims 10-11 and 13-14 require the knit strips to serve any functional purpose. This is demonstrated by the '511 patent's specification, which confirms that two of the claimed “properties,” textures and stitches, may serve purely aesthetic purposes. *See* EX1001, 10:4-5 (“Textures...may exhibit aesthetic differences....”), 10:16-19 (“[S]titches...may be utilized to vary the...aesthetics of footwear”).

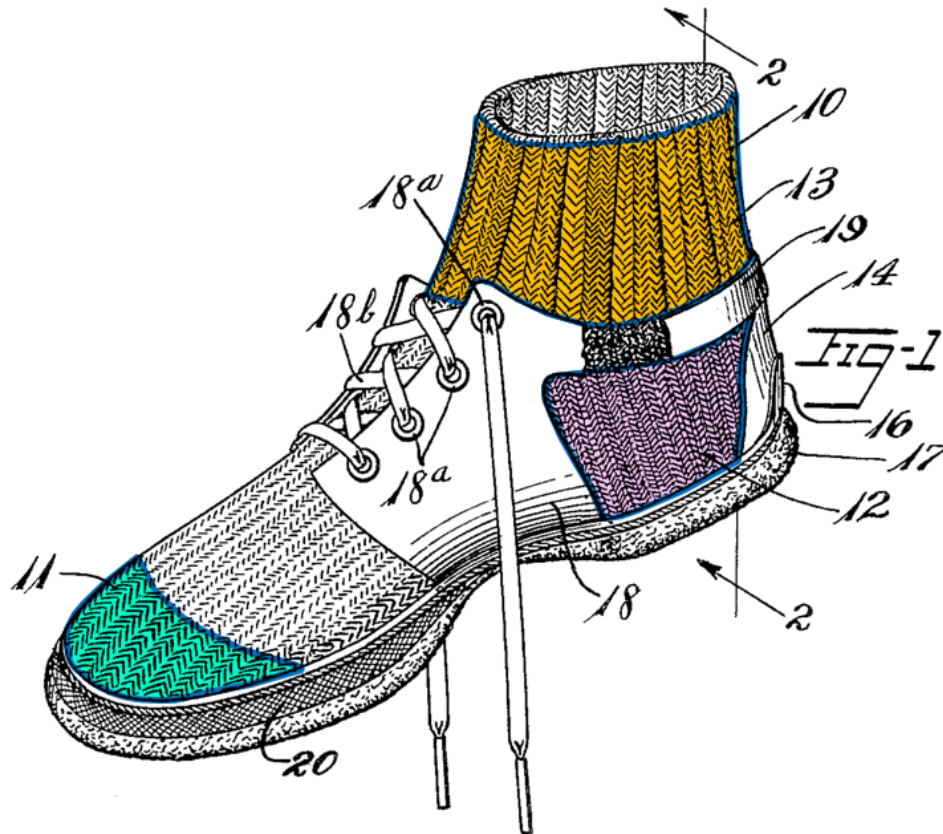
283. Herbert in view of Glidden, and, if necessary, Spencer, teaches “a first knit strip having a first property and a second knit strip having a second property that is different from the first property.”

284. Figures 1 and 2 of Herbert, annotated below, include a first knit strip having a first property and a second knit strip having a second property different from the first, as shown by the color variations below:



285. As Herbert discloses, tuck stitch rib areas 12 and 13 and plain rib are 11 are knit strips having different properties. *See* EX1016, 2:50-54. Herbert also teaches that “[t]he areas 12 and 13 may contain other stitch variations than the tuck stitches, such, for example, as transferred stitches or they may be made of plain jersey fabric.” *Id.*, 3:1-4.

286. Glidden also depicts multiple knit strips with different qualities or properties in, for example, the toe (11, in green), heel (12, in pink), and ankle (13, in orange) portions of the claimed article of footwear, as shown in the annotated version of Figure 1 below:



EX1017, Fig. 1.

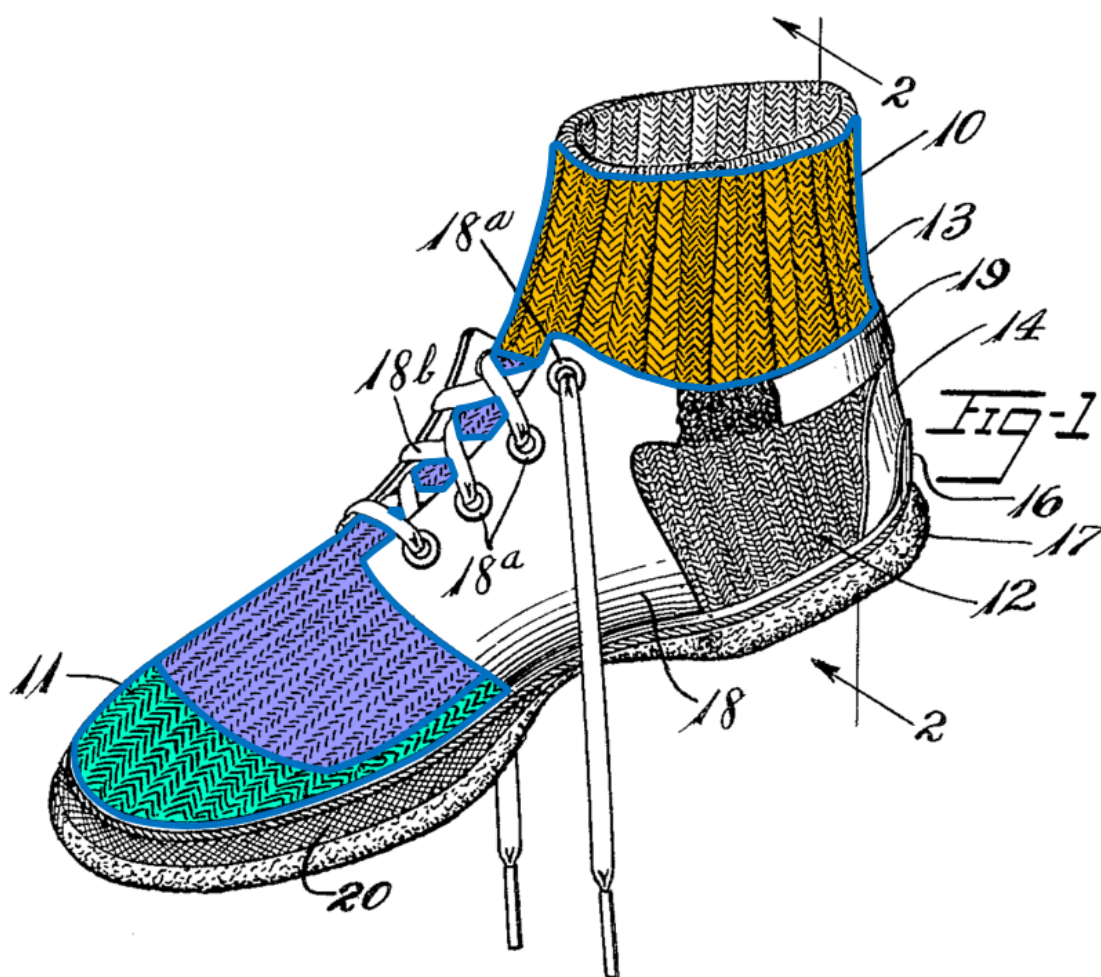
287. In describing Figure 1, Glidden explains that different areas of the upper may be “fabricated,” or knitted, in different ways in order to provide different characteristics or properties, which can include variable weight, extensibility, yarn thickness, softness, and elasticity:

In fabricating the unitary upper, as by knitting, areas thereof which are normally subjected to greater wear and in which a lower degree of elasticity is desired, such as the toe 11 [colored in teal] and the heel portion 12 [colored in purple], may be more densely fabricated to provide therein heavier weight and less extensibility than in the other parts of the upper, as by changing the type of stitch or amount of thickness of the yarn in the knitting. Other areas, such as the ankle portion 13 [colored in orange], are preferably made so as to provide softness and elasticity, as by making them of ribbed construction, as shown.

Id., 2:19-44.

288. Furthermore, yarns of different thicknesses would impart different physical and mechanical properties to the areas in which they are used. As I noted in preceding paragraph, Glidden explains that “ankle portion 13[is] preferably made so as to provide softness and elasticity....” *Id.*, 2:33-44. A POSITA would thus understand that Glidden has at least a first knit strip having a first property and a second knit strip having a second property that is different from the first.”

289. I have provided below a comparison of Glidden’s claimed article of footwear with a Skechers shoe that I understand Patent Owner has accused of infringing the ’511 patent in the related district court litigation. In particular, the textured strips in both images are distributed in a similar manner:



EX1011, 102 (annotated and flipped horizontally); EX1017, Fig. 1.

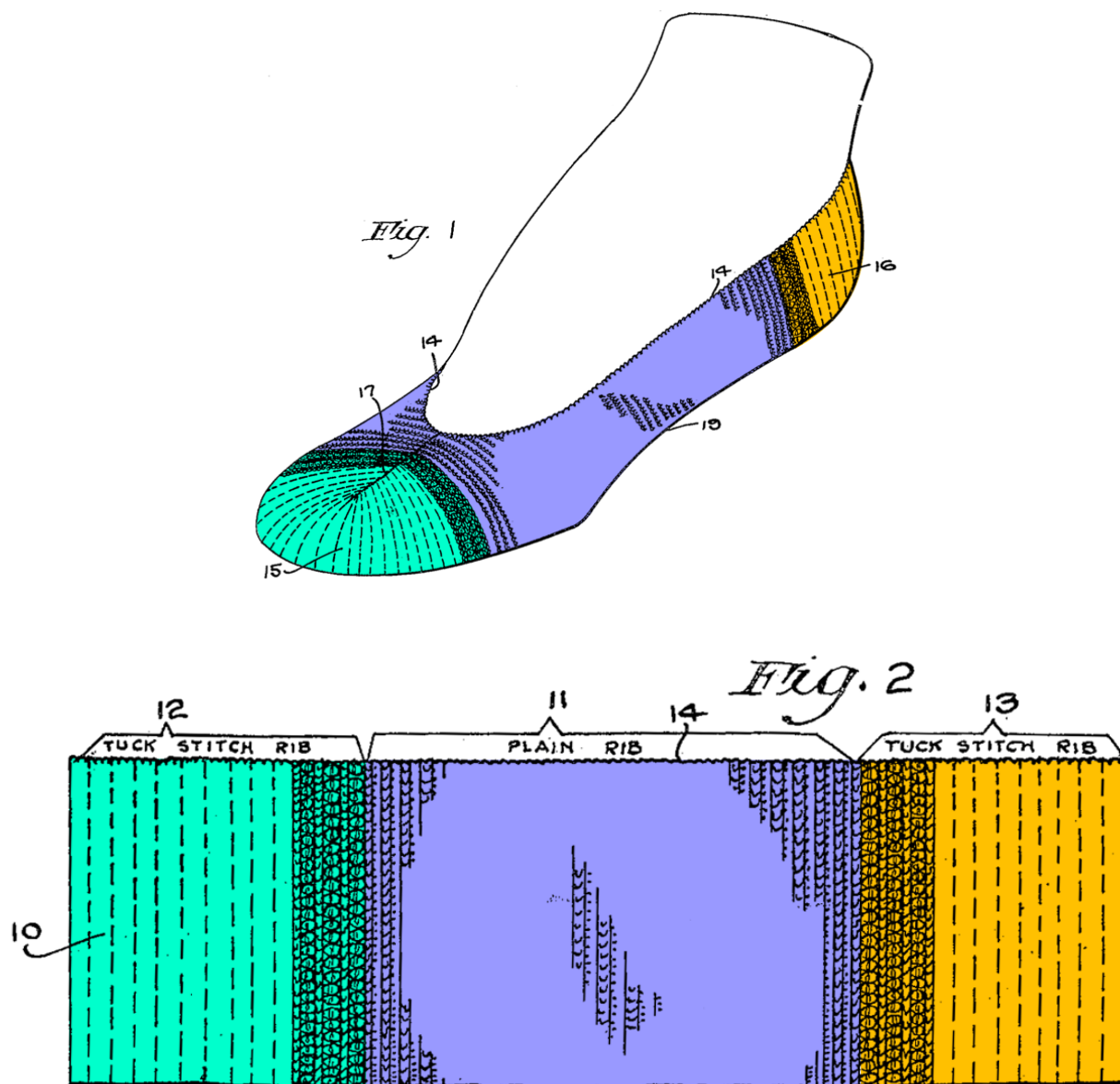
290. Moreover, Herbert and Glidden may be combined with Cusinato and/or Spencer, which discloses knit strips with different properties and techniques for creating them, as I explained with respect to Ground 1 in Section VIII.A.3.

