UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

KIMBERLY-CLARK CORPORATION,
Petitioner,

v.

THE PROCTER & GAMBLE COMPANY,
Patent Owner.

Case No. PGR2026-00078
U.S. Patent No. 12,516,475
Issue Date: January 6, 2026

DECLARATION OF DR. D. STEVEN KELLER

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I. INTRODUCTION

1. I have been retained as an independent expert by counsel for Petitioner Kimberly-Clark Corporation ("Kimberly Clark" or "Petitioner") in the above-captioned proceeding before the Patent Trial and Appeal Board ("PTAB" or "Board").

2. I understand that Kimberly Clark is requesting that the Board institute a post grant review ("PGR") proceeding of Claims 1, 3, 4, 9, 10-14, 15, 17, 18, 23, and 24-28 of U.S. Patent No. 12,516,475 ("the '475 Patent") (EX1001), currently assigned to The Procter & Gamble Company ("PG" or "Patent Owner"). I understand that this declaration is being filed as an Exhibit in the PGR.

3. I am being compensated at my usual and customary rate of $350 per hour. My compensation does not depend on the nature of my findings, the presentation of my findings in testimony, or the outcome of this proceeding. I have no financial interest in Petitioner or Patent Owner.

A. Qualifications and Experience

4. I earned my Ph.D. in paper physics from the State University of New York, College of Environmental Science and Forestry, in 1996. I also received a B.S. in chemistry from Syracuse University in 1980.

5. I am currently a Professor in the Department of Chemical, Paper, and Biomedical Engineering at Miami University in Oxford, Ohio, a position I have held

since 2016. Prior to that, I served as an Associate Professor in the same department from 2006 to 2016.

6. Before joining Miami University, I was an Associate Professor in the Faculty of Paper Science and Engineering at the State University of New York, College of Environmental Science and Forestry ("SUNY-ESF") in Syracuse, New York from 2001 to 2006. I was an Assistant Professor in the same department from 1996 to 2001.

7. From 1990 to 1996, I was a Lecturer and Research Support Specialist in the Empire State Paper Research Institute ("ESPRI") at SUNY-ESF.

8. From October 2013 to February 2014, I took a sabbatical as a Fulbright Scholar, serving as a Visiting Professor lecturing and conducting research at the Institute for Paper, Pulp, and Fibre Technology at Graz University of Technology in Graz, Austria.

9. As a professor, I have taught introductory and upper division courses that discuss differences in fiber sources, including non-wood fibers, for use in papermaking. For example, at Miami University, I have taught "Principles of Pulp and Paper Science," "Paper Properties," "Pulp and Paper Chemistry," "Papermaking," and "Paper Coating" courses, which cover the material science of paper, including structural aspects, standard testing methods, wet end chemistry, pulping methods, and stock preparation, amongst other topics. In these courses, I

have used examples of bamboo, bagasse and kenaf as non-wood fibers used in tissue manufacture. I have also taught how fiber geometry and ultrastructure, and pulping and refining conditioning determine end use paper characteristics.

10. My research interests include paper physics, paper chemistry, surface chemistry, and materials science. In particular, my research has focused on providing a deeper understanding of the meso-scale three-dimensional structure that results from fiber furnish, the forming processes, Yankee and TAD drying strategies, creping, embossing and ply-assembly, and how that resultant three-dimensional structure impacts the end use properties.

11. I have over 32 peer-reviewed publications and 39 refereed proceedings on paper-related topics. My published research includes studies of paper thickness and density using profilometry, tissue and towel structural properties, and softness characterization. I authored a chapter focusing on softness in the book "Make Paper Products Stand Out" (2020), and a chapter on "Paper" for The World Book Encyclopedia (2000). I am also a named contributor to the "Handbook of Physical Testing of Paper" (2002).

12. I have received several awards, including a Fulbright Visiting U.S. Scholar grant, the 2017 TAPPI Paper and Board Division Technical Award and Harris O. Ware Prize, and multiple best paper or presentation awards from the Technical Association of Pulp and Paper Industry ("TAPPI").

13. I am a member of several professional societies, including the American Chemical Society, Sigma Xi (the Scientific Research Honor Society), and the International Association of Scientific Papermakers.

14. I have previously been retained as an expert witness in patent litigation involving tissue products. Specifically, I was retained by Irving Consumer Products in *First Quality Tissue, LLC v. Irving Consumer Products Limited*, C.A. No. 19-428-RGA (D. Del.), where I provided expert testimony on tissue papermaking and assessing the softness and other characteristics of tissue products.

15. Additional information regarding my background, qualifications, and publications is included in my *curriculum vitae*, which is attached as EX1004.

B. Materials Considered

16. In forming my opinions, I reviewed the following documents, in addition to others I have cited in my declaration. I also relied on my own knowledge of and experience in the field of papermaking and considered the viewpoint of a person of ordinary skill in the art at the time of the earliest claimed priority date of the ’475 Patent, i.e., April 8, 2022.

Ex. No.	Description
1001	U.S. Patent No. 12,516,475 B2 to Young et al. (the “’475 Patent”)
1002	File History of U.S. Patent No. 12,516,475 B2 to Young et al.
1003	Declaration of Dr. Steven Keller

1004	*Curriculum Vitae* of Dr. Steven Keller
1005	U.S. Patent No. 12,534,855 B2 to Young et al.
1006	Khan, M.U., A. Rehman, M.A. Khan, A.R. Khan, S. Ali and Z. Ahmad. 2024. *Utilization of non-wood fibers as raw materials for pulp and paper production in Pakistan: A review.* Pakistan Journal of Forestry, 74(2): 53-62.
1007	Söderberg & Lucisano, *Aq-vanes: a new technology for stratified forming*, ATIP. Association Technique de L'Industrie Papetiere 58(6):17-19 (2004).
1008	de Assis, T., Reisinger, L. W., Pal, L., Pawlak, J., Jameel, H., and Gonzalez, R. W. (2018). *Understanding the effect of machine technology and cellulosic fibers on tissue properties – A Review*, BioRes. 13(2), 4593-4629.
1009	Han, J.S. (1998) *Properties of Nonwood Fibers*. In: Proceedings of the Korean Society of Wood Science and Technology Annual Meeting, The Korean Society of Science and Technology, Seoul, 3-12.
1010	*The TSA – Tissue Softness Analyzer*, TissueMAG, May 2017, 194-197.
1011	Wang, Y., De Assis, T., Zambrano, F., Pal, L., Venditti, R., Dasmohapatra, S., Pawlak, J., and Gonzalez, R. (2019). *Relationship between human perception of softness and instrument measurements*, BioRes. 14(1), 780-795.
1012	Dhamodaran, T.K., Gnanaharan, R., Pillai, K.S., *Bamboos: Distribution, Utilization, Storage and Economics, in* BAMBOO FOR PULP AND PAPER: A STATE OF THE ART REVIEW WITH ANNOTATED BIBLIOGRAPHY, Kerala Forest Research Institute (March 2003)
1013	de Assis, T., Pawlak, J., Pal, L., Jameel, H., Venditti, R., Reisinger, L. W., Kavalew, D., and Gonzalez, R. W. (2019). *Comparison of wood and non-wood market pulps for tissue paper application*, *BioRes.* 14(3), 6781-6810

1014	Pawlak, J. J., Frazier, R., Vera, R. E., Wang, Y., and Gonzalez, R. (2022). *Review: The softness of hygiene tissue, BioResources* 17(2), 3509-3550.
1015	Pydimalla, Madhuri & Kamma, Rithusha & Mamidala, Akanksh. (2022). *A Review on Morphological, Chemical and Structural Properties of Wood and Non-wood Fiber Species*. La Pensée. 51. 229-239.

II. SUMMARY OF GROUNDS AND OPINIONS

17. I have been asked to consider and provide my opinions on certain topics related to the ’475 Patent, including: (1) The level of a person of ordinary skill in the art (POSITA) at the time of the alleged invention described in the claims of the ’475 Patent; (2) whether there is sufficient written description to demonstrate possession of the invention claimed in the ’475 Patent; and (3) whether the claims of the ’475 Patent are enabled to their full scope.

18. In forming my opinions, I considered the documents listed in Section I.B.

19. My opinions are based upon my education, training, and experience in the discipline of papermaking and fiber characterization as well as the documents I considered.

20. As I discuss in more detail below, it is my opinion that (1) claims 1, 3, 4, 9, 10-14, 15, 17, 18, 23, and 24-28 of the ’475 Patent lack sufficient written

description; and (2) claims 1, 3, 4, 9, 10-14, 15, 17, 18, 23, and 24-28 of the '475 Patent are not enabled.

21. This declaration summarizes the opinions I have formed to date. I reserve the right to modify my opinions, if necessary, based on further review and analysis of information that I receive subsequent to the filing of this declaration, including in response to positions taken by Patent Owner or its expert that I have not yet seen.

III. RELEVANT LEGAL STANDARDS

22. I am not an attorney, and I do not offer legal opinions. However, I have been informed of the relevant legal standards that apply to the issues addressed in this declaration, and I have applied those standards in forming my technical opinions.

A. Level of Ordinary Skill in the Art

23. When interpreting and analyzing a patent, I understand that it is important to identify the relevant art pertaining to that patent, as well as the level of ordinary skill in that art at the time of the claimed invention. The "art" is the field of technology to which the patent is related.