291. Therefore, Herbert in view of Glidden, Cusinato, and/or Spencer satisfies Element 1[a2].

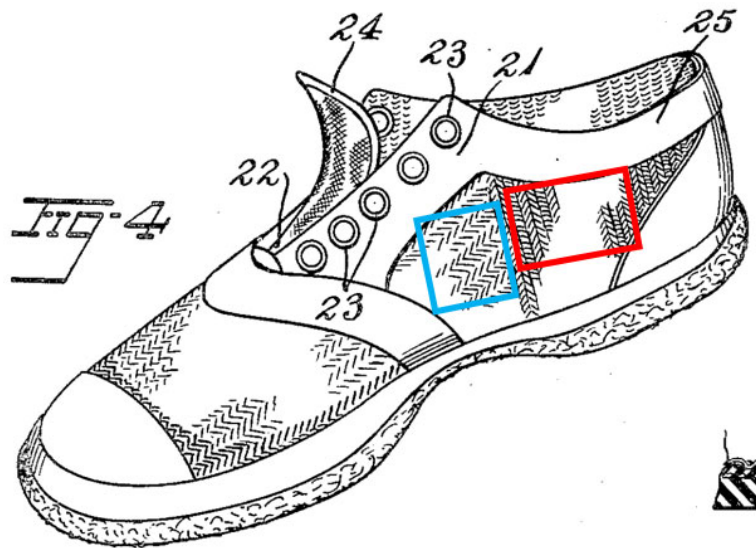
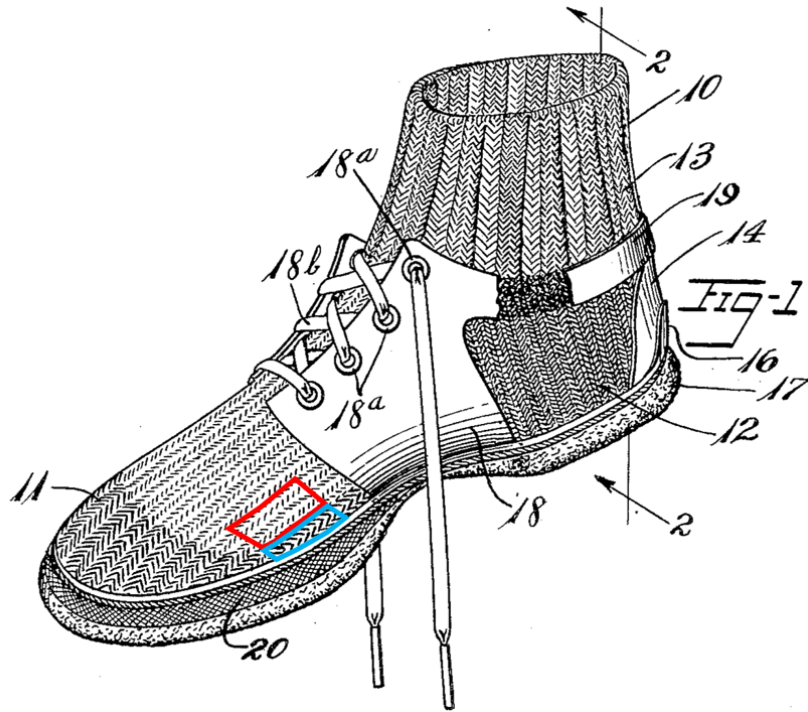
4. Element 1[b]: “wherein the first knit strip and the second knit strip are positioned adjacent to each other along one or more of a lateral side and a medial side of the upper.”

292. Herbert in view of Glidden, Cusinato and, if necessary, Spencer discloses a first knit strip and a second knit strip positioned adjacent to one another along one or more of a lateral side and a medial side of the upper. I note that, as claimed, the location and orientation of these knit strips may be solely for aesthetic purposes.

293. Herbert’s ribbed slipper includes knit strips with different properties positioned adjacent to one another along one more of a lateral and a medial side of the upper, as shown in Figures 1 and 2. These figures have been annotated below to illustrate these knit strips (“plain rib” (11) in purple, and “tuck stitch rib” (12 and 13) in green and orange):



294. As shown in Figures 1 and 4 of Glidden (annotated, below), Glidden teaches multiple different fabric textures adjacent to one another on the medial side of the upper (*i.e.*, “a first knit strip and second knit strip positioned adjacent to each other along one or more of a lateral side and a medial side of the upper”), because the two strips annotated in red and blue below have different textures and are positioned adjacent to one another:



EX1017, Figs. 1, 4; *see also id.*, 2:19-44.

295. Moreover, this design choice, which relates to the location and arrangement of knit strips, would have been obvious or obvious to try, could be accomplished using elements of any or all of the Obvious Design Choices, and a

POSITA would have had a reasonable expectation of success. *See supra* Section VII.G.

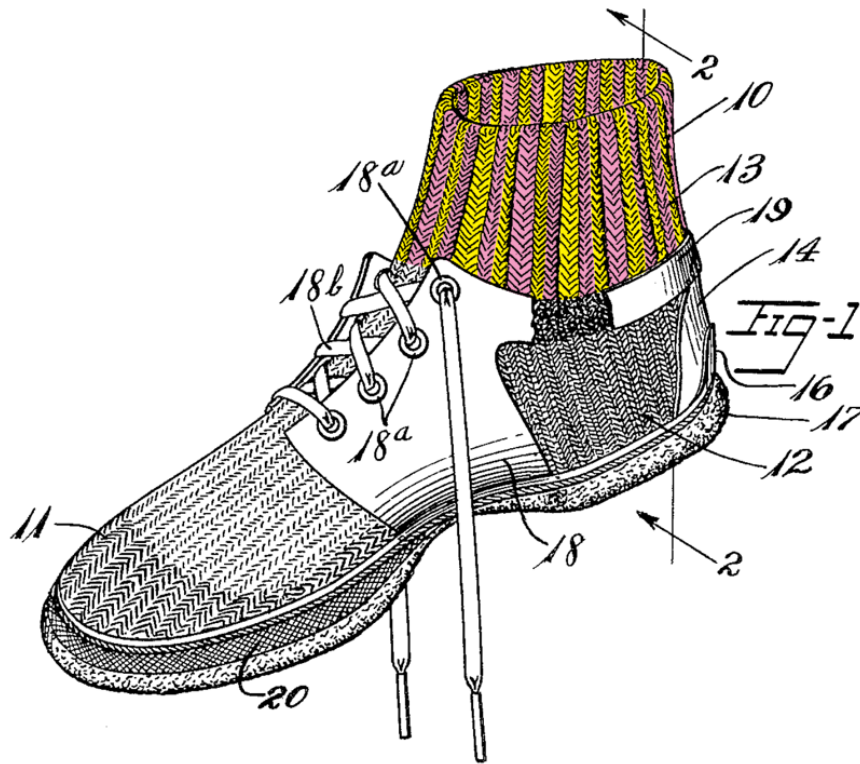
296. Therefore, Herbert in view of Glidden, Cusinato and/ Spencer satisfies Element 1[b].

B. Claim 2

“The upper of claim 1, wherein one or both of the first knit strip and the second knit strip comprises a plurality of knit strips.”

297. Claim 2 imposes an additional aesthetic limitation for the upper of Claim 1, and it would have been obvious in light of Herbert, Glidden, and/or Cusinato to create the upper of Claim 1 “wherein one or both of the first knit strip and the second knit strip comprises a plurality of knit strips” for the same reasons described with respect to Claim 1.

298. For example, Glidden shows a plurality of first and second knit strips adjacent to one another (annotated in yellow and pink, respectively):



EX1017, Fig. 1; *see also id.*, 2:19-44.

299. Spencer also teaches patterns of repeating strips, including, for example, ribs. In the image below, which is taken from Figure 16.9 of Spencer, repeating first and second knit strips can be seen:



EX1050, 186; *see also supra* Section VIII.C.

300. Moreover, this design choice, which simply requires increasing the number of strips, would have been obvious or obvious to try, could be accomplished using elements of any or all of the Obvious Design Choices, and a POSITA would have had a reasonable expectation of success. *See supra* Section VII.G.

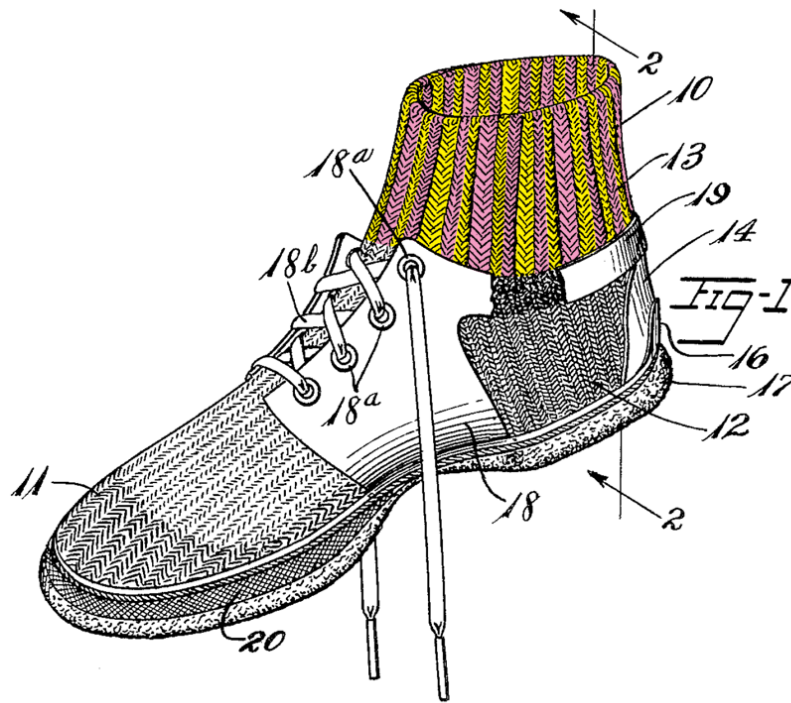
301. As such, Claim 2 is obvious over Herbert in view of Glidden and/or Cusinato.

C. Claim 3

“The upper of claim 2, wherein the first and second knit strips alternate with one another along one or more of the lateral side and the medial side of the upper.”

302. Claim 3 imposes an additional aesthetic limitation for the upper of Claim 2, and it would have been obvious in light of Herbert, Glidden Cusinato, and/or Spencer to create the upper of Claim 2 “wherein the first and second knit strips alternate with one another along one or more of the lateral side and the medial side of the upper” for the same reasons described with respect to Claim 2.

303. As shown in the annotated figure below, Glidden discloses a plurality of first knit strips and second knit strips that alternate with one another along the later and medial sides of the upper:



EX1017, Fig. 1; *see also id.*, 2:19-44.

304. In addition, Spencer teaches alternating patterns, as I explained with respect to Claim 3 in Ground 1. *See supra* Section VIII.C; *see also* EX1050, 186 (zoomed-in version of Fig. 16.9 below).



305. Moreover, this design choice, which relates to the location and spacing of knit strips, would have been obvious or obvious to try, as it would merely require

repeating the pattern used for each knit strip in an alternating fashion, could be accomplished using elements of any or all of the Obvious Design Choices, and a POSITA would have had a reasonable expectation of success. *See supra* Section VII.G.

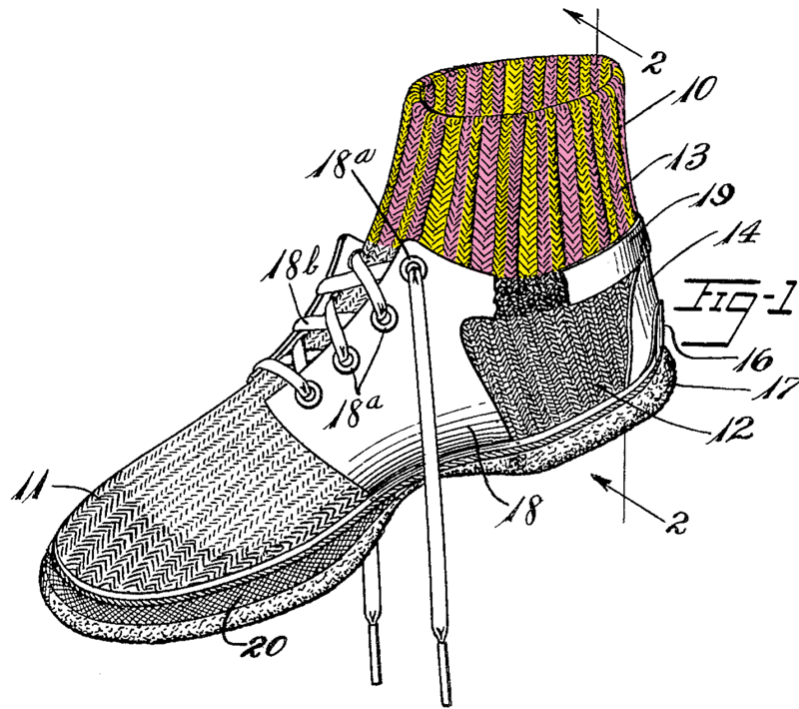
306. As such, Claim 3 is obvious over Herbert in view of Glidden, Cusinato, and/or Spencer.

D. Claim 4

“The upper of claim 2, wherein the flat knit textile element comprises at least two first knit strips and at least two second knit strips.”

307. For similar reasons to those discussed above with respect to Claim 2, it would have been obvious to create a flat knit textile element comprising at least two first knit strips and at least two second knit strips.

308. As shown below, Glidden discloses a plurality of both first and second knit strips (*i.e.*, at least two of each):



EX1017, Fig. 1; *see also id.*, 2:19-44.

309. In addition, Spencer teaches alternating patterns, as I explained with respect to Claim 3 in Ground 1. *See supra* Section VIII.C; *see also* EX1050, 186 (zoomed-in version of Fig. 16.9 below).



310. Moreover, this design choice, which simply requires increasing the number of strips used in the textile element, would have been obvious or obvious to

try, could be accomplished using elements of any or all of the Obvious Design Choices, and a POSITA would have had a reasonable expectation of success. *See supra* Section VII.G.

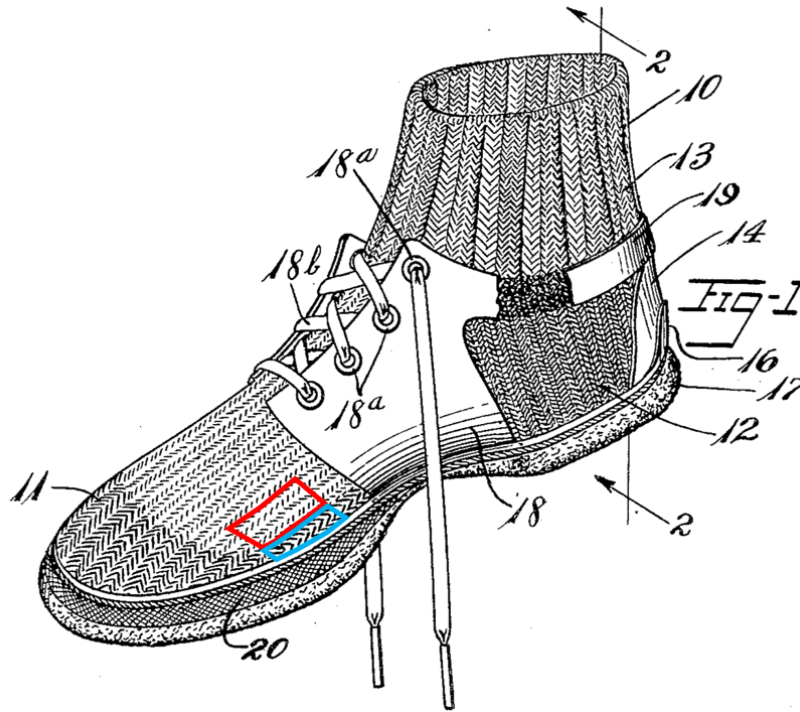
311. As such, Claim 4 is obvious over Herbert in view of Glidden, Cusinato and/or Spencer.

E. Claim 5

“The upper of claim 1, wherein the first knit strip and the second knit strip extend along the lateral side of the upper from an instep region of the upper to an area proximate to a lower region of the upper.”

312. For the same reasons I discussed above with respect to Claim 1, it would have been obvious to create the upper of Claim 1, wherein the first knit strip and the second knit strip extend along the lateral side of the upper from an instep region of the upper to an area proximate to a lower region of the upper.

313. For example, Glidden discloses two different fabric textures adjacent to one another on the medial side of the upper in the area between the instep and a lower region of the upper:



EX1017, Fig. 1; *see also id.*, 2:19-44.

314. I note that, while Figure 1 of Glidden appears to depict the article of footwear as seen from the medial side, its disclosure of this limitation on the lateral side is implied by the generally symmetrical nature of the upper.

315. Moreover, it would have been obvious or obvious to try to use the textured strips disclosed in Glidden to serve aesthetic purposes in Cusinato and to arrange them in accordance with this Claim. This could be accomplished using elements of any or all of the Obvious Design Choices, and a POSITA would have had a reasonable expectation of success. *See supra* Section VII.G.

316. As such, Claim 5 is obvious over Herbert in view of Glidden, Cusinato, and/or Spencer.

F. Claim 6

“The upper of claim 1, wherein the first knit strip and the second knit strip extend along the medial side of the upper from an instep region of the upper to an area proximate to a lower region of the upper.”

317. While Claim 5 refers to knit strips extending “along the lateral side of the upper,” Claim 6 refers to the “medial side of the upper.” This is the only difference between the two claims. Therefore, Claim 6 would have been obvious for the same reasons discussed above with respect to Claim 5.

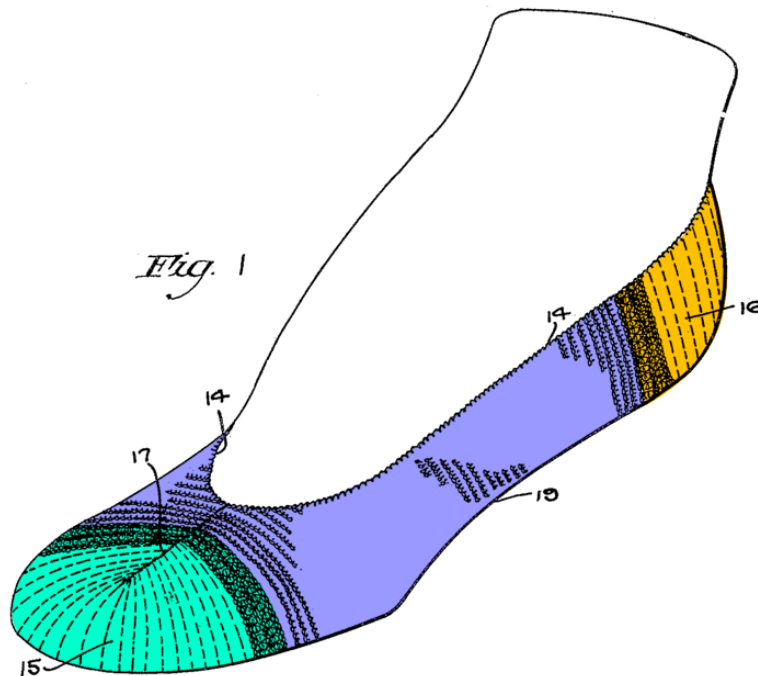
G. Claim 7

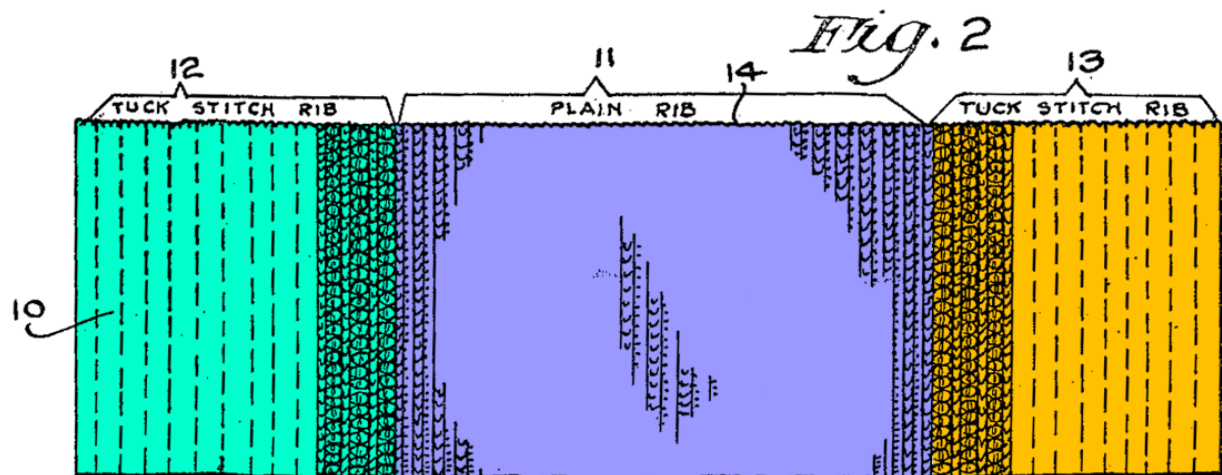
“The upper of claim 1, wherein the first property comprises a first knit construction and the second property comprises a second knit construction.”

318. As an initial matter, and as I explained above with respect to Ground 1, Spencer demonstrates that a person of skill in the art would understand that different knit stitches form different “knit constructions.” *See supra* Section VIII.G.

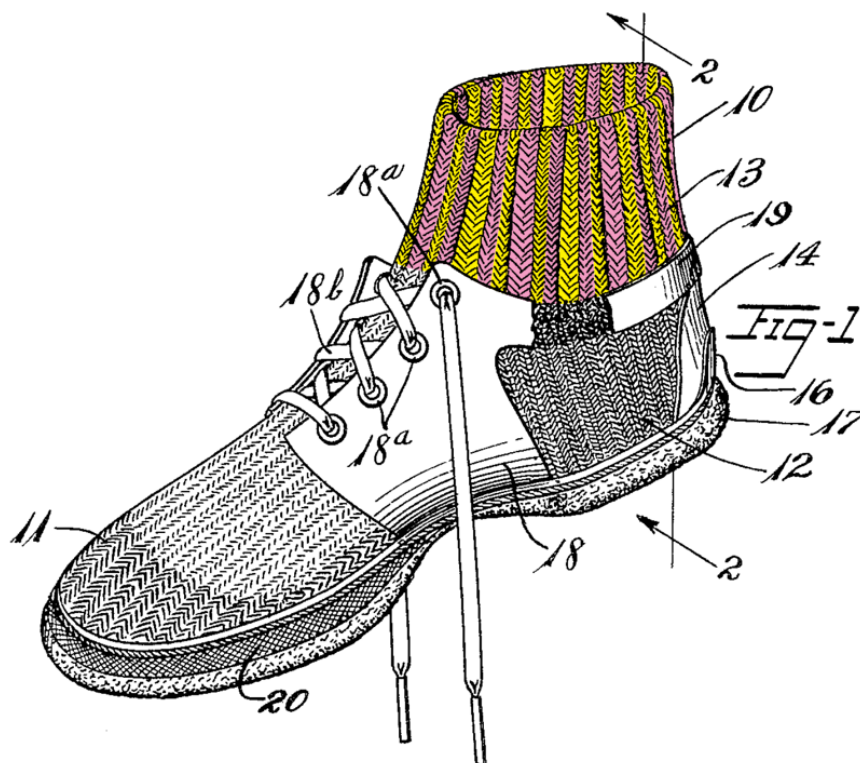
319. As I have also explained above, both Herbert and Glidden show multiple knit strips having various knit constructions (knit strips of varying properties positioned adjacent to one another), as demonstrated in Figures 1 and 2 of Herbert and Figure 1 of Glidden, annotated below. The properties of Herbert’s and Glidden’s knit strips comprise various knit constructions. For example, as shown in the figures below, Herbert’s upper includes plain ribs and tuck stitch ribs, which have different effects on the elasticity of the textile element. *See* EX1016, 3:1-8.

Meanwhile, Glidden teaches that the disclosed fabric “may be more densely fabricated to provide therein heavier weight and less extensibility than in the other parts of the upper, as by changing the type of stitch or amount or thickness of the yarn in the knitting. Other areas, such as the ankle portion 13, are preferably made so as to provide softness and elasticity, as by making them of ribbed construction, as shown.” EX1017, 2:33-44. Glidden thus discloses that different knit constructions can be used by changing, for example, the type of stitch, the thickness of the yarn, or the softness and elasticity of the upper or areas thereof. *See supra* Section IX.A.3.





EX1016, Figs. 1, 2.



EX1017, Fig. 1.

320. Moreover, Spencer discloses that different knit stitches form different knit constructions. *See supra* Section VIII.G.

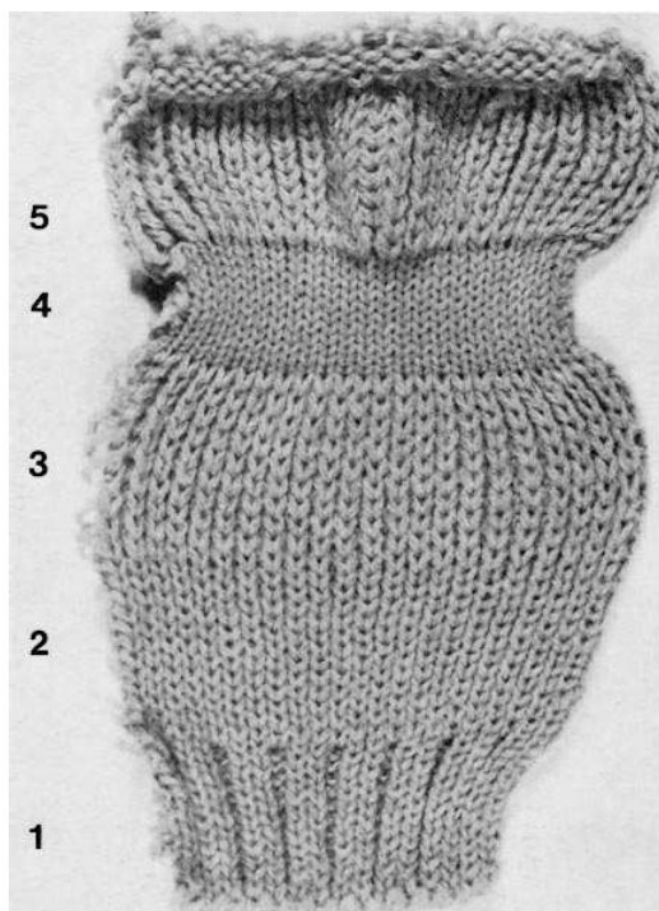


Fig. 16.13 Stitch shaping (1 = 2×2 rib; 2 = 1×1 rib; 3 = half-cardigan; 4 = tubular courses; 5 = full cardigan).