24. I am informed and understand that the person of ordinary skill in the art ("POSITA") is a hypothetical person who is presumed to know the relevant prior art, common general knowledge, conventional techniques, and the applicable

scientific and engineering principles of the pertinent field. I understand that the actual inventor's skill is not determinative of the level of ordinary skill. I further understand that factors that may be considered in determining level of skill include: (i) the types of problems encountered in the art; (ii) prior art solutions to those problems; (iii) the rapidity with which innovations are made; (iv) the sophistication of the technology; and (v) the educational level of active workers in the field. I understand that not all such factors may be present in every case, and one or more of them may predominate.

25. I understand that a POSITA is one who is presumed to be aware of all pertinent art, thinks along conventional wisdom in the art, and is a person of ordinary creativity.

26. It is my opinion that a person of ordinary skill in the art relevant to the '475 Patent would have at least at least a Bachelor of Science degree in paper science and engineering, materials science, chemistry, chemical engineering, or an equivalent degree, plus at least two years of academic or industry experience in papermaking, fiber characterization, or related fields involving alternative or non-wood fibers. Additional relevant experience could substitute for formal education, and vice versa.

27. I held such qualifications well before the earliest priority date of the '475 Patent, and I have taught and worked with many individuals at this level of skill

throughout my career. All my opinions in this declaration are offered from the perspective of such a person of ordinary skill in the art at the time of the alleged inventions. I note that my opinions set forth herein would not change if a slightly different definition of a POSITA were used.

B. Written Description

28. I understand that a patent specification must contain a written description of the invention sufficient to demonstrate that the inventor had possession of the claimed subject matter as of the filing date. The test for written description requires an objective inquiry into the four corners of the specification from the perspective of a person of ordinary skill in the art. A description that merely renders the invention obvious does not satisfy the written description requirement.

29. I understand that where a claim defines a genus, the specification must describe a representative number of species falling within the scope of the genus, or describe structural features common to the members of the genus, so that one of skill in the art can visualize or recognize the members of the genus.

30. I understand that a patent specification that merely draws a fence around the outer limits of a purported genus, without describing the species within that genus or common structural features, does not satisfy the written description requirement. Similarly, a specification that leaves to others the task of exploring the

unknown contours of the claimed genus does not demonstrate the requisite possession.

C. Enablement

31. I understand that the written description requirement is separate and distinct from the enablement requirement.

32. I understand that a patent specification must enable a person of ordinary skill in the art to make and use the full scope of the claimed invention without undue experimentation. If a patent claims an entire class of compositions of matter, the specification must enable a person skilled in the art to make and use the entire class.

33. I understand that claims are not enabled when, at the effective filing date of the patent, one of ordinary skill in the art could not practice the full scope of the claims without "undue" experimentation. A specification that provides only a 'research assignment'—requiring the skilled artisan to engage in trial-and-error experimentation to determine whether and how the claimed invention can be practiced—does not satisfy the enablement requirement.

34. I understand that the following factors, known as the Wands factors, are relevant to determining whether experimentation is undue: (1) the scope of the claimed invention; (2) whether the patent discloses specific working examples; (3) the amount of guidance presented; (4) the nature and predictability of the field; (5)

the quantity of experimentation necessary; (6) how routine any necessary experimentation is; and (7) the level of ordinary skill in the art.

35. I understand that it is the specification, not the knowledge of one skilled in the art, that must supply the novel aspects of an invention in order to constitute adequate enablement. The more one claims, the more one must enable.

IV. TECHNOLOGY BACKGROUND AND STATE OF THE ART

A. The Sanitary Tissue Papermaking Process

36. Manufacturing sanitary tissue products is a complex, multi-stage process where modifications to any of the many variables at each stage can have a substantial impact on the properties of the resulting tissue product, including its softness.

37. There are three main stages of the tissue manufacturing process: (1) fiber selection and stock preparation; (2) forming, pressing, and drying; and (3) converting.

38. The very first step of any papermaking process is the selection of (i) what fibers to use and (ii) what process to use to prepare those fibers to make them suitable for use in a particular application (here, a sanitary tissue product). Determining how to properly prepare these fibers is not a trivial matter.

39. As an initial note, fibers from even the same species of plant can have markedly different properties based on the geographic region where the plant was

grown. Thus, selecting a fiber for use in a sanitary tissue product involves not only selecting ***what*** plant source and specific species of said plant to harvest fibers from, but also taking into consideration ***where*** the plant was grown and the resultant differences in fiber properties.[1]

40. Any raw material, whether from wood sources like eucalyptus trees, non-wood sources like bamboo, or others, must be broken into individual fibers in a process called "pulping." There are a variety of methods of pulping which broadly fall into three categories: (1) chemical pulping, (2) mechanical pulping, and (3) semi-mechanical pulping.

41. Examples of just some of the many pulping methods include: alkaline pulping, caustic soda pulping, kraft pulping, NACO pulping, sulfite pulping, neutral sulfite pulping, alkaline sulfite pulping, organosolv pulping, and ethanol pulping. This is by no means an exhaustive list of pulping methods—the full spectrum of pulping methods is quite vast and new techniques and methods must often be developed for novel fiber types.

[1] EX1006, 3 ("An additional difficulty associated with non-wood plant materials is that their chemical composition and morphology are subject to vary with harvesting seasons due to factors including harvesting or cutting time, geographical place and plant breeding[.]").

42. As demonstrated by the multitude of methods of pulping, there is a corresponding multitude of variables that can be adjusted to achieve certain pulp characteristics with specific fibers. Optimizing these variables for a given fiber and application can require extensive experimentation.

43. Once pulped, the fibers are either "never-dried" or are dried into bales or sheets, referred to as "once-dried" fibers. As the '475 Patent acknowledges, "[a]lthough never-dried and once-dried fibers are chemically similar, they differ greatly in their physical properties."[2] For example, the '475 Patent explains:

> Never-dried fiber walls contain much more water per unit dry mass than those of dried fibers after reslushing. Being more swollen, the never-dried walls are more flexible or conformable. In contrast, the walls of once-dried (and rewetted or reslushed or repulped) fibers are stiff (compared to never-dried fibers). Significant changes in the papermaking properties of fibers occur with water removal as the walls become progressively more rigid and less conformable.[3]

44. Never-dried fibers remain in a slurry and typically can be fed directly into the papermaking stock, whereas the bales or sheets of once-dried fibers, referred to as pulp lap, must be repulped into aqueous slurries. At the slurry stage, additional processing is commonly performed to ensure that the stock is uniformly dispersed, de-aerated, and fibrillated in a step known as the approach system. Process and

[2] EX1001, 17:48-50.

[3] EX1001, 17:50-58.

functional additives are added throughout the approach to the paper machine using chemicals controlling what is generally referred to as "wet end chemistry."

45. Wet end chemistry can involve the addition of chemical strength additives such as permanent wet-strength resins (e.g., polyamide-epichlorohydrin (PAE) resins such as Kymene™ 5221), temporary wet-strength additives (e.g., modified glyoxalated polyacrylamides (GPAM) such as Fennorez™ 91). and dry strength agents (e.g., carboxy methyl cellulose), defoamers, debonders, and several other chemicals used to optimize the fibers for their intended use.

46. In stock preparation of the approach system, the fibers can be further conditioned in a process known as "refining." Refining entails applying compression and shearing forces in order to fibrillate and delaminate the cell wall. This results in modifications to fiber characteristics and develops fiber-fiber bonding for improved strength and fiber flexibility. The amount of refining performed is based on the intended final product, as while additional refining may result in more strength, it tends to negatively impact softness.

47. As the '475 Patent itself acknowledges, "In order to maintain the correct ratios of strength, softness, and flexibility, the substrate developer will vary chemistry inclusion, fiber composition by layers, and refining of the wood pulp.

Choices in any of these variables (and more) will affect the resultant substrate characteristics, making the substrate more or less consumer desirable."[4]

48. Thus, each fiber pulp will have unique characteristics, depending on the fiber's original properties (e.g., plant species source, geographic growing location, etc.) and modifications that are introduced by the pulping and refining processes.

49. Once the desired characteristics for the fiber slurry have been achieved, the actual forming of the tissue can begin. There are a variety of papermaking methods, which are distinguished by different machines, machine configurations, and manufacturing steps taken or not taken in the papermaking process.

50. For sanitary tissue products, the first step in forming the tissue product is feeding the slurry to an "approach system" that de-flocculates and dilutes the fibers prior to the slurry or combination of slurries being fed into the "headbox" of a papermaking machine. The purpose of a headbox is to disperse the slurry or "furnish" in a "jet" onto the forming fabric or "wire" to begin the dewatering process (i.e., water is removed from the web) and produce a nascent fibrous web.[5]

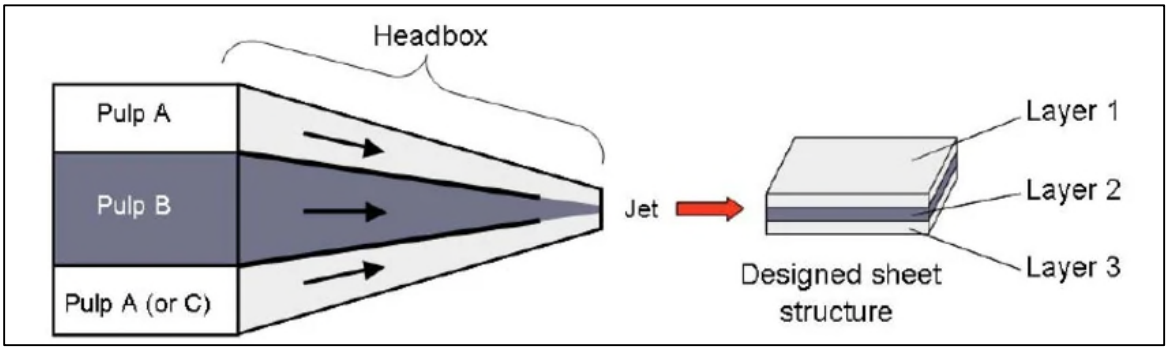
51. Headboxes can be single- or multi-layered. A multi-layer headbox has multiple chambers from which separate streams of furnish can be deposited onto the

[4] EX1001, 16:64-17:2.

[5] EX1001, 12:19-23, 12:45-48, 14:55-58.

wire, thereby resulting in separate layers of furnish being formed.[6] A single chambered headbox merely dispenses a single jet of a single furnish onto the wire.

52. A schematic of a multi-layered headbox and the intended resulting layered product is provided below:[7]

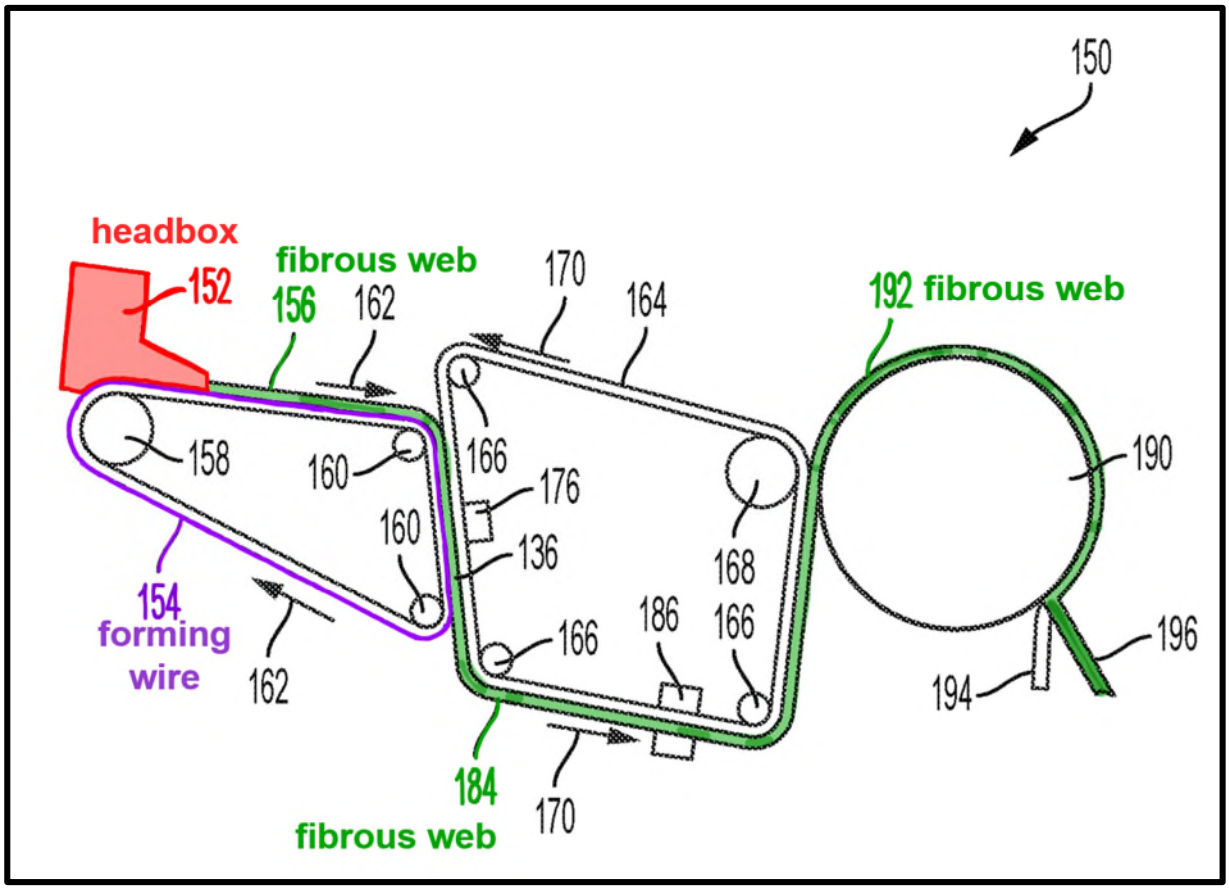


53. As the ’475 Patent explains and depicts in Figure 6A, “[f]rom the headbox **152**, the aqueous dispersion of fibers can be delivered to a foraminous member **154**, which can be a Fourdrinier wire, to produce an embryonic fibrous web **156**.”[8] In the annotated figure from the ’475 Patent below, I have colored the headbox red, the forming wire purple, and the nascent web in green:

[6] EX1001, 29:16-18.

[7] EX1007, 2 (Fig. 1).

[8] EX1001, 12:45-48, Fig. 6A.



EX1001, Fig. 6A (annotated and cropped).

54. The relative speed of the jet coming out of the headbox and the speed of the wire upon which the jet is dispersed onto (which the '475 Patent refers to as the "jet-to-wire ratio") impacts the fiber orientation, tensile ratio, and formation of the tissue web.[9] As the '475 Patent acknowledges, "the relationships between

[9] EX1001, 14:55-15:15.

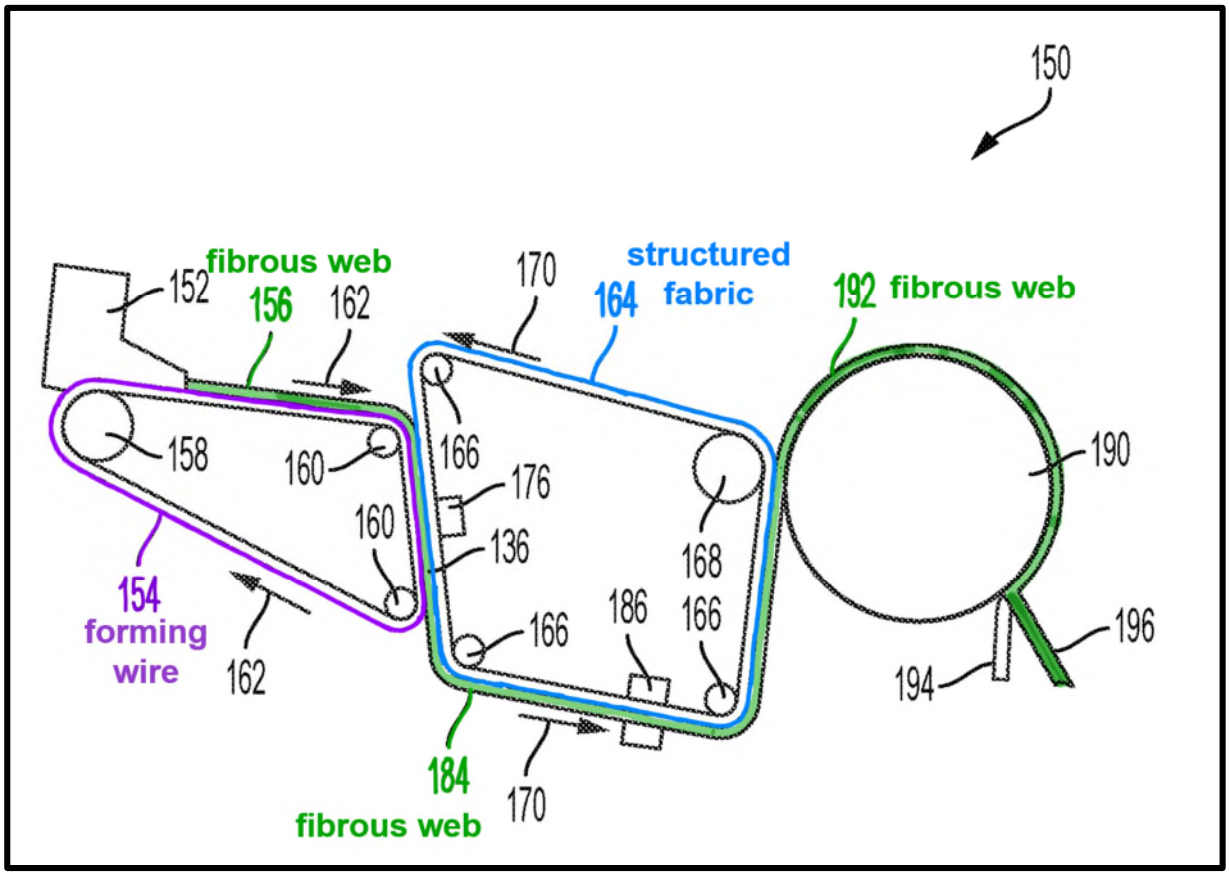
jet/wire, tensile ratio, and formation are different for non-wood fibers than they are for wood fibers."[10]

55. At this point, there are multiple different papermaking processes and machine configurations that can be used to form the tissue product, though they all share the next few basic steps.

56. Once the web is formed, it is transferred from the forming wire to a papermaking belt and/or additional structured fabrics, which can impart additional three-dimensional structure to the web. On the belt, the web can be deflected, rearranged, and/or further dewatered.[11] In the annotated figure from the '475 Patent below, I have colored the forming wire in purple, the fibrous web in green, and the structured fabric in blue:

[10] EX1001, 15:27-31.