EX1050, 191.

321. It would have been an obvious design choice to apply the textured strips described in Glidden and/or Spencer for aesthetic purposes in Herbert, and to vary stitches to achieve different knit constructions, and a POSITA would have had a reasonable expectation of success. *See supra* Section VII.G (Obvious Design Choices).

322. As such, Claim 7 is obvious over Herbert, Glidden, Cusinato, and/or Spencer.

H. Claim 8

“The upper of claim 1, wherein the first property of the first knit strip comprises a smooth texture, and the second property of the second knit strip comprises a rough texture.”

323. Herbert in view of Cusinato, Clark, and/or Spencer renders obvious the upper of Claim 1, “wherein the first property of the first knit strip comprises a smooth texture, and the second property of the second knit strip comprises a rough texture,” for the same reasons described with respect to Claim 7.

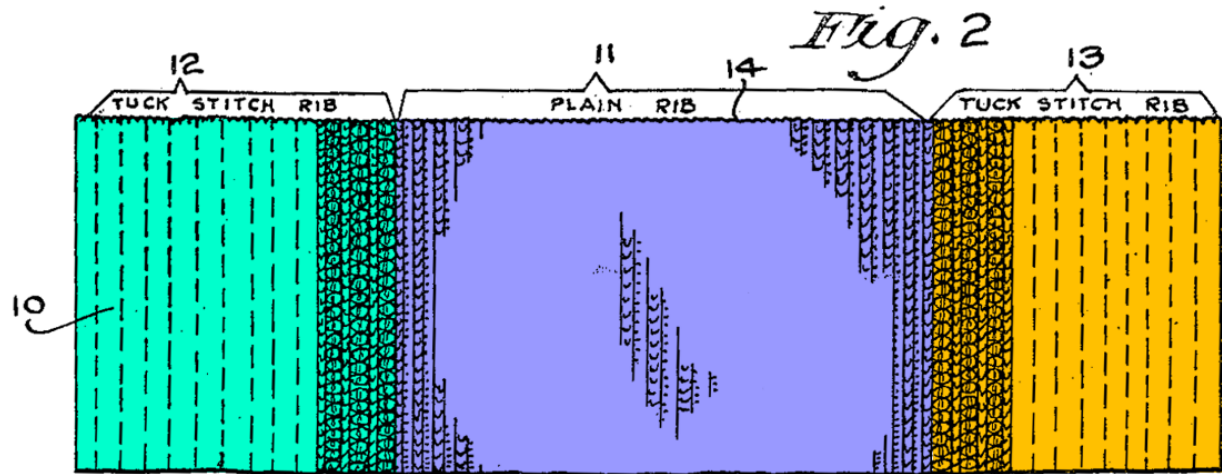
324. As I explained above, Patent Owner served infringement contentions in the related district court litigation which purport to assert that certain Skechers shoes infringe one or more claims of the '511 patent. *See supra* Section VIII.H. These contentions indicate that Patent Owner views the terms “smooth texture” and “rough texture” as matters of degree, and not as any precise numerical definition or limit. *Id.* For ease of reference, I have reproduced the shoe photos I used in Section VIII.H here:



EX1011, 88, 95.

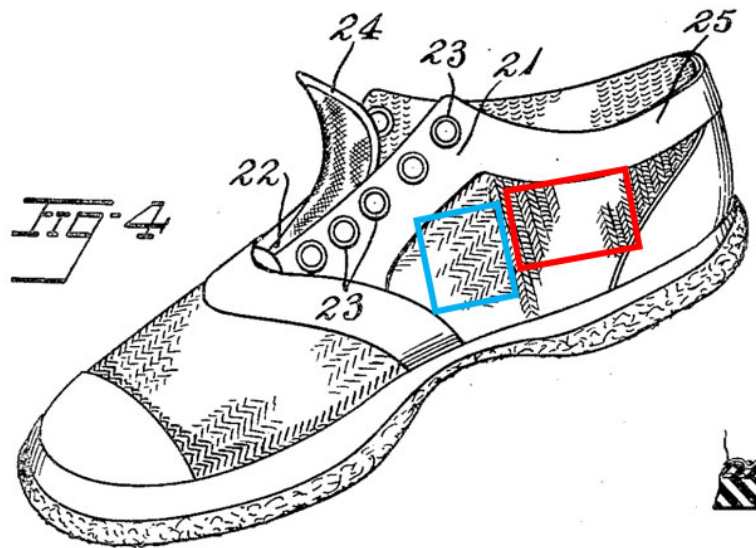
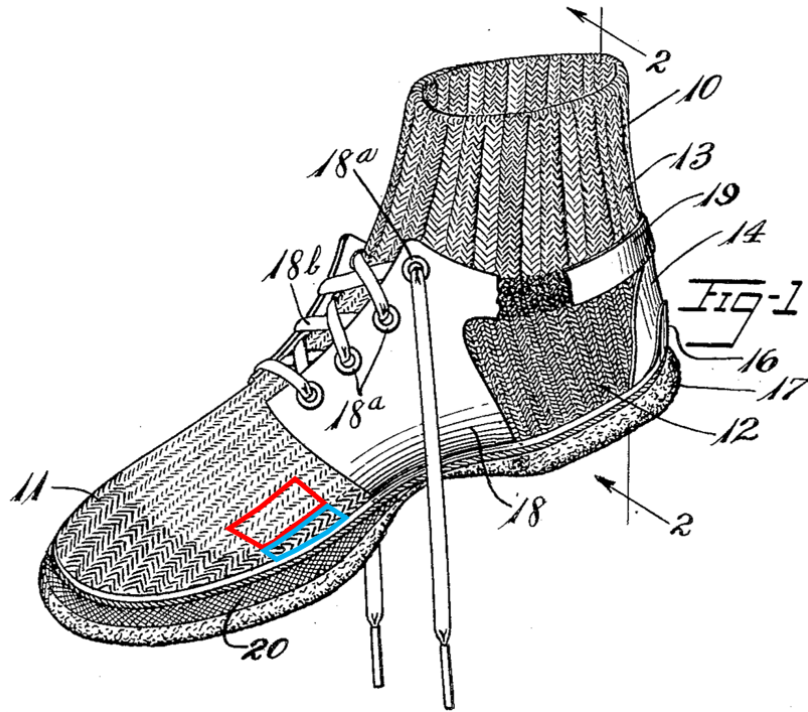
325. Herbert teaches multiple knit strips of various textures positioned adjacent to one another, and that smooth “plain jersey fabric” can be substituted for rougher ribbed fabric in areas 12 and 13, indicating that one of these textures is

rougher than the other, EX1016, 3:1-8, as demonstrated in Figure 2, annotated below:



EX1016, Fig. 2.

326. As I explained with respect to Claim 7, Glidden teaches that the fabric in the claimed upper may be fabricated in different ways (e.g., using different stitches and/or yarns) in different areas of the upper, and thus discloses multiple different textures adjacent to one another. *See* EX1017, 2:33-44.



EX1017, Figs. 1, 4.

327. Each of those areas, or knit strips, is made up of different stitch types, and would have a different degree of smoothness or roughness than other knit strips. (As I explained above in Section VIII.H, the '511 patent describes “smooth” and

“rough” textures only in relative terms, and two knit stitches of different types will necessarily have different degrees of smoothness or roughness. *See* EX1001, 9:65-66.) Glidden therefore discloses a first property of the first knit strip comprising a smooth texture, and a second property of the second knit strip comprising a rough texture.

328. Finally, to the extent these properties are not expressly disclosed in Herbert and/or Glidden, the use of smooth and rough textures would have been an obvious design choice, and a POSITA would have had a reasonable expectation of success. *See supra* Section VII.G (Obvious Design Choices).

329. As such, Claim 8 is obvious over Herbert in view of Glidden, Cusinato, and/or Spencer.

I. Claim 9

“The upper of claim 1, wherein the flat knit textile element further comprises a plurality of apertures in an instep region of the upper.”

330. Herbert in view of Glidden, Cusinato, and/or Spencer discloses the upper of Claim 1, “wherein the flat knit textile element further comprises a plurality of apertures in an instep region of the upper.”

331. For example, Glidden teaches that “[t]he principal objects of the present invention are to provide comfort, stretchability, light weight, breathability and absorption properties.” EX1017, 1:25-27. Glidden further discloses “a shoe having

an upper of knitted material providing elasticity and ventilating porosity by virtue of the knitted construction.” *Id.*, claim 2. Glidden’s objectives of providing at least “light weight, breathability...and ventilating porosity” would be served by incorporating apertures, to the extent this teaching does not expressly disclose them.

332. While apertures are not taught or disclosed in Glidden, it would have been obvious to include apertures for either aesthetic or functional purposes in footwear with knitted uppers, for the same reasons I described above with respect to Claim 9 in Ground 1. For example, apertures would serve one of Glidden’s “principal objects” of providing “breathability,” an important consideration in footwear. Moreover, Spencer discloses knitting open-work structures that include apertures. *See* EX1050, 57-58. The use of apertures would also have been an obvious design choice or obvious to try, and a POSITA would have had a reasonable expectation of success. *See supra* Section VIII.I; *see also supra* Section VII.G (the Obvious Design Choices).

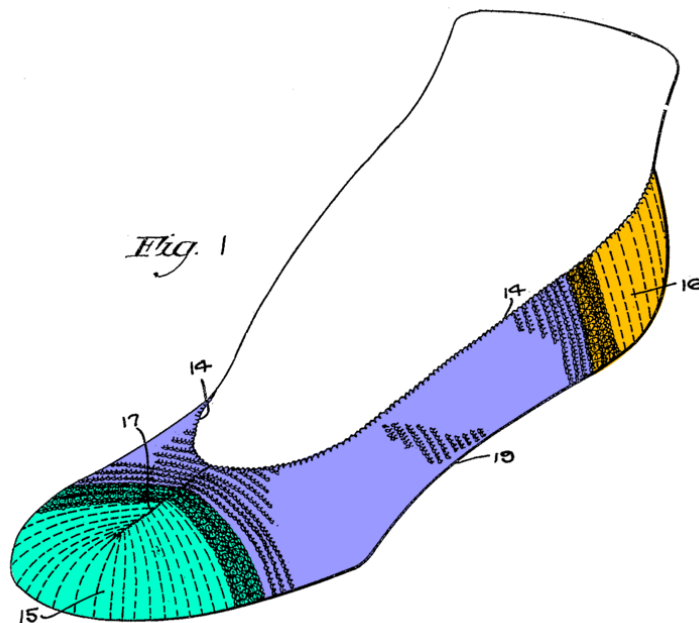
333. Therefore, Claim 9 would have been obvious over Herbert in view of Glidden, Cusinato, and/or Spencer.

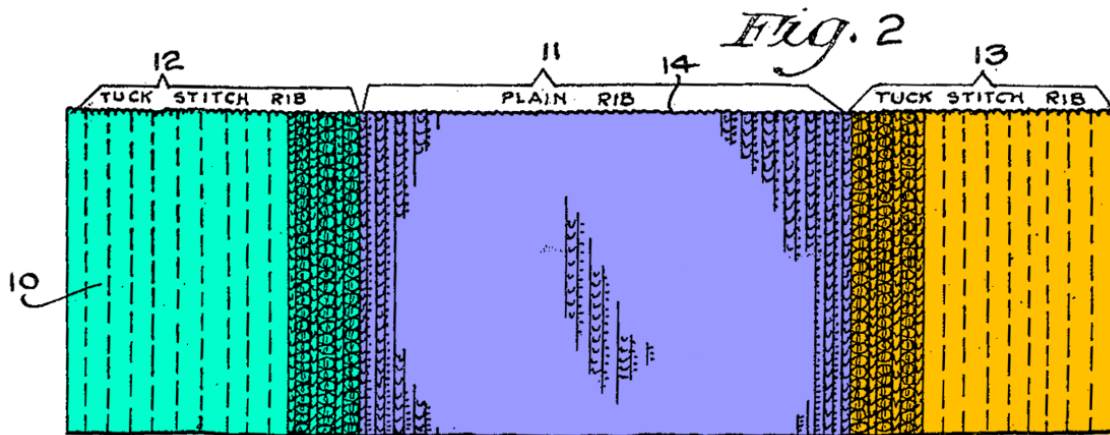
J. Claim 10

“The upper of claim 1, wherein the first property of the first knit strip comprises a higher degree of stretch than the second property of the second knit strip.”

334. Herbert in view of Glidden, Cusinato and/or Spencer renders obvious the upper of Claim 1, “wherein the first property of the first knit strip comprises a higher degree of stretch than the second property of the second knit strip.”