[11] EX1001, 12:63-13:20



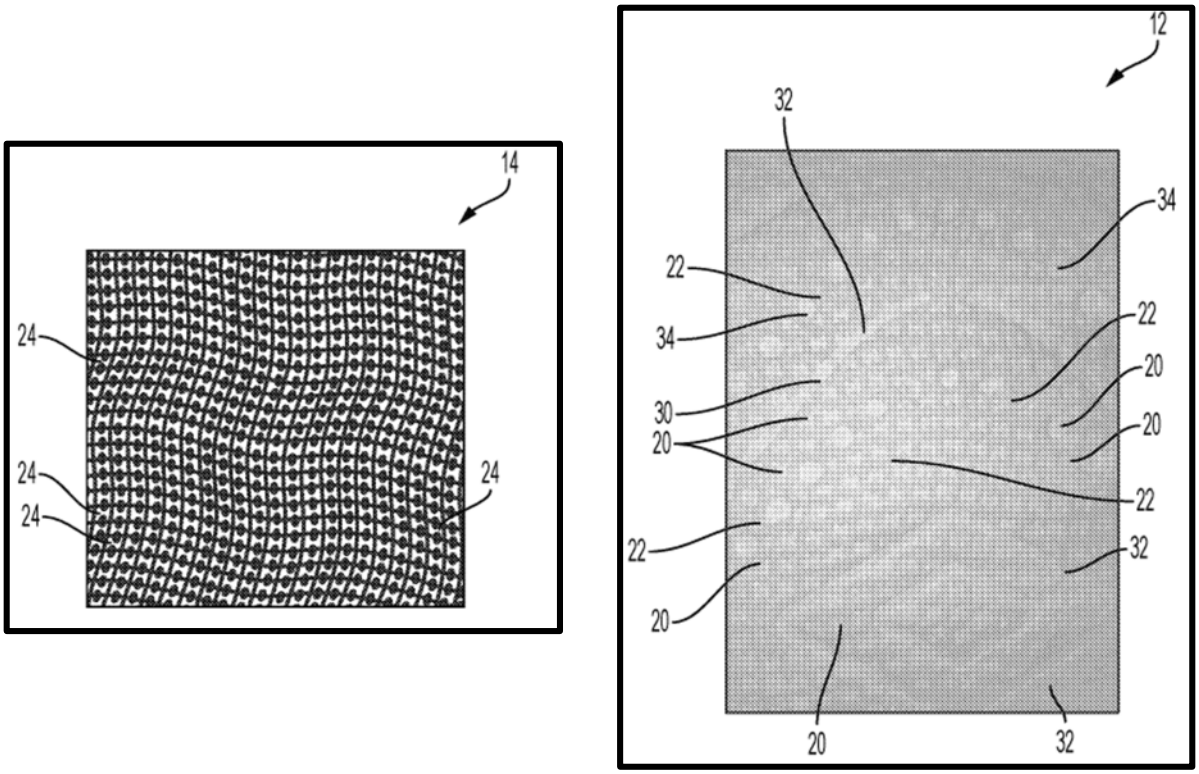
EX1001, Fig. 6A (annotated and cropped).

57. For example, the web may be pressed onto the structured fabric in order to create zones of differential density.[12] These regions of differential density, as the '475 Patent explains, can "contribute to the softness of the fibrous structures."[13] An

[12] EX1001, 16:42-46.

[13] EX1001, 22:54-57

example of these structured fabrics is provided in Figure 5, and the resulting areas of differential density in the final tissue product are depicted in Figure 3A:[14]

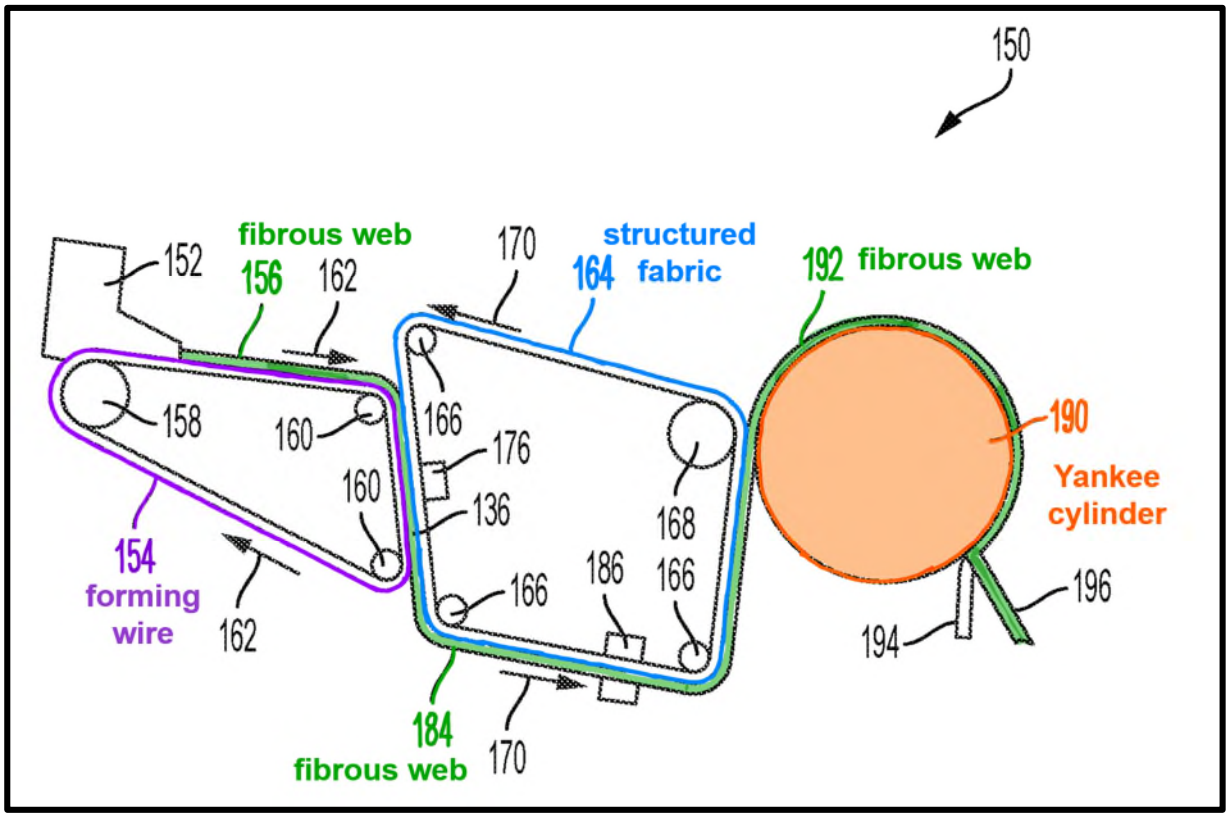


EX1001, Fig. 5 and Fig. 3A (cropped).

[14] EX1001, 22:65-23:6 ("FIG. **5** shows a portion of the pattern on the mask **14** used to make a papermaking belt (not particularly shown, but of the type shown in FIG. **17**) that is capable of making the sanitary tissue **12** shown in FIG. **3**A. The sanitary tissue **12** of FIG. **3**A exhibits a pattern of knuckles **20** and pillows **22** that were formed by discrete cured resin knuckles **20** on a papermaking belt, and which correspond to the white areas, i.e., the cells **24**, of the mask **14** shown in FIG. **5**.")

58. While on the structured fabric, the web will be further dewatered and dried.[15] This can be accomplished by a machine part known as a through-air-drying ("TAD") cylinder, which blows hot air through the tissue web as it is supported by the structured fabric. Further drying may be carried out by transferring the web from the structured fabric to a part known as a Yankee cylinder, which is a steam-heated rotating metal drum. In the annotated figure from the '475 Patent below, I have colored the Yankee cylinder in orange, the fibrous web in green, the structured fabric in blue, and the forming wire in purple:

[15] EX1001, 13:7-9 ("While in contact with the papermaking belt 164, the embryonic fibrous web 156 can be deflected, rearranged, and/or further dewatered.")

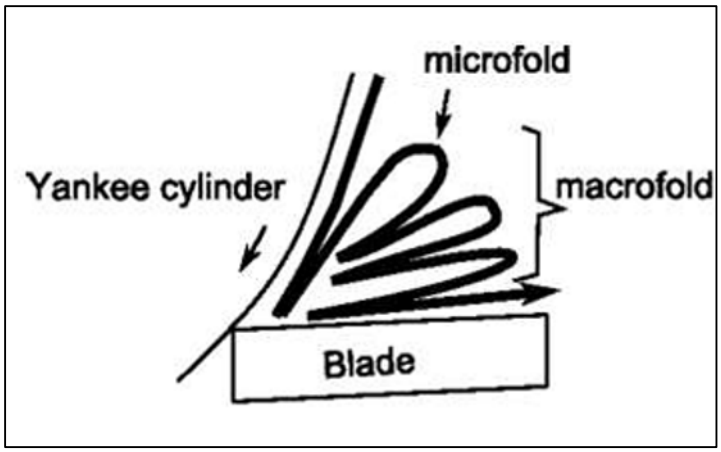


EX1001, Fig. 6A (annotated and cropped).

59. When using a Yankee cylinder in the papermaking process, the web is typically scraped off of the cylinder by a "creping blade" in a process called "creping."[16] As the '475 Patent explains, "creping refers to the reduction in length of a dry (having a consistency of at least about 90% and/or at least about 95%) fibrous web which occurs when energy is applied to the dry fibrous web in such a way that the length of the fibrous web is reduced and the fibers in the fibrous web

[16] EX1001, 13:43-47.

are rearranged with an accompanying disruption of fiber-fiber bonds."[17] Typically, a "creping adhesive" is applied to the Yankee cylinder to temporarily bond the still wet web to the surface of the cylinder, which allows the creping blade to cleanly scrape the dried web off the cylinder.[18] Creped products are generally associated with soft and bulky tissue products.[19] I have provided a depiction of the result of creping below:[20]



[17] EX1001, 13:47-53.

[18] *See, e.g.*, EX1001, 54:55-58, 57:8-17, 58:11-14.

[19] EX1008, 10 ("The creping process softens the paper by improving the bulk softness when fibers bonds are broken and sheet extensibility is improved. Creping can also increase the surface smoothness.").

[20] EX1008, 12 (Fig. 2 (cropped)).

60. As I noted, there are a variety of papermaking processes and machine configurations. The ’475 Patent recites multiple processes, including fabric crepe, creped through-air-drying (“CTAD”), TAD, un-creped through-air drying (“UCTAD”), NTT, QRT, and ATMOS.[21] The exact process used and the different conditions and parameters for each process, including the drying type and temperature, creping, and fabrics used, all influence the characteristics of the final tissue product, including its softness, bulk, and strength.

61. After the tissue web is formed and dried, it is wound into a parent roll that will go through additional post-papermaking manipulations called “converting” to form the final tissue product. Converting processes may include: adding additional structural features through a process called “embossing,”[22] putting the paper web through a process called “calendering”[23] where the web is passed through a calender machine (which is a series of heavy pressure rollers), applying surface softeners, bonding together single ply tissue webs to create multi-ply tissue products, and ultimately rewinding the product onto a core and cutting into consumer sized

[21] EX1001, 9:61-11:16, 16:46-48.

[22] EX1001, 8:13-20, 10:66-11:4, 11:19-31.

[23] EX1001, 13:55-59.

rolls. In short, the converting process is where the tissue web is converted to a final sanitary tissue product and each of the converting processes I have described can impact the final product's softness, strength, bulk, and surface texture.

62. Given the multitude of variables at issue in papermaking, developing new sanitary tissue products requires an extensive amount of time to dial in on the right combination of fiber furnish, stock preparation, wet end chemistry, manufacturing configuration, including specific forming conditions, and converting processes to achieve a product with desired features. Moreover, the cost of papermaking machinery and volume of materials needed to manufacture sanitary tissue products (even at pilot, rather than commercial, scale) is significant. Put simply, it is no small feat to develop a sanitary tissue product, particularly when using a novel fiber type.

B. Non-Wood Fibers in Papermaking

63. The art recognizes that "[t]he observed properties of commercial tissue products are basically a function of fibers, chemistry, and manufacturing technology."[24] Along with the chemistry and manufacturing process choices I discussed above, the selection of what fiber or fibers to use in a tissue product significantly impacts the properties of the final product.

[24] EX1008, 1.

64. Historically, wood fibers have been the most common fiber used in paper and tissue making and most tissue products use a mix of hardwood fibers (which tend to be shorter and impart softness) and softwood fibers (which tend to be longer and impart strength).

65. As the ’475 Patent explains, traditional wood fibers are “coming under increasing environmental pressure.”[25] Thus, interest in alternative fibers, and particularly non-wood fibers for paper making has grown as the world’s timber supply has declined in recent years.

66. It is well known in the art that “[non-wood] fibers have tremendous variations in chemical and physical properties as compared to wood fiber.”[26] In general, non-wood fibers differ greatly from wood fibers in their morphology, including their coarseness, length, width, wall thickness, and chemical composition—all of which can impact the flexibility and bonding behavior of the fibers which in turn has an impact on the features of products which incorporate these fibers, including softness.[27]

[25] EX1001, 46:50-52, 47:19-20, 47:53-54, 48:19-20, 49:22-23.

[26] EX1009, 1, 9.

[27] EX1001, 8:49-64.

67. It is not just that non-wood fibers differ from wood fibers—non-wood fibers encompass a wide array of different plants and origins of fibers that differ greatly from one another. As the '475 Patent explains, non-wood fibers can be any "naturally-occurring fibers derived from non-wood plants, including animal fibers, mineral fibers, plant fibers and mixtures thereof, and specifically excluding non-naturally-occurring fibers (e.g., synthetic fibers)."[28] In another patent that I understand is assigned to Patent Owner and was filed on the same day as the '475 Patent, Patent Owner highlighted the challenges of working with non-wood fibers given their wide variety:

> Particularly, fiber morphology characteristics such as length, cell wall thickness, width, kink, curl, fibrillation, and other characteristics ***can vary significantly from non-wood to non-wood***, as well as compared to wood pulps. It is, therefore, a current problem to develop sanitary tissue products having desired characteristics when utilizing non-wood fibers that have much different (versus wood pulps) morphologies that often compromise sanitary tissue product performance.[29]

68. Ultimately, non-wood fibers, such as abaca and bamboo, have varying morphological characteristics and those characteristics directly affect their behavior during the papermaking process and the final tissue product incorporating them.

[28] EX1001, 24:14-19.

[29] EX1005 (U.S. Patent No. 12,534,855), 1:52-62 (emphasis added).

69. There are various challenges to working with non-wood fibers in papermaking. For example, the ’475 Patent recognizes that the papermaking process is “easier to run” when the “Yankee contacting layer” (i.e., the layer/side of the web that comes in contact with a Yankee cylinder) has “lower or no non-wood fibers contacting the surface” because “the non-wood fibers have less interaction with the complex chemical and physical interactions with the glue coating and creping process.”[30]

70. Thus, as the ’475 Patent admits, “incorporation of non-woods into sanitary tissue products is a real challenge, even for experienced papermakers.”[31]

C. Measuring and Assessing Softness of Sanitary Tissue Products

71. As the ’475 Patent notes, “[o]f particular interest is the softness of sanitary tissue products.”[32]

72. As softness of tissue products is typically a subjective metric, it is often assessed through “panel testing,” where a group of panelists are provided with samples of products and are asked to rate or compare the different samples for softness.

[30] EX1001, 44:50-62.

[31] EX1001, 1:29-31.

[32] EX1001, 1:25-26.

73. The "human hand feeling" of softness is determined by three basic parameters: "the real softness, which comes from the fiber stiffness; the roughness, which comes from the surface profile of the sample; and the stiffness, which is determined by the fiber behavior, the production technology and chemicals."[33]

74. The Emtec Tissue Softness Analyzer (TSA) claims to provide an objective measurement of surface softness of tissue products. The Emtec instrument "a rotor with vertical blades which rotate on the test sample at a defined and calibrated rotational speed (set by manufacturer) and contact force of 100 mN."[34] A microphone measures the sound created by the contact between vertical blades and the tissue sample and Emtec TSA software analyzes the sound recording.[35] I refer to softness measures by an Emtec TSA instrument as "acoustic softness."

75. There are two main acoustic softness measurements provided by an Emtec TSA instrument—TS7 and TS750. TS7 values are supposed to correlate with the true "real softness" of material, and TS750 values are supposed to correlate with

[33] EX1010, 5-6.

[34] EX1001, 82:60-63.

[35] EX1001, 82:63-67.

the "roughness" or the overall surface texture of the material.[36, 37] Based on the noise produced by the blade contacting the surface of the tissue, these metrics essentially measure the micro- and macro-surface variations that contribute to how soft a material would feel to a user.

76. Both of these values are measured in units of dB V^2 rms. A lower TS7 value generally corresponds to a softer tissue, while a lower TS750 value generally corresponds to a smoother tissue.

77. Both TS7 and TS750 values are surface-specific, meaning that the measured value depends on features of the surface of the tissue sample being tested. It is known in the art that a tissue's TS7 value is impacted by the fiber stiffness and orientation of the fibers at the surface, which means that the specific fiber furnish and how the furnish was pulped and refined can influence the resulting TS7 value.[38]

[36] EX1010, 6; *see also* EX1001, 82:58-60.

[37] The third parameter that contributes to the hand feel of softness, stiffness, is measured by a separate, deformation based measurement that is not at issue here. *See* EX1010, 6.

[38] EX1011, 4.

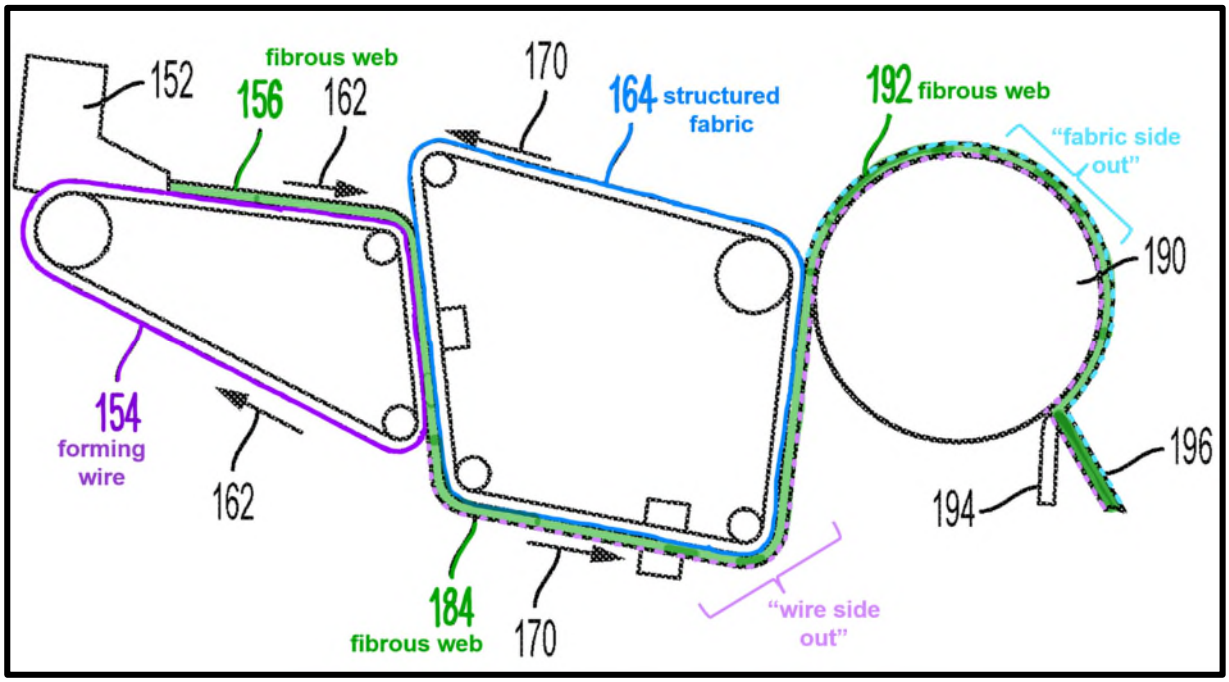
As for TS750 values, it is known in the art that the surface roughness and surface's features (like embossing or creping) can impact the resulting TS750 value.[39]

78. Accordingly, which side of the tissue sample is tested can impact the resulting TS7 and TS750 values because each side may have different surface textures and properties.