335. As I have explained above, both Herbert and Glidden show multiple knit strips with various degrees of stretch, as demonstrated in Figures 1 and 2 of Herbert, annotated below:



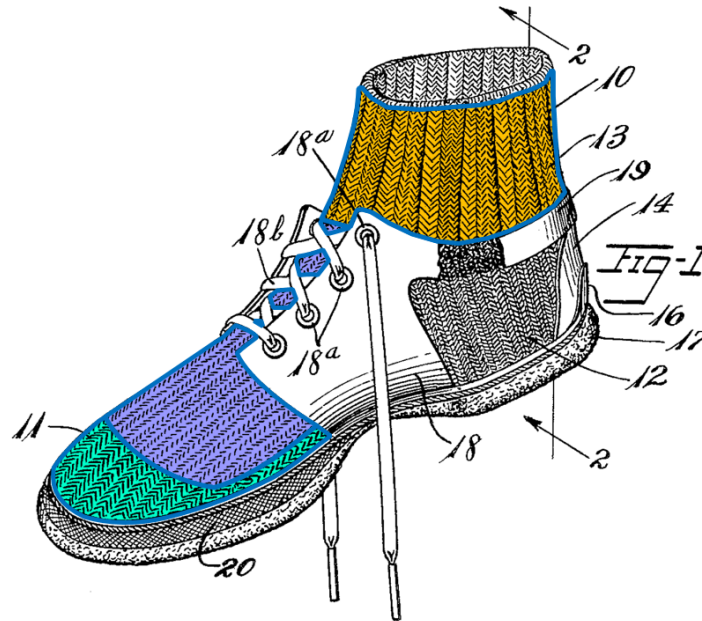


EX1016, Figs. 1, 2.

336. In particular, Herbert teaches that the “true rib fabric [in purple area 11 above] may be used throughout the slipper foot, but if less stretch is desired in the heel and toe areas [green and orange, respectively], as when the sole section has sufficient elasticity, then the stitch structure of the heel and the toe may be varied over the true rib stitch structure to reduce the elasticity of the same...for example, by knitting the heel and the toe sections of tuck stitch rib, transferred stitches or even plain jersey fabric.” EX1016, 2:19-29; *see also id.*, 3:1-8 (“[A]reas 12 and 13 may contain other stitch variations than the tuck stitches....”), 4:4-14 (“The provision of the tuck stitch wales in the heel and in the toe sections...reduces somewhat the elasticity in these sections....”).

337. Glidden also discloses a plurality of knit strips with various degrees of stretch on different areas of the same upper. For example, “ankle portion 13 [(in

orange)]...[is] preferably made so as to provide...elasticity,” as compared to other knit strips, EX1017, 2:33-44, as shown in the annotated version of Figure 1 below:



EX1017, Fig. 1.

338. Finally, Spencer discloses knit strips having varying degrees of elasticity, as shown in Figure 16.13 below:

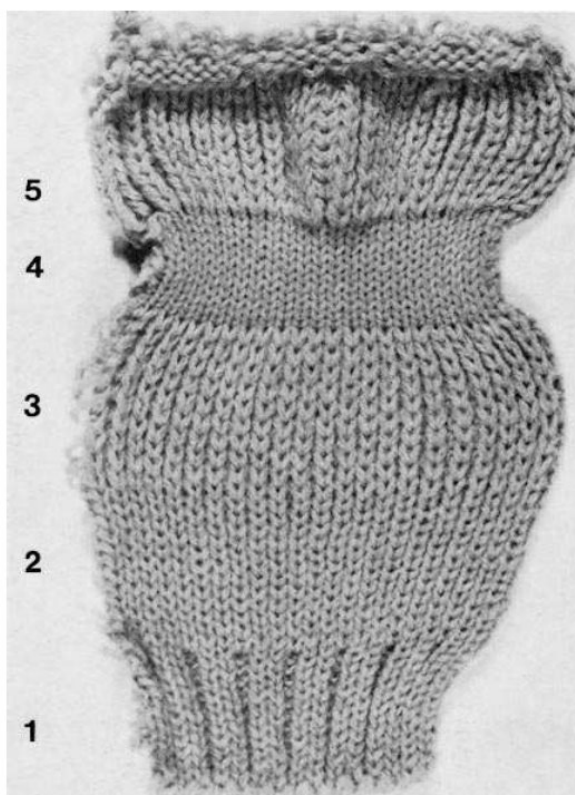


Fig. 16.13 Stitch shaping (1 = 2×2 rib; 2 = 1×1 rib; 3 = half-cardigan; 4 = tubular courses; 5 = full cardigan).

339. As such, Claim 10 is obvious over Herbert in view of Glidden, Cusinato, and/or Spencer.

K. Claim 11

“The upper of claim 1, wherein the second property of the second knit strip comprises a higher degree of stretch than the first property of the first knit strip.”

340. I note that Claim 11 simply reverses which of the two knit strips described in Claim 1 has the higher degree of stretch: in Claim 10 the first knit strip has the higher degree of stretch, and in Claim 11 the second knit strip has the higher degree of stretch.

341. Therefore, for the same reasons I discussed above with respect to Claim 10, Claim 11 is obvious over Herbert in view of Glidden, Cusinato, and/or Spencer.

L. Claim 12

“The upper of claim 1, wherein the first property comprises a first yarn type and the second property comprises a second yarn type.”

342. Herbert in view of Glidden, Cusinato, and/or Spencer renders obvious the upper of Claim 1, “wherein the first property comprises a first yarn type and the second property comprises a second yarn type.”

343. For example, Glidden discloses a plurality of strips having different yarns. More specifically, the fabric “may be more densely fabricated to provide therein heavier weight and less extensibility than in the other parts of the upper, as by changing the type of stitch or amount or thickness of the yarn in the knitting. Other areas, such as the ankle portion 13, are preferably made so as to provide softness and elasticity, as by making them of ribbed construction, as shown.” EX1017, 2:33-44.

344. Because Glidden clearly teaches that the “amount or thickness of the yarn in the knitting” may be changed, and thickness is a property, a person of skill in the art would recognize that it renders this limitation obvious.

345. Moreover, Spencer also teaches that this a common, well-known technique in the field of knitting: “Recently there has been an increasing use of *Lycra*

and other elastane yarns, in bare or in covered form, at every course or at alternate courses....” EX1050, 260; *see also id.*, 264 (describing “precisely plac[ing] spliced areas of elastane yarns to give selective comfort support whilst saving expensive yarn.”). Thus, a POSITA would recognize that a first yarn type could be used to create a first property in a first knitted strip and a second yarn type could be used to create a second property in a second knitted strip in the combination of Herbert, Glidden, Cusinato, and/or Spencer, including to achieve functional benefits such as increased elasticity or cost savings. These properties include the properties recited in Claims 13 and 14, which I address below.

346. As such, Claim 12 is obvious over Herbert in view of Glidden, Cusinato, and/or Spencer.

M. Claim 13

“The upper of claim 12, wherein the first yarn type of the first knit strip comprises at least one of a higher biodegradability, moisture absorption, insulation, durability, and/or hydrophobicity than the second yarn type of the second knit strip.”

347. Herbert in view of Glidden, Cusinato, and/or Spencer discloses the upper of claim 12, “wherein the first yarn type of the first knit strip comprises at least one of a higher biodegradability, moisture absorption, insulation, durability, and/or hydrophobicity than the second yarn type of the second knit strip” for essentially the same reasons I described above with respect to Claim 12.

348. Specifically, Glidden discloses that using a thicker yarn in one region of the upper would provide “heavier weight...than in other parts of the upper.” *Id.*, 2:37-39.

349. All other things being equal, using a yarn of heavier weight and a strip made from such yarn would provide improved “insulation” and “durability,” as recited by this claim. As I have noted above, different fibers, yarns and fabrics have different properties. *See, e.g.*, EX1062, 555-648 (describing properties).

350. As such, Claim 13 is obvious over Herbert in view of Glidden, Cusinato, and/or Spencer.

N. Claim 14

“The upper of claim 12, wherein the first yarn type of the first knit strip comprises at least one of a higher strength, support, stiffness, recovery, fit and/or form than the second yarn type of the second knit strip.”

351. I note that Claim 14 is substantially the same as Claim 13, except that it recites different common properties of various types of yarn (“strength, support, stiffness, recovery, fit and/or form” rather than “biodegradability, moisture absorption, insulation, durability, and/or hydrophobicity”). It is therefore obvious for the same reasons I explained with respect to Claim 12.

352. Glidden discloses the use of a variety of yarn types, as I explained above with respect to Claim 13, *see* EX1017, 2:19-32, and that the upper may be fabricated in varying degrees of density and with different stitches and amounts of

yarn. *Id.*, 2:33-44. The thicker yarn referred to in Glidden (*see* Claim 13 above) would have a “higher strength” and thicker “form” than other yarns. In particular, knit strips formed of such yarn would have “less extensibility” (*i.e.*, a greater degree of stiffness) and heavier weight (*i.e.*, strength) than other knit strips. *Id.*

353. Therefore, for the same reasons I discussed above with respect to Claim 13, Claim 14 is obvious over Herbert in view of Glidden, Cusinato, and/or Spencer. Specifically, two different yarn types could be employed to achieve the functional benefits of Claim 14, and a POSITA would have had a reasonable expectation of success. *See supra* Section IX.L.

O. Claim 15

354. I note that Claim 15 is substantially similar to Claim 1, with an additional limitation of “a sole structure secured to the upper” (Element 15[c]). Therefore, Herbert in view of Glidden, Cusinato, and/or Spencer satisfies all limitations of Claim 15 for the same reasons I explained with respect to Claim 1.

1. Element 15[pre]

355. For the same reasons I discussed above with respect to Element 1[pre], Herbert in view of Glidden, Cusinato, and/or Spencer satisfies Element 15[pre].

2. Element 15[a1]

356. For the same reasons I discussed above with respect to Element 1[a1], Herbert in view of Glidden, Cusinato, and/or Spencer satisfies Element 15[a1].

3. Element 15[a2]

357. For the same reasons I discussed above with respect to Element 1[a2], Herbert in view of Glidden, Cusinato, and/or Spencer satisfies Element 15[a2].

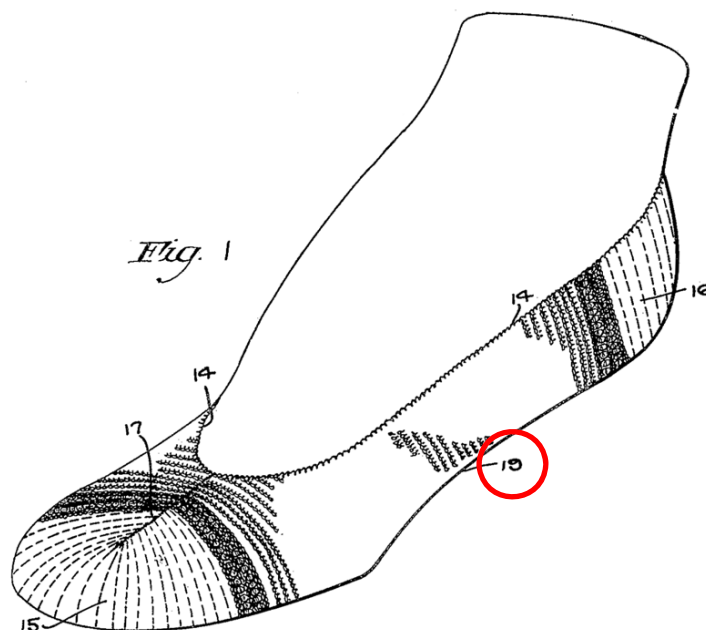
4. Element 15[b]

358. For the same reasons I discussed above with respect to Element 1[b], Herbert in view of Glidden, Cusinato, and/or Spencer satisfies Element 15[b].

5. Element 15[c]: “a sole structure secured to the upper.”

359. Herbert in view of Glidden, Cusinato, and/or Spencer discloses or renders obvious “a sole structure secured to the upper.”

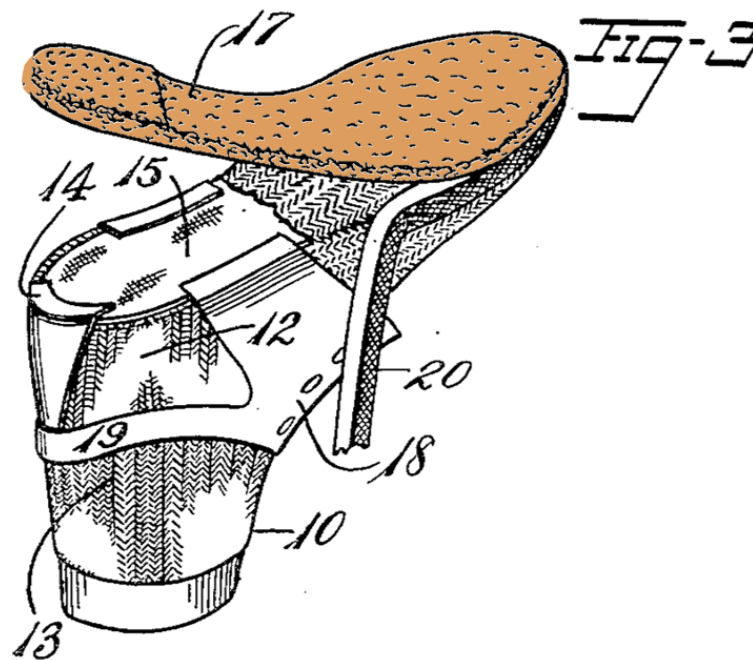
360. Herbert expressly teaches “[a] bottom or sole portion 19 of the slipper foot covering,” which plainly satisfies the claim limitation “a sole structure secured to the upper.” EX1016, 3:17-18. The annotated version of Figure 1 below shows sole portion 19:



EX1016, Fig. 1.