79. In tissue making, the two "sides" of a tissue web are the fabric-side-out ("FSO"), which is the side that touches the structured fabrics, and the wire-side out ("WSO"), which is the side that touches the forming wire.[40] I have depicted these two sides in an annotated version of Figure 6A from the '475 Patent. Below, after the web transfers from the forming wire to the structured fabric, I have marked the "wire side out" with light purple dashes and, after the web transfers from the structured fabric to the Yankee cylinder, I have marked the "fabric side out" with light blue dashes:

[39] EX1011, 4.

[40] EX1001, 23:19-29.



EX1001, Fig. 6A (altered and annotated).

80. As the ’475 Patent acknowledges, if certain structural features are introduced with the structured fabrics, which side of the tissue web is on the outer surface can impact TS7 values:

> [T]he relevance of whether the consumer-facing side of the fibrous structure is wire side (WSO) or is fabric side (FSO) is whether a flatter surface (non-pillow-facing-outward surface) is desired, or whether a pillow-facing-outward surface is desired. When pillows face outwardly, TS7 values decrease (versus when knuckles are on the consumer-facing surface).[41]

81. Accordingly, the ’475 Patent states that TS7 and TS750 testing should be “performed individually on the top surface (outer facing surface of a rolled

[41] EX1001, 23:30-36.

product) … and on the bottom surface (inner facing surface of a rolled product)."[42] Therefore, in the '475 Patent "the reported values for TS7 and TS750 will be the overall average of the eight test values from the top and bottom surfaces," thus taking into account the surface dependent nature of TS7 and TS750 measurements.[43]

82. As explained above, TS7 and TS750 values, therefore, are not intrinsic properties of the fiber furnish alone. Instead, TS7 and TS750 values reflect the composite result of what (i) fibers make up the product, (ii) how those fibers are prepared, (iii) structural features introduced to the sheet during forming, (iv) structuring, such as through contact with the fabrics and Yankee cylinder (iv) what converting processes are applied to the product, and (v) even just which side or orientation of the product is tested.

V. THE '475 PATENT

83. The '475 Patent is titled "Soft Sanitary Tissue Products Comprising Non-Wood Fibers" and is related to "[s]anitary tissue products having non-wood fibers selected from the group consisting of bamboo, abaca, and mixtures thereof

[42] EX1001, 83:34-38.

[43] EX1001, 83:48-51; *see also id.*, 83:39-48.

and exhibiting a TS7 of less than about 14 dB V^2 rms and/or a TS750 less than about 45 dB V^2 rms."[44]

84. The '475 Patent laments that "[t]he art does not disclose how to achieve soft fibrous structures comprising bamboo, abaca, or other sustainable non-wood fibers; incorporation of non-woods into sanitary tissue products is a real challenge, even for experienced papermakers."[45] According to the inventors, softness is "where so many sustainable sanitary tissue products comprising non-woods fail."[46]

85. The inventors claim to have "found that adding coarse bamboo fibers (bamboo is especially coarse versus eucalyptus) into the fibrous structure, even at high inclusion levels, and/or even disposed at a consumer-facing side of a sheet, can result in sanitary tissue products with good softness, even with premium softness."[47]

86. In particular, the '475 Patent claims to have solved these softness problems by achieving particular softness thresholds, quantified as TS7 values of less than about 14 dB V^2 rms and TS750 values of less than about 45 dB V^2 rms, in

[44] EX1001, Title & Abstract.

[45] EX1001, 1:27-31.

[46] EX1001, 1:26-27.

[47] EX1001, 1:32-38.

multi-layer tissue products wherein each layer must include between about 5% to about 100% by weight of bamboo, abaca, or combinations of the two fibers.[48]

A. The Specification

1. The '475 Patent's Disclosures Regarding Bamboo

87. According to the '475 Patent, "the 'bamboo,' 'bamboo fibers,' 'bamboo content,' or 'bamboo fiber content' incorporated into fibrous structure(s) of the present disclosure are fibrous materials derived from any bamboo species."[49] The specification goes on to provide nearly fifty exemplary bamboo species,[50] however, there are well over a thousand recognized bamboo species.[51]

88. Moreover, the '475 Patent states that "it is to be understood that the compositions disclosed herein, unless otherwise stated, are not limited to containing any one bamboo fiber and may comprise a plurality of fibers of different species."[52]

[48] EX1001, claims 1, 9, 15, 23, 2:18-38.

[49] EX1001, 25:20-23.

[50] EX1001, 25:25-40.

[51] EX1012, 8.

[52] EX1001, 25:43-47.

89. The ’475 Patent notes various challenges of using bamboo fibers, including its tendency to flocculate in the headbox,[53] its poor ability to drain and resulting unsuitability in through-air-drying machines,[54] and its general higher coarseness that can impact the softness.[55]

90. Nonetheless, the ’475 Patent claims that bamboo can be more desirable than other non-wood fibers like straw in tissue products due to their longer length and the resulting strength of the tissue product.[56]

91. The ’475 Patent provides 12 examples of bamboo-containing multilayer tissue products with bamboo in every layer[57] that also have measured TS7 values below 14 dB V² rms and TS750 values below 45 dB V² rms,[58] which I have highlighted below:

[53] EX1001, 14:20-25.

[54] EX1001, 15:59-67.

[55] EX1001, 15:34-37, 28:52-62.

[56] EX1001, 26:22-29.

[57] EX1001, Fig. 18A-1.

[58] EX1001, Figs. 21E-1 & 21E-2.

						Fabric Layer			Center Layer			Wire Layer			% of total Sheet			
Substrate	Type	Sample ID	Fractionation	# Unique Layers	Non-wood	EUC	NSK /SW	Non-wood	EUC	NSK /SW	Non-wood	EUC	NSK /SW	Non-wood	EUC	Softwood	Non-wood	FSO/ WSO
Bath tissue	Inventive	1	Accepts to fabric	2	Bamboo	84%	0%	16%	32%	54%	14%	32%	54%	14%	52%	33%	15%	FSO
Bath tissue	Inventive	2	Accepts to fabric	2	Bamboo	69%	0%	31%	32%	39%	29%	32%	39%	29%	46%	24%	30%	FSO
Bath tissue	Inventive	3	Rejects to fabric	2	Bamboo	77%	0%	23%	32%	59%	10%	32%	59%	10%	49%	36%	15%	FSO
Bath tissue	Inventive	4	Rejects to fabric	2	Bamboo	53%	0%	47%	32%	49%	19%	32%	49%	19%	40%	30%	30%	FSO
Bath tissue	Inventive	5	Accepts to C/W, sewer rejects	2	Bamboo	100%	0%	0%	27%	49%	24%	27%	49%	24%	55%	30%	15%	FSO
Bath tissue	Inventive	6	Accepts to C/W, sewer rejects	2	Bamboo	100%	0%	0%	13%	39%	48%	13%	39%	48%	46%	24%	30%	FSO
Bath tissue	Inventive	7	No fractionation	2	Bamboo	100%	0%	0%	27%	49%	24%	27%	49%	24%	55%	30%	15%	FSO
Bath tissue	Inventive	8	No fractionation	2	Bamboo	100%	0%	0%	13%	39%	48%	13%	39%	48%	46%	24%	30%	FSO
Bath tissue	Inventive	15	No fractionation	2	Bamboo	100%	0%	0%	13%	39%	48%	13%	39%	48%	46%	24%	30%	FSO
Bath tissue	Inventive	16	Rejects to fabric	2	Bamboo	53%	0%	47%	32%	49%	19%	32%	49%	19%	40%	30%	30%	FSO
Bath tissue	Inventive	17	Rejects to fabric	2	Bamboo	53%	0%	47%	32%	49%	19%	32%	49%	19%	40%	30%	30%	FSO
Bath tissue	Inventive	18	Rejects to fabric	2	Bamboo	21%	0%	79%	32%	36%	32%	32%	36%	32%	28%	22%	50%	FSO
Bath tissue	Inventive	19	Rejects to fabric	2	Bamboo	0%	0%	100%	0%	0%	100%	0%	0%	100%	0%	0%	100%	FSO
Bath tissue	Inventive	20	Rejects to Wire	2	Bamboo	47%	35%	18%	47%	35%	18%	47%	0%	53%	47%	23%	30%	WSO
Bath tissue	Inventive	21	No frac, C/F only	2	Bamboo	20%	35%	45%	20%	35%	45%	100%	0%	0%	47%	23%	30%	WSO
Bath tissue	Inventive	22	No frac, both layers	2	Bamboo	47%	35%	18%	47%	35%	18%	47%	0%	53%	47%	23%	30%	WSO
Bath tissue	Inventive	23	Rejects to wire	2	Bamboo	0%	0%	100%	0%	0%	100%	0%	0%	100%	0%	0%	100%	WSO

EX1001, Fig. 18A-1 (annotated and cropped).

						Fabric Layer			Center Layer			Wire Layer			% of total Sheet			
Substrate	Type	Sample ID	Fractionation	# Unique Layers	Non-wood	EUC	NSK /SW	Non-wood	EUC	NSK /SW	Non-wood	EUC	NSK /SW	Non-wood	EUC	Softwood	Non-wood	FSO/ WSO
Bath tissue	Inventive	34		2	Abaca	23%	65%	12%	23%	65%	12%	100%	0%	0%	50%	42.5%	7.5%	WSO
Bath tissue	Inventive	35		2	Abaca	23%	54%	23%	23%	54%	23%	100%	0%	0%	50%	35%	15%	WSO
Bath tissue	Inventive	36		2	Abaca	23%	38%	38%	23%	38%	38%	100%	0%	0%	50%	25%	25%	WSO
Bath tissue	Inventive	37		2	Abaca	23%	38%	8%	23%	38%	8%	100%	0%	0%	50%	25%	25%	WSO
Bath tissue	Inventive	38		2	Abaca	23%	0%	77%	23%	0%	77%	100%	0%	0%	50%	0%	50%	WSO
Bath tissue	Inventive	39		2	Abaca	23%	0%	77%	23%	0%	77%	100%	0%	0%	50%	0%	50%	WSO
Bath tissue	Inventive	40		2	Unbleached Bamboo	67%	33%	0%	67%	33%	0%	0%	0%	100%	43%	21%	36%	WSO
Bath tissue	Inventive	41		2	Hemp	67%	33%	0%	67%	33%	0%	0%	0%	100%	44%	22%	34%	WSO
Bath tissue	Inventive	42		2	Bagasse	75%	25%	0%	75%	25%	0%	0%	0%	100%	47%	16%	37%	WSO
Bath tissue	Inventive	43		2	Cotton	67%	33%	0%	67%	33%	0%	0%	0%	100%	34%	17%	49%	WSO
Bath tissue	Inventive	44		3	Bleached Bamboo	0%	0%	100%	0%	100%	0%	0%	0%	100%	0%	11%	89%	WSO
Bath tissue	Inventive	50		2	Bamboo	0%	0%	100%	0%	0%	100%	80%	0%	20%	20%	0%	80%	WSO
Bath tissue	Inventive	51		2	Bamboo	0%	0%	100%	0%	0%	100%	80%	0%	20%	20%	0%	80%	WSO
Bath tissue	Inventive	52		1	Bamboo										0%	0%	100%	WSO
Bath tissue	Inventive	53		1	Bamboo										0%	0%	100%	WSO
Bath tissue	Inventive	54		2	Bamboo	0%	0%	100%	0%	0%	100%	80%	0%	20%	20%	0%	80%	WSO
Bath tissue	Inventive	55		2	Bamboo	0%	0%	100%	0%	0%	100%	80%	0%	20%	20%	0%	80%	WSO

EX1001, Fig. 18B-1 (annotated and cropped).

Sample ID	Stack Compressibility	Resilient Bulk	Stack Compressibility x Resilent Bulk	TS7 Avg	TS750 Avg	Plate Stiffness	Slip Stick CoF Avg	Kinetic CoF Avg	Bulk (cc/g)
1	37.0	50.8	1881	5.2	36.4	1.9	346	0.96	10.6
2	36.0	50.2	1806	5.9	38.9	2.1	353	1.01	10.5
3	40.0	51.5	2063	5.6	37.8	2.1	333	1.02	10.7
4	35.9	49.3	1771	5.9	36.0	2.2	325	0.98	10.3
5	38.5	52.5	2020	5.3	36.8	1.9	387	1.07	10.9
6	38.9	51.3	1997	5.0	35.9	2.1	290	1.00	10.5
7	39.9	52.0	2074	5.3	34.9	2.1	282	0.98	10.5
8	37.2	51.6	1918	5.0	33.5	2.0	301	1.04	10.5
15	33.8	53.0	1792	5.1	31.0	1.8	331	1.00	10.3
16	34.2	51.2	1748	5.7	35.7	1.9	373	0.94	9.9
17	33.8	51.6	1743	5.5	32.5	2.1	388	1.04	10.0
18	33.9	51.4	1742	6.0	31.2	2.0	410	1.03	9.8
19	34.9	50.7	1770	7.9	34.0	2.1	537	1.03	9.9
20	30.3	65.9	1993	9.4	19.4	3.2	404	0.94	12.4
21	30.0	62.0	1859	9.3	26.1	3.1	371	0.90	11.6
22	29.0	63.0	1828	9.6	19.9	3.6	417	0.95	11.6
23	32.1	62.9	2016	9.3	17.6	3.9	491	0.99	11.7

EX1001, Figs. 21E-1 and 21E-2 (annotated and collated).

92. While there are an additional 20 examples of bamboo-containing samples, these samples do not contain bamboo in every layer or are single layered.

93. The ’475 Patent does not appear to identify anything about which species (singular or plural) of bamboo was used in any of these samples.

2. The ’475 Patent’s Disclosures Regarding Abaca

94. Abaca fibers are derived from *Musa textilis*, a species of banana plant, which is also commonly referred to as “manilla hemp.”[59]

95. The ’475 Patent specifically calls out that “[a]baca comprises characteristics that can make it challenging (especially at higher incorporation levels) for incorporating into sanitary tissue products of the present invention as it is better known for being used to produce thin, strong, and porous paper capable of withstanding hard use.”[60]

96. For example, the ’475 Patent reports that “[a]baca may have a fiber coarseness of greater than 16 mg/100 mm (or less than 20 mg/100 mm).”[61] This is much coarser that most traditional hardwood fibers used to impart softness in

[59] EX1001, 26:30-37.

[60] EX1001, 26:43-47.

[61] EX1001, 26:38-42.

sanitary tissue products.[62] Generally, "[l]ower coarseness contributes to improved softness."[63]

97. Moreover, "[f]ibers of higher coarseness" like abaca tend to be "stiff" which results in "surface roughness of the paper."[64]

98. Nonetheless, the '475 Patent asserts that "abaca's length, width, and coarseness make it a more suitable softwood replacement, its higher fibrillation increases specific surface area of the fiber and its carboxyl groups make it better for attaching strength chemistries."[65] Caution must be taken, however, "regarding using abaca for its strength characteristics as described in this paragraph, it is desirable to keep it from collapsing into a tightly bonded, rough, thin network with little variation in pore size." [66]

[62] EX1013, 7-8; EX1001, 48:51-53 ("Hardwood fibers are desirous for improving softness when dry, due to their low coarseness and length.").

[63] EX1014, 32.

[64] EX1015, 6.

[65] EX1001, 27:4-7.

[66] EX1001, 50:5-9.

99. While the '475 Patent provides 22 examples of tissue products comprising abaca,[67] none of these examples are of multi-layer tissue products that contain abaca in every layer. I have annotated the figures below with red highlighting to demonstrate how these samples either (i) do not have abaca in every layer of a multi-layer ply or (ii) do not have multiple layers:

						Fabric Layer			Center Layer			Wire Layer			% of total Sheet			
Substrate	Type	Sample ID	Fractionation	# Unique Layers	Non-wood	EUC	NSK /SW	Non-wood	EUC	NSK /SW	Non-wood	EUC	NSK /SW	Non-wood	EUC	Softwood	Non-wood	FSO/ WSO
Bath tissue	Inventive	24	No fractionation	1	Bamboo										0%	0%	100%	WSO
Bath tissue	Inventive	25		1	Bamboo										0%	0%	100%	WSO
Bath tissue	Inventive	26		1	Bamboo										0%	0%	100%	WSO
Bath tissue	Inventive	27		1	Bamboo										0%	0%	100%	WSO
Bath tissue	Inventive	28		2	Abaca	100%	0%	0%	67%	33%	0%	67%	33%	0%	55%	37%	8.0%	FSO
Bath tissue	Inventive	29		2	Abaca	100%	0%	0%	33%	50%	17%	33%	50%	17%	55%	22.5%	22.5%	FSO
Bath tissue	Inventive	30		2	Abaca	100%	0%	0%	25%	38%	38%	25%	38%	38%	55%	22.5%	22.5%	FSO
Bath tissue	Inventive	31		2	Abaca	100%	0%	0%	25%	0%	75%	25%	0%	75%	55%	0%	45%	FSO
Bath tissue	Inventive	32		2	Abaca	100%	0%	0%	25%	0%	75%	25%	0%	75%	55%	0%	45%	FSO
Bath tissue	Inventive	33		2	Abaca	100%	0%	0%	25%	0%	75%	25%	0%	75%	55%	0%	45%	FSO

EX1001, Fig. 18A-2 (collated and annotated).