361. If Patent Owner were to assert that Herbert's slipper does not depict or disclose a sole structure, in spite of the disclosure described above, adding said sole structure to the slipper would nevertheless be an obvious modification. For example, a sole would be added to provide additional cushioning, protection, and traction to the wearer of the article of footwear, and a POSITA would be motivated to incorporate a sole structure to gain those benefits.

362. For example, Glidden's Figure 3, which has been annotated below, discloses a sole structure secured to the upper:



363. All five of the claims in Glidden also recite “a sole on said upper,” or some minor variation on that language. *Id.*, claims 1-5. A POSITA in possession of Herbert seeking to create a knit shoe more rugged and protective than Herbert's

slipper would thus have turned to Glidden's teachings, for example, and would have been motivated to combine the two references.

P. Claim 16

“The article of footwear of claim 15, wherein the first property comprises one or more of a first knit construction and a first yarn type and wherein the second property comprises one or more of a first knit construction and a second yarn type.”

364. Claim 16 is substantially similar to Claims 7 and 12, and this limitation would be obvious for the same reasons I explained above with respect to Claims 7 and 12.

Q. Claim 17

“The article of footwear of claim 15, wherein the flat knit textile element comprises a plurality of first knit strips extending along the lateral side and the medial side of the upper and a plurality of second knit strips extending along the lateral side and the medial side of the upper.”

365. Claim 17 is substantially similar to Claims 2 and 4 through 6, and this limitation would be obvious for the same reasons I explained above with respect to Claims 2 and 4 through 6.

R. Claim 18

“The article of footwear of claim 15, wherein the first knit strip is parallel to the second knit strip.”

366. Claim 18 is substantially similar to Claim 3 (“the first and second knit strips alternate with one another...”), and it would be obvious to arrange the first and

second knit strips parallel to one another in the article of footwear of Claim 15 for the same reasons that apply to Claim 3.

367. Therefore, for similar reasons to those I discussed above with respect to Claim 3, Claim 18 is obvious over Herbert in view of Glidden, Cusinato, and/or Spencer.

S. Claim 19

“The article of footwear of claim 15, wherein the first knit strip and the second knit strip extend along the lateral side of the upper from an instep region of the upper to an area proximate to the sole structure.”

368. Claim 19 is substantially similar to Claim 5, but recites “...to an area proximate to the sole structure” rather than “...to an area proximate to a lower region of the upper.”

369. This slight variation in claim language does not make Claim 19 any more inventive than Claim 5, because there is no meaningful difference between them. An “area proximate to the sole structure” of an assembled article of footwear with a sole is the same thing as an “area proximate to a lower region of the upper,” as the “lower region of the upper” would occupy the same space as a “sole structure” in an assembled article of footwear with a sole (as described in Claim 15).

370. Therefore, for similar reasons to those I discussed above with respect to Claim 5, Claim 19 is obvious over Herbert in view of Glidden, Cusinato, and/or Spencer.

T. Claim 20

“The article of footwear of claim 15, wherein the first knit strip and the second knit strip extend along the medial side of the upper from an instep region of the upper to an area proximate to the sole structure.”

371. Claim 20 is substantially the same as Claim 19, but refers to the “medial side” of the upper rather than the “lateral side.” It is also substantially the same as Claim 6, which, as I noted above in Section IX.F, is simply a slight variation on Claim 5.

372. Therefore, Claim 20 would be obvious for the same reasons discussed above with respect to Claims 5, 6, and 19.

SABIT ADANUR

Professor

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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 [Cla]ssroom 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.
- 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>
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Spring 2024

MECH 2140	Kinematics and Dynamics	3	65
MECH 5520/65200-PFEN 6200	Manufacturing of Polymeric Structures	4 (3+1)	50

Fall 2023

MECH 2140	Kinematics and Dynamics	3	32
MECH 5320/63200/6970D01	Engineered Flexible Structures	3	76

Summer 2023

MECH 2140	Kinematics and Dynamics	3	13
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Spring 2023

MECH 2140	Kinematics and Dynamics	3	65
MECH 5520/65200-PFEN 6200	Manufacturing of Polymeric Structures	4 (3+1)	80

Fall 2022

MECH 2140	Kinematics and Dynamics	3	45
MECH 5320/63200/6970D01	Engineered Flexible Structures	3	81

Spring 2022

MECH 2140	Kinematics and Dynamics	3	50
MECH 5970/6970-PFEN 6200	Manufacturing of Polymeric Structures	4 (3+1)	72

Fall 2021

MECH 2140	Kinematics and Dynamics	3	27
MECH 5970/6970	Engineered Flexible Structures	3	72

4.A.2 Graduate Students Whose Work Has Been CompletedStudents for Whom The Candidate Served as Major Professor

Student	Degree	Chair	Department	Graduation Date	Current Employer
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
Silver, 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.	PhD	Dr. Adanur	PFEN	Dec. 2005	Nexus Software Sol, Inc., MN
Ascioglu, Birgul	PhD	Dr. Adanur	PFEN	Aug. 2005	Valeo, Inc., Bursa, Turkey
Irsale, Swagat J.	MS	Dr. Adanur	Textile Eng.	Dec. 2003	Nexus Software Sol, Inc., PA.
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. Gowayed	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, 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).

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. 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, September 3, 2024, Vol. 54, 1-51, <https://doi.org/10.1177/15280837241282110>.
2. A. Jayswal*, J. Liu, G. Harris, R. Mailen and S. Adanur, Creep behavior of 3D printed polymer composites, Journal of Polymer Engineering and Science, 2023; 63: 3809-3818, doi:10.1002/pen.26486.
3. 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.
4. A. Jayswal*, R. W. Mailen, J. Liu, G. Harris, M. Siwakoti, and S. Adanur, Thermo-mechanical behavior of 3D printed fabric structures, submitted to Journal of Polymer Engineering and Science, Published 7 April 2023, <http://doi.org/10.1002/pen.26319>.
5. 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, <https://doi.org/10.1177/08927057231163489>, 14 March 2023.
6. 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, 5 January 2023, <https://doi.org/10.1177/00405175221146295>.

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Invited Feature Articles

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36. Adanur, S., (50%) and Xu, B.* (50%), "Influence of Microwave Fast-Preheating on Epoxy Resin Chemorheology Properties", American Society of Mechanical Engineers (ASME) Congress, Textile Engineering Division, November 1998, Anaheim, CA.
37. Adanur, S. (50%), and Liao, T. (50%), "3D Modeling of Textile Composite Preforms", Proceedings of the ICCE/5 Fifth International Conference on Composites Engineering, July 5-11, 1998, Las Vegas, NV.
38. Adanur, S. (50%), and Xu, B.* (50%), "Impact Resistance of Microwave Cured Glass/Epoxy Composites", Proceedings of the Second International Conference on Composite Science and Technology, ICCST/2, June 9-11, 1998, Durban, South Africa.
39. Mallick, S. B*. (50%), Elton, D. J. (25%), and Adanur, S. (25%), "A New Approach in Modeling of Soil-Geotextile Interface Behavior in Pullout Tests", Proceedings of the Sixth International Conference on Geosynthetics, March 25-29, 1998, Atlanta, GA.
40. Adanur, S.(50%), and Xu, B.* (50%), "Fast, Net Shape Manufacturing of Textile Composites", Proceedings of the Design and Manufacturing Grantees Conference, National Science Foundation, Monterrey, Mexico, January 1998.
41. Adanur, S. (50%), Hou, Z. * (50%), "Recycling and Reuse of PVC Coated Polyester Fabric", TCL7, Proceedings of the 7th International Conference on Textile Coating and Laminating, Charlotte, NC, November 1997.
42. Adanur, S. (50%), and Xu, B.* (50%), "Characteristics of Microwave-Cured Braided Glass/Epoxy Composites", Proceedings of the Composites at Lake Louise, CALL '97, Lake Louise, Canada, October 1997.
43. Adanur, S. (50%), Arumugam, Y. S.* (5%), and Xu, B.* (45%), "Fast Net Shape Manufacturing of Braided Textile Composite Structures", Proceedings of the Fourth International Conference on Composites Engineering (ICCE/4), Hawaii, July 1997.
44. Adanur, S. (50%), and Sreekanthreddy, G.* (50%), "Compression Behavior of 3D Reinforced Glass/Epoxy Laminar Composite Profiles", ICAPC-97, Proceedings of the International Conference on Advanced Polymer Composites, Materials, Processing and Applications, Beijing University of Aeronautics and Astronautics, Beijing, China, June 1997.
45. Basu Mallick, S.* (40%), Elton, D. J. (30%), and Adanur, S. (30%), "An Experimental Characterization of Soil-Woven Geotextile Interface in Large Box Pullout Tests", Proceedings of the Geosynthetics '97, Long Beach, CA, March 1997, pp. 927-940.
46. Adanur, S., "Manufacturing of Industrial Textiles", 10 pages, Proceedings of the NSF sponsored Symposium, December 1996, Alexandria, Egypt.
47. Adanur, S. (40%), Mallick, S.*(30%) , and Zhai, H.*(30%), "Analysis of Geotextile-Soil Interaction in Pull-Out Tests", Proceedings of the IS Kyushu '96, International Symposium on Earth Reinforcement, Fukuoka, Japan, November 1996.
48. Warren, A.* (50%), El-Halwagi, M. (25%) and Adanur, S. (25%), "Design of a New Process for Converting Textile Solid Waste into Transportation Fuel", Proceedings of the First Trabzon International Energy and Environment Symposium, Karadeniz Technical University, Trabzon, Turkey, July 1996.
49. Adanur, S. (50%), and Gongalareddy, S.*(50%), "Compressive Properties of Stitched Woven Fiberglass Fabric Reinforced Composite Sections for Civil Engineering Applications", ICCE/3, Proceedings of the Third International Conference on Composites Engineering, New Orleans, LA, July 1996.
50. Adanur, S., (80%) and Tam, C. A*. (20%), "On-machine Stitching of 3-D Laminate Structures for Composites", Proceedings of the 2nd International Conference on Composites Engineering (ICCE/2), New Orleans, LA, August 1995.

51. Wang, S.* (40%), Adanur, S. (40%) and Jang, B. Z. (20%), "Thermo-Mechanical Behavior of Fiber/Filler Reinforced Phenolic Matrix Composites", Proceedings of the 2nd International Conference on Composites Engineering (ICCE/2), New Orleans, LA, August 1995.
52. Wang, S.* (40%), Adanur, S. (40%). and Jang, B. Z. (20%), "Mechanical Behavior of Fiber/Filler Reinforced Phenolic Matrix Composites", Proceedings of the 2nd International Conference on Composites Engineering (ICCE/2), New Orleans, LA, August 1995.
53. Adanur, S. (50%), Mallick, S. B.* (25%), and Zhai, H.* (25%), "Design and Characterization of Geotextiles for High Performance Applications", Proceedings of the Hi-Tech Textiles Exhibition and Conference, Textile World and INDA, Greenville, SC, July 1995.
54. Mallick, S. B.* (40%)., and Zhai, H.* (40%), "A Laboratory Study on Pull-out Performance of Woven Geotextiles", Geosynthetics '95 Conference Proceedings, Nashville, TN, February 1995. This student paper, directed by Dr. Adanur (10%) and Dr. Elton (10%), was one of the 6 papers accepted for the conference.
55. Adanur, S. (60%), and Tsao, Y. P.* (40%), "Stitch Bonded Textile Structural Composites", SAMPE, Proceedings of the 26th International Technical Conference, Atlanta, GA, October 94.
56. Kozey, K.* (40%), Kumar, S. (20%), (Ga Tech), Adanur, S. (20%), and Mohamed, M. H. (20%), (NC State), "Compressive Failure Mechanisms in Woven and Laminate Glass/Epoxy Composites", SAMPE, Proceedings of the 26th International Technical Conference, Atlanta, GA, October 94.
57. Adanur, S. (60%), Tsao, Y. P.* (20%), and Tam, C. W.* (20%), "Improving Fracture Resistance in Laminar Textile Composites", Proceedings of International Conference on Composite Engineering, ICCE/1, New Orleans, LA, August 1994.
58. Adanur, S., "Design and Structure of Fabrics for Papermaking", 3rd Annual International Hi-Tech Textiles Conference, Textile World and INDA, Greenville, SC, June 1994.
59. Adanur, S., (50%) and Walker, R. P. (50%), "Yarn Preparation for Weaving in the Future", Proceedings of the 33rd Annual Textile Slashing Short Course, Auburn University, AL, September 1993.
60. Adanur, S., "Effects of Forming Fabric Design on Paper Properties", Second International Hi-Tech Textiles Exhibition and Conference Proceedings, Greenville, SC, July 1993.

Non-refereed Journal Articles

1. Griffin, K., Jayswal, A., and Adanur, S., Additive Manufacturing of Braided Structures for Composite Reinforcement, Auburn University, Journal of Undergraduate Scholarship, 19 August 2022.
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.
3. O'Dell, H., "Narrow Fabrics in Broad Use", Industrial Fabrics Products Review, Nov. 2007, pp. 48-51 (Adanur was interviewed and quoted in this article).
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.
6. Adanur, S., "Latest Developments in Weaving Machinery at ATME-I 93 Show", Textiles and Technique, Turkish/English, September 1993 (in Turkish).

Tech Briefs

1. Bakhtiyarov, S., Overfelt, R. A., and Adanur, S., "Improvements in Fabrication of Sand/Binder Cores for Casting", NASA Tech Briefs, July 2005.
2. "US-Turkey Cooperative Research", AL EPSCoR, 2004 Annual Report to the AL Commission on Higher Education, 10 Dec. 2004, pp. 18-19.
3. A summary report was submitted to Ms. Jennifer Braxton, Economic Development Analyst with the Economic Development Partnership of Alabama, Birmingham, entitled "Fiberglass Composite Research", Sept. 3, 2004; 4 pages.
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. 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).
2. *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.
3. 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.
4. *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.
5. *Jayswal, A.*, and *Adanur, S.*, Design, fabrication, and testing of novel 3D printed facemasks, CPAC Summer seminar series, Auburn University, 20 July 2021.
6. *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.
7. *Adanur, S.*, and Jayswal, A., 3D Printing of Fabric-like Structures, TechTextil North America, 19 November 2020 (Webex presentation).
8. *LaBombard, K.*, and *Adanur, S.*, "Manufacturing of Nanoparticle Reinforced Materials Through Electrospinning", The Fiber Society 2017 Fall Conference, Athens, GA, Nov. 8-10, 2017.
9. 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.
10. 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.
11. *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.
12. *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).
13. *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.
14. *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.

15. *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.
16. *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.
17. *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).
18. *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).
19. 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.
20. *Adanur, S.*, A Novel Filling Insertion System for Weaving, The 3rd International R&D Project Brokerage Event, Bursa, Turkey, Feb. 10-11, 2011.
21. *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.
22. 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).
23. 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.
24. *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.
25. *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.
26. 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.
27. *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.
28. *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.
29. *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.
30. *Adanur, S.*, Nanotechnology Applications in Textiles, The 6th Textile Congress, Suleyman Demirel University, Isparta, Turkey, May 1-3, 2009.
31. *Liu, W.*, and *Adanur, S.*, “Activated carbon fiber filter media for PEM fuel cell cathode”, AU Annual Research Forum, 10 March 2009.
32. *Adanur, S.*, “Nanotechnologies are Coming Your Way”, Industrial Fabrics Association International (IFAI) Expo '08, October 21-23, 2008, Charlotte, NC (invited presentation).
33. *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.

34. *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.*
35. *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.*
36. *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.*
37. *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.*
38. *Adanur, S., "Innovation in Textiles, Nanotechnology Practices and Technical Textiles", 1st International Textile and Apparel Summit, June 2-3, 2007, Denizli, Turkey.*
39. *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.*
40. *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.*
41. *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.*
42. *Adanur, S., and Irsale, S., "Textile Stent Prototyping and Modeling", IFAI Expo 2006 Medical Textiles Symposium, Atlanta, Oct. 31, 2006.*
43. *Adanur, S., "Wide World of Industrial Textiles", presentation given to the teachers at the Istanbul Textile Vocational School, June 22, 2006, Istanbul, Turkey.*
44. *Adanur, S., "Dynamics of Air-Jet Weaving", The First Istanbul International Textile and Textile Machinery Congress, June 1-2, 2006, Istanbul, Turkey.*
45. *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.*
46. *Adanur, S., Isikel, L., and Abdelhady, F., "Coated and Laminated Fabrics for Fuel Cells", TechTextil Symposium North America, March 28-30, 2006, Atlanta, GA.*
47. *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.*
48. *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.*
49. *Adanur, S., "Application of Industrial Textiles", Seminar given to ITAS 8960 Class, 8 Sept. 2005.*
50. *Adanur, S., "High Tech Textiles", Bossa, Adana, Turkey, 18 July 2005.*
51. *Adanur, S., "Coated and Laminated Fabrics for Fuel Cells", 2nd International Technical Textiles Congress, Istanbul, Turkey, 13-15 July 2005.*
52. *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.*
53. *Adanur, S., "Higher Education in the U.S", Suleyman Demirel University, Isparta, Turkey, 8 July 2005.*
54. *Adanur, S., "High Tech Textiles", Suleyman Demirel University, Isparta, Turkey, 8 July 2005.*
55. *Adanur, S., "High Tech Textiles", Denizli Chamber of Commerce, Turkey, 7 July 2005.*

56. *Adanur, S.*, “High Tech Textiles”, Pamukkale University, Denizli, Turkey, 6 July 2005.
57. *Adanur, S.*, “Higher Education in the U.S”, Karadeniz Technical University, Trabzon, Turkey, 30 June 2005.
58. *Irsale, S.*, and *Adanur, S.*, “Exporing Textile Stents: Prototyping and Modeling”, Fiber Society Spring 2005 Conference, May 25-27, 2005, St. Gallen, Switzerland.
59. *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.
60. *Irsale, S.*, and *Adanur, S.*, “Textile Prosthesis for Vascular Applications”, NTC Paper presentation, 10 January 2005, Spidle Hall, Auburn University.
61. *Ascioglu, B.* and *Adanur, S.*, “Heat Transfer Modeling in Nanofiber Reinforced Composite”, NTC Paper presentation, 10 January 2005, Spidle Hall, AU.
62. *Adanur, S.*,” High Performance and Nano Fibers”, Twtichell Corporation, Dothan, AL, Sept. 2, 2004.
63. *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.
64. *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.
65. *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.
66. *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.
67. *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.
68. *Adanur, S.*, “Geotextiles”, Unsa, Inc., Istanbul, Turkey, July 19, 2004.
69. *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.
70. *Irsale, S.*, and *Adanur, S.*, “Monofilament Yarns in Braided Vascular Prostheses”, TechTextil Symposium North America, Atlanta, GA, March 30-April 1, 2004.
71. *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.
72. *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.
73. *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.
74. *Adanur, S.*, “Wide World of Industrial Textiles”, June 19, 2003, Marmara University, Istanbul, Turkey,
75. *Sathendra, V.*, and *Adanur, S.*, “Fabric Design and Analysis System in 3D Virtual Reality”, Auburn University Annual Research Forum, Auburn, AL, 20 March 2003.
76. *Adanur, S.*, “Wide World of Industrial Textiles”, Dong Hua University, Shanghai, China, 26 Sept. 2002.
77. *Adanur, S.*, and *Onal, L.*, “Experimental Analysis of Textile Composites”, TechTextil North America Symposium, Atlanta, GA. April 9-11, 2002, April 9-11, 2002.
78. *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.
79. *Adanur, S.*, and *Turel, T.*, “Mechanics of Air-Jet Filling Insertion”, 2001 ASME International Mechanical Engineering Congress & Exposition, New York, NY, Nov. 14, 2001.

80. *Adanur, S.*, "Role of Technical Fabrics in Papermaking: An Overview", Techtextil Symposium North America, March 13-15, 2001, Atlanta, Georgia.
81. *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.
82. *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.
83. *Adanur, S.*, and Orak, H., "Textile Composites", DOE/TACOM Army 21st Century Truck Program, Auburn University, Auburn, AL. 3 August 2000.
84. *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.
85. *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.
86. *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.
87. 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.
88. *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.
89. *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.
90. *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.
91. *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.
92. *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.
93. *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.
94. *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.
95. 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.
96. *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.
97. *Adanur, S.*, and Xu, B., "Characteristics of Microwave-Cured Braided Glass/Epoxy Composites", Composites at Lake Louise, CALL '97, October 12-17, 1997, Canada.
98. *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.

99. *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.
100. *Adanur, S.*, "Geotextiles: Design and Applications in Alabama", Presentation to Alabama Congressional Delegation, May 9, 1997.
101. 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.
102. 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.
103. *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.
104. *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.
105. 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.
106. *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.
107. *Adanur, S.*, Design and Characterization of Geotextiles for High Performance Applications, Nonwovens Cooperative Research Center, 5th Annual Meeting, May 29, 1996, Raleigh, NC.
108. *Adanur, S.*, "Manufacturing of Industrial Textiles: Requirements and Opportunities", Sulzer-Ruti Technical Fabric Symposium, February 21-23, 1996, Spartanburg, SC.
109. *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.
110. 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.
111. *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.
112. 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.
113. *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.
114. *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.
115. *Adanur, S.*, and Tsao, Y. P., "Stitch Bonded Textile Structural Composites", The 26th International Technical Conference, SAMPE, October 24-27, 94, Atlanta, GA.
116. *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.
117. *Adanur, S.*, "Design and Structure of Fabrics for Papermaking", Third International Hi-Tech Textiles Exhibition & Conference, June 21-22, 1994, Greenville, SC.
118. *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.

119. *Adanur, S.*, "Paper Machine Clothing", Istanbul Technical University, Textile Engineering Department, August 4, 1993.
120. *Adanur, S.*, "Effects of Forming Fabric Design on Paper Properties", 2nd International Hi-Tech Textiles Conference, July 21, 1993, Greenville, SC.
121. ElMogahzy, Y., Gawayed, Y. and Adanur, S., "Mechanical Characterization of Geotextiles/Soil Interaction", The Fiber Society Spring Meeting, May 1993, Raleigh, NC.
122. *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. *S. Adanur*, A. Sapkota and S. Ghimire, Manufacturing of Polymeric Structures, AU Undergraduate Research Showcase poster presentation 17 October 2023.
2. *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.
3. *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.
4. *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.
5. *A. Sapkota* and S. Adanur, Additive manufacturing of polymeric flexible structures, MECH-MATL Graduate Student Research Poster Competition, 1 October 2023.
6. A. Jayswal and S. Adanur, Additive manufacturing of polymeric flexible structures, AU Student Research Symposium, March 28, 2023, Auburn University.
7. *A. Jayswal* and S. Adanur, Additive manufacturing of polymeric flexible structures, Graduate Engineering Research Showcase (GERS), March 23, 2023, Huntsville, AL.
8. *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.
9. *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.
10. *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.
11. *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.
12. *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.
13. *Jayswal, A.*, and Adanur, S., Additive Manufacturing of Fabric-like Structures, 2020 Virtual Student Research Symposium, April 2020.
14. *Adanur, S.*, "Air-Jet Filling Insertion System", Mechanical Engineering Undergraduate Research Information Poster Session, 10 October 2017, Wiggins Hall, Auburn University.
15. *Adanur, S.*, "Air-Jet Filling Insertion System", Mechanical Engineering Undergraduate Research Information Poster Session, 1 September 2016, Wiggins Hall, Auburn University.

16. *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.
17. 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.
18. 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.
19. *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.
20. *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.
21. *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.
22. *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.
23. *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.
24. *Adanur, S.*, A Novel Filling Insertion System for Weaving, The 3rd International R&D Project Brokerage Event, Bursa, Turkey, Feb. 10-11, 2011.
25. *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.
26. 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).
27. 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.
28. *Adanur, S.*, and Irsale, “Development of Drug Eluting Textile Stents”, NTC Forum, June 3, 2008, Greenville, S.C.
29. 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.
30. 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.
31. 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.
32. 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.
33. Yacoob, 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.
34. *Adanur, S.*, Isikel, L., and Abdelhady, F., “Coated and Laminated Fabrics for Fuel Cells”, TechTextil Symposium North America, March 28-30, 2006, Atlanta, GA.
35. *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.
36. *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.

37. 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.
38. 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.
39. 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.
40. Irsale, S., and Adanur, S., "Exploring Textile Stents: Prototyping and Modeling", AU Annual Graduate Student Research Forum, March 10, 2005, Auburn, AL.
41. 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.
42. 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.
43. 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.
44. 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.
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 16-18, 2003, Hilton Head, SC.
46. 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.
47. 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.
48. 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.
49. 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.
50. 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.
51. Tascan, M., and Adanur, S., "Filling Yarn Insertion in Air-Jet Weaving", 11th Research Forum, Auburn University, March 19, 2001.
52. Onal, L., and Adanur, S., "Impact Properties of Textile Composites", 11th Research Forum, Auburn University, March 19, 2001.
53. Kilinc, F. S., and Adanur, S., "3D Fabric Design and Analysis", 11th Research Forum, Auburn University, March 19, 2001.
54. 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.
55. 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.
56. 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.
57. 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.

58. 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.
59. 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.
60. Adanur, S., and Xu, B., "Fast Net Shape Manufacturing of Braided Textile Composites", NSF CAREER Awardees Meeting, January 10-12, 1999, Washington D.C.
61. 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.
62. 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.
63. 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.
64. 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.
65. 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.
66. Adanur, S., Thomas, H., Gawayed, Y., "On-Line Monitoring", National Textile Center Annual Forum, January 28-30, 1997, Myrtle Beach, SC.
67. 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.
68. 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.
69. 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.
70. Adanur, S., et al., "Textile Structural Composites", National Textile Center Annual Forum, January 24-26, 1996, Raleigh, NC.
71. 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.
72. Mohamed, M., Adanur, S., et al., "Textile Structural Composites", National Textile Center, Annual Forum, January 26-28, 1995, Atlanta, GA.
73. 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.
74. 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.
75. Mohamed, M., Adanur, S., et al., "Textile Structural Composites", National Textile Center, Annual Forum, Greenville, SC, February 1994.
76. 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.
77. 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", submitted to 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. International Istanbul Textile Congress 2013, Session: New Materials, Room 3, May 30-31, 2013, 13.40-15.40, Istanbul, Turkey.

2. Session 202: Composites, Techtextil North America Symposium, Wednesday, April 2, 2008, 8:30 a.m. - 11:00 a.m., Atlanta, GA.
3. Session 3 (afternoon session) at the First Istanbul International Textile and Textile Machinery Congress, June 2, 2006, Istanbul, Turkey.
4. Session 4, 2nd International Technical Textiles Congress, Istanbul, Turkey, 13-15 July 2005.
5. 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.
6. 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.
7. Session 203 Paper Making Fabrics, Techtextil Symposium North America, March 13-15, 2001, Atlanta, Georgia. Developed and chaired the session with 5 speakers.
8. 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.
9. 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.
10. 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.
11. The Fiber Society, Fall 1996 General Technical Conference, Session IV: Marine Applications of Textiles, Wednesday, Oct. 16, 1996, Newport, Rhode Island.
12. 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.
13. 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.
14. 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 Eurosia 2013, in Istanbul, Turkey, May 29, 2013.
2. Composite Manufacturing Workshop, March 30-31, 2005, Auburn, AL.

Editorships

1. Member of the Editorial Board for Journal of Industrial Textiles, Sage Publications (Jan. 2000 - present).
2. Member of the Editorial Board for the Electronic Journal of Textiles (August 2002 – 2010)
3. Member of the Editorial Board for the POLITEKNIK (Turkish/English), (Dec. 2004-2009).
4. Member of the Editorial Board for the Electronic Journal of Textiles (August 2002 – 2009).
5. Member of the Editorial Board for Journal of Coated Fabrics, Technomic Publishing, Co., Inc., Lancaster, PA, (January 1998 – Jan. 2000).
6. 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. ME Undergraduate Curriculum Committee (Fall 2022-present).
2. Founding faculty advisor for AU Chess Club, August 2020 – present (105 members).
3. Member of the Academic Standards Committee, August 2020 – 2023.
4. Member of the Student Conduct Committee, August 2020 – 2023.
5. Mechanical Engineering Senator for AU Faculty Senate, June 2020 – present.
6. Member of the Academic Honesty Committee, Aug. 2019 – Aug. 2022.
7. Member of the Patent and Invention Disclosure Committee, Aug. 2017 - Aug. 2020.
8. Chair of the Academic Computing Committee, Aug. 2019 - Aug. 2020 (member Aug. 2017 - Aug. 2020).
9. Member of the Faculty Salaries and Welfare Committee, Aug. 2015 – Aug. 2018.
10. Prepared and submitted SACS Assessment Reports for PFEN Masters and Ph.D. programs, June 2017.
11. Prepared and submitted SLO7 report for SACS, 20 November 2014.
12. Member of the Calendar and Schedules Committee, Aug. 2014 – Aug. 2017.
13. Member of the Academic Program Review Committee, Aug. 2013-Aug. 2016.
14. Prepared and submitted SACS Assessment Reports for TE/PFEN B.S., M.S. and Ph.D. programs, 2011-2017.
15. 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.
16. Participated in the AU Strategic Planning Focus Group sponsored by the Office of the Provost, 19 March 2013.
17. Member of the Academic Standards Committee, Aug. 2012-Aug. 2015.
18. Member of the Post Tenure Review Committee, Aug. 2012-Aug. 2015.
19. Prepared the 2011 SACS assessment reports for PFEN B.S., M.S., and Ph.D. programs, Jan.-Feb. 2012.
20. Member of the PFEN faculty search committee, Aug. 2011- Aug. 2012.
21. Member of the Faculty Handbook Review Committee, Aug. 2011-Aug. 2014.
22. Member of the Faculty Dismissal Committee, Aug. 2010-Aug. 2013.
23. Mentor - AU Early Career Faculty Mentoring Program, Sept. 2009-present.
24. Chair of the AU Faculty Grievance Committee, Aug. 2009-Aug. 2010.
25. Member of the Student Discipline Committee, Aug. 2009-Aug. 2012
26. Hosted TALON exhibit for incoming engineering freshman with Julia Freeman at the AU Hotel and Conference Center, Feb. 18, 2008.
27. Member of the new PFEN PhD Program Committee, Apr. 2008-present.
28. Member of the AU Faculty Grievance Committee, Nov. 2007-May 2009.
29. Member of the PFEN Faculty Search Committee (Chair: Dr. Buschle-Diller), Aug. 2007-Apr. 2008.
30. 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).
31. Chair of the PFEN Faculty Search Committee, Fall 2006-Spring 2007.
32. Member of the Alumni Engineering Research Award Committee (meeting held on March 10, 2008).

33. Responsible for the polymer processing equipment purchase (visited University of Akron, Oct. 2006).
34. Chair of the AU Student Academic Grievance Committee, Jan. 2006-Aug. 2008.
35. Member of the AU Student Academic Grievance Committee, Aug. 2005- Dec. 2005.
36. Member of the AU Academic Honesty Committee, 2003-2006.
37. Member of the Alumni Professorship Committee, 2002-2005.
38. Member of the Budget Advisory Committee, Feb. 2003-2005.
39. Graduate Faculty (reappointed November 2002)
40. Member of the Ginn Professorship Selection Committee, 2002.
41. Member of the Engineering Faculty Council (EFC), 2002-2005.
42. Member of the AU Diversity Leadership Council, May 2002-2004.
43. TE Department Futures Committee Member, 2001.
44. Mentoring Committee member for Dr. Alicia McClain, Assistant Professor. February 2001- 2004.
45. Member of the AU Senate Research Grant-in-Aid Committee, Fall 2000- Fall 2003.
46. Member of the Textile Engineering Department Head Search Committee, 1999-2000.
47. Member of the College of Engineering Freshman Computing Initiative (FCI) Committee (1999-2000)
48. 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.
49. Chairman of the Textile Engineering Curriculum Committee (1993-2000).
50. Coordinated the Semester Transition activities for TXEN, TXCH, TXMT, TXTS and ITAS programs. Prepared/edited the departmental semester transition package (162-page document)
51. College of Engineering Priorities Task Force Member (1998). Participated in two task force teams: one in research and one in teaching.
52. Member of the College of Engineering Curriculum Committee (1993 to 2016).
53. 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).
54. Member of the new PhD program in Integrated Textiles and Apparel (ITAS) preparation committee (1994 - 1998).
55. Member of the three new faculty and two new technician search committees in Textile Engineering (1994-2000).
56. Participated in the 1994-1995 and 1995-96 Faculty/Student Mentor Program
57. Honorary Member of the Phi Psi Textile Fraternity.
58. 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. Reviewed 4 AU internal proposals for the NSF MRI program, 11 August 2023.
2. National Science Foundation, STTR Phase I. Reviewed 3 proposals online, Sept. 2, 2021.
3. 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.
4. National Science Foundation, SBIR/STTR Program (reviewed 5 proposals), Sept. 11, 2020.
5. National Science Foundation FMSG Materials and Construction Virtual Panel, 6 proposals reviewed out of 17 (panelist for others), July 27-28, 2020, Zoom Meeting.
6. National Science Foundation SBIR/STTR Program (reviewed 4 proposals), Oct. 10-11, 2019.
7. National Science Foundation SBIR/STTR Program (reviewed 4 proposals), March 11-12, 2019.
8. NSF Panelist for Nanomanufacturing Proposals (Panel #: P100737), Dec. 14, 2009, Arlington, VA. Reviewer/Lead/Scribe for 8 proposals, Panelist for 26 proposals.
9. Panelist for NSF SBIR-STTR Program, Aug. 23, 2007, National Science Foundation, Arlington, VA.
10. NSF Proposal No. 0242891 entitled "Human Powered Wearable Computers" by Hechmi Hamouda and Warren J. Jasper, November 2002.
11. Proposal No: INT-9811022, National Science Foundation, PI: C. L. Smith, North Carolina State University, June 1998.
12. Reviewer for the National Textile Center Proposals (Fabrication Competency), 1998-2001.
13. 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 a hundred articles have been reviewed to date.

Other:

1. Judge for AU GERS 3M Research Presentations (5 presentations judged), 12 October 2023.
2. Judge for the MECH-MATL Graduate Student Research Poster Competition, 1 October 2023 (8 posters).
3. Judge for AU Student Research Symposium, March 28, 2023 (judged 4 oral presentations).
4. Judge, 2021 Graduate Engineering Research Showcase, 28 October 2021 (6 posters).
5. Judge for the ME Graduate Student Poster Competition, 25 Sept. 2022 (7 posters).
6. Judge, AU Research 2021 Student Symposium, 31 March 2021, (4 online presentations).
7. Judge, College of Engineering FiveInFive Graduate Student Presentations (4 online presentations), 28 October 2020.
8. Judge, 2020 Virtual Auburn Student Research Symposium (6 posters), 1 May 2020.
9. Judge for Three Minute Thesis (3MT), Auburn University, 24 October 2019.
10. Judge for ME Conference Graduate Student Poster Session, 15 Sept. 2019.
11. Judge, Auburn Research Student Symposium, 9 April 2019.
12. Judge for AU SG Graduate Engineering Research Showcase, 24 October 2018.
13. Judge for AU This is Research Student Symposium, Biomedical Health (Oral Presentations), 26 March 2018.
14. Judge for ME Conference Graduate Student Poster Session, 30 Sept. 2018.
15. Gave a presentation about the education opportunities in the U.S.A. to a group of university students in Istanbul, Turkey, July 16, 2018.
16. Judge for AU This is Research Student Symposium, Biomedical Health (Oral Presentations), 26 March 2018.
17. Judge for Graduate Student Poster Contest at ME Conference, 17 September 2017.
18. Prepared and submitted SACS Assessment Reports for PFEN Masters and Ph.D. programs, June 2017.
19. Judge for two proposals submitted to UTIB International R&D Brokerage Event, 27-28 April 2017, Bursa, Turkey (14 April 2017).
20. Judge for AU This is Research Student Symposium, 13 April 2017.
21. Judge, "2017 Finish in 5 Competition", AU SG College of Engineering Graduate Students (CEGS), 22 March 2017.
22. Judge, AU SG College of Engineering, Graduate Engineering Research Showcase, 20 October 2016.
23. Judge for AU This is Research Student Symposium, 13 April 2016.
24. Judge for several proposals submitted to UTIB International R&D Brokerage Event, 12-13 May 2016, Bursa, Turkey.
25. Judge for AU SG College of Engineering Fall 2015 Graduate Engineering Research Showcase, 22 October 2015.
26. Judge for eight proposals submitted to UTIB International R&D Brokerage Event, 27-29 May 2015, Bursa, Turkey.
27. Judge for oral session; This is Research: Student Symposium 2015, Auburn University, 13 April 2015.
28. Feb. 27, 2015; gave polymer processing lab tours during the E-day.
29. Judge, Fall 2014 Graduate Engineering Research Showcase, Auburn University, Oct. 23, 2014.
30. Judge for the "Turkey Innovation Week", Dec. 6-8, 2012, Istanbul, Turkey. Judged 10 proposals.
31. Recommendation letter for promotion of a professor at an NTC University, December 2004.
32. Member of the Fiber Society Award Committee, 2011- 2013.
33. 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.

34. Gave the commencement speech at Marmara University, College of Engineering Graduation Ceremony, Istanbul, Turkey, 6 July 2011.
35. Presented the NTC booth, 1.00-5.00 pm, Techtextil North America Symposium, April 2, 2008, Atlanta, GA.
36. Helped with the Engineering Technologies Academy for Civil Air Patrol cadets, July 8-12, 2003, Auburn University.
37. 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.
38. Gave a lecture to Prof. Richard Penaskovic's class RELG 0304 – Western Religions on June 1, 1999.
39. Attended the Milliken Summer Challenge University/Industry Programs (1997 and 1998).
40. Served as judge in the Industrial Fabrics Association International (IFAI)'s annual International Achievement Awards competitions (1995-2000)
41. 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).
42. Reviewer of Proposals for National Science Foundation (NSF)
43. 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.
44. "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.
45. Gave a presentation to Alabama Congressional Delegation on Geotextiles, May 9, 1997.
46. Prepared and presented the AU Textile Engineering booth during the 3rd International High-Tech Textiles Conference, Greenville, SC, June 94.
47. 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 2012 season
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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