						Fabric Layer			Center Layer			Wire Layer			% of total Sheet			
Substrate	Type	Sample ID	Fractionation	# Unique Layers	Non-wood	EUC	NSK /SW	Non-wood	EUC	NSK /SW	Non-wood	EUC	NSK /SW	Non-wood	EUC	Softwood	Non-wood	FSO/ WSO
Bath tissue	Inventive	34		2	Abaca	23%	65%	12%	23%	65%	12%	100%	0%	0%	50%	42.5%	7.5%	WSO
Bath tissue	Inventive	35		2	Abaca	23%	54%	23%	23%	54%	23%	100%	0%	0%	50%	35%	15%	WSO
Bath tissue	Inventive	36		2	Abaca	23%	38%	38%	23%	38%	38%	100%	0%	0%	50%	25%	25%	WSO
Bath tissue	Inventive	37		2	Abaca	23%	38%	8%	23%	38%	8%	100%	0%	0%	50%	25%	25%	WSO
Bath tissue	Inventive	38		2	Abaca	23%	0%	77%	23%	0%	77%	100%	0%	0%	50%	0%	50%	WSO
Bath tissue	Inventive	39		2	Abaca	23%	0%	77%	23%	0%	77%	100%	0%	0%	50%	0%	50%	WSO

EX1001, Fig. 18B-1 (cropped and annotated).

[67] EX1001, Figs. 18A-2, 18B-1, 19.

					% of total Sheet			
Substrate	Type	Sample ID	# Unique Layers	Non-wood	Euc	Softwood	Non-wood	FSO/ WSO
Towel	Inventive	9	1	Bamboo	37%	53%	10%	FSO
Towel	Inventive	10	1	Bamboo	42%	48%	10%	FSO
Towel	Inventive	11	1	Bamboo	34%	46%	20%	FSO
Towel	Inventive	12	1	Bamboo	44%	36%	20%	FSO
Towel	Inventive	13	1	Bamboo	31%	40%	30%	FSO
Towel	Inventive	14	1	Bamboo	46%	24%	30%	FSO
Towel	Inventive	45	1	Bagasse	40%	25%	35%	WSO
Towel	Inventive	46	1	Flax	40%	25%	35%	WSO
Towel	Inventive	47	1	Hemp	40%	25%	35%	WSO
Towel	Inventive	48	1	Unbleached Bamboo	40%	25%	35%	WSO
Towel	Inventive	49	1	Abaca	40%	25%	35%	WSO
Towel	Inventive	56	1	Abaca	35%	0%	65%	FSO
Towel	Inventive	57	1	Abaca	34%	36%	30%	FSO
Towel	Inventive	58	1	Abaca	36%	33%	31%	FSO
Towel	Inventive	59	1	Abaca	36%	33%	31%	FSO
Towel	Inventive	60	1	Abaca	36%	33%	31%	FSO
Towel	Inventive	61	1	Abaca	35%	0%	65%	FSO
Towel	Inventive	62	1	Abaca	40%	0%	60%	FSO
Towel	Inventive	63	1	Abaca	45%	0%	55%	FSO
Towel	Inventive	64	1	Abaca	35%	0%	65%	FSO
Towel	Traditional	Z02	1		40%	60%	0%	FSO
Towel	Traditional	Z12	1		40%	60%	0%	WSO
Towel	Traditional	Z14	1		35%	65%	0%	FSO
Towel	Traditional	Z15	1		35%	65%	0%	FSO
Towel	Traditional	Z16	1		35%	65%	0%	FSO

EX1001, Fig. 19 (annotated).

100. Notably, for the multi-layer samples that do not have abaca in every layer, the abaca is either missing from the fabric layer (Samples 28-33) or the wire layer (Samples 34-39). Even more notably, for those samples with no abaca in the fabric layer, the consumer-facing side is "FSO" or "fabric side out" and for those samples with no abaca in the wire layer, the consumer-facing side is "WSO" or "wire

side out."[68] In other words, the layer without abaca (which would be expected to be softer due to the presence of lower coarseness eucalyptus) is oriented towards the consumer. In these samples, a single-ply product would have at least one exterior surface without any abaca in it, in a two- or multi-ply product, the layer not containing abaca could be relegated to the interior only, such that the exterior and consumer-facing surfaces have no abaca at all.

101. There is also no explanation for how the "% of total Sheet" values for EUC (i.e., eucalyptus), Softwood, and Non-wood (i.e., abaca) were reached. For example, Sample 29 has 17% abaca in both the center and wire layers, but the total sheet is 22.5% abaca.[69] To a POSITA, this could indicate that the three layers are not evenly distributed by weight such that the two abaca-containing layers contribute more proportionally to the sheet than the fabric layer which contains no abaca. But the '475 Patent does not actually provide any explanation or disclosure regarding the

[68] EX1001, 23:21-23 ("[T]he consumer-facing side may be the either fabric-side-out ('FSO') or wire-side-out (['])WSO[']).), Figs. 18A-2 (Samples 28-33 with no abaca in wire layer and consumer-facing side is WSO), 18B-1 (Samples 34-39 with no abaca in fabric layer and consumer-facing side is FSO).

[69] EX1001, Fig. 18A-2.

weight distribution of the layers, so a POSITA would only be able to guess as to why the 22.5% of the total sheet is abaca.

102. This lack of disclosure is particularly troublesome in light of Sample 28, which contains ***no abaca in any layer*** and yet the total sheet is ***8.0%*** abaca.[70] How the total sheet of Sample 28 resulted in 8.0% abaca is entirely unexplained by the '475 Patent, and leaves the POSITA once again to mere guesswork.

103. For seven of these samples, the '475 Patent does include some additional information about additional properties of the tissue product—namely, that they are two-ply, made with a through-air-drying (TAD) process, and that the sheets were creped. But Figure 20A does not provide ***any*** such information for the other abaca-containing samples, Samples 28-30, 32-38, 58, 60, and 62, and so there is no disclosure regarding how those samples were made other than their fiber compositions.

[70] EX1001, Fig. 18A-2.

Substrate	Type	Non-wood	Sample ID	Ply Count	Process	Crepe	Differential Density	Dry Tensile Ratio	PVD 2.5-100 micron PVD Hysteresis	PVD 2.5-160 micron PVD Absorption	PVD 2.5-160 micron PVD Desorption
Towel	Inventive	Abaca	59	2	TAD	Y	Y		292	785	1496
Towel	Inventive	Abaca	56	2	TAD	Y	Y		435	874	1618
Towel	Inventive	Abaca	57	2	TAD	Y	Y		362	787	1631
Towel	Inventive	Abaca	61	2	TAD	Y	Y	1.35	421	1060	1599
Towel	Inventive	Abaca	64	2	TAD	Y	Y	1.38	423	1023	1551
Towel	Inventive	Bamboo	10	2	TAD	Y	Y	1.44	552	885	1611
Towel	Inventive	Bamboo	12	2	TAD	Y	Y	1.41	519	835	1583
Towel	Inventive	Bamboo	14	2	TAD	Y	Y	1.68	430	835	1561
Bath tissue	Inventive	Abaca	31	2	TAD	Y	Y	1.51	473	1296	1487
Bath tissue	Traditional		Z8	2	TAD	Y	Y	1.73	405	812	1088
Bath tissue	Inventive	Abaca	39	2	TAD	Y	Y	1.83	383	844	1075

EX1001, Fig. 20A (annotated and cropped).

104. Beyond the details provided in Figure 20A for those seven samples, however, there is no further disclosure of how the samples were made—e.g., how the abaca fibers were pulped and processed, the morphology of the fibers used, what, if any, structured fabrics were used, and whether any additional converting processes were done (beyond, for those seven samples, that plies were combined to make a two-ply product).

105. The ’475 Patent does report TS7 and TS750 values for most of these abaca-containing samples,[71] however it omits values for Sample ID 49 and reports

[71] EX1001, Figs. 21E-2, 21E-3, 21J.

TS7 values over 14 dB V² rms and TS750 values over 45 dB V² rms for 8 of the samples (which I have called out with red highlighting below):

Sample ID	Stack Compressibility	Resilient Bulk	Stack Compressibility x Resilent Bulk	TS7 Avg	TS750 Avg	Plate Stiffness	Slip Stick CoF Avg	Kinetic CoF Avg	Bulk (cc/g)
28	33.4	56.2	1876	6.0	41.7	2.2	391	0.95	10.9
29	33.1	56.8	1882	5.9	39.6	2.1	373	0.96	10.9
30	37.6	57.5	2159	5.4	36.8	2.3	407	1.03	11.3
31	32.2	58.3	1878	5.8	39.6	2.5	410	0.99	10.9
32	34.1	59.1	2014	5.5	35.5	2.2	437	0.99	11.2
33	34.4	60.5	2081	5.2	34.8	2.1	378	1.02	11.8
34	43.0	67.2	2887	12.6	26.3	4.9	472	0.88	13.0
35	40.6	67.9	2756	12.1	26.6	4.8	452	0.93	13.2
36	41.4	68.6	2841	12.0	27.1	5.3	443	0.87	14.3
37	35.2	64.9	2283	10.7	23.3	5.2	450	0.89	14.3
38	36.4	66.7	2427	11.4	23.9	5.0	489	0.90	12.7
39	39.1	67.6	2640	11.4	22.7	4.7	464	0.87	13.5

EX1001, Figs. 21E-2 and 21E-3 (annotated and collated).

Sample ID	Stack Compressibility	Resilient Bulk	Stack Compressibility x Resilient Bulk	TS7 Avg	TS750 Avg	Plate Stiffness	Slip Stick CoF Avg	Kinetic CoF Avg	Bulk (cc/g)
9	70.6	100.4	7086	18.3	43.6	12.5	964	0.99	20.5
10	71.6	100.8	7218	17.8	43.0	13.8	812	0.94	20.8
11	76.9	108.6	8354	19.3	41.5	15.9	810	0.94	22.8
12	75.4	107.9	8140	19.9	45.0	15.2	766	0.91	22.3
13	69.8	97.6	6812	20.2	43.3	13.5	827	0.94	21.9
14	71.6	105.0	7514	20.3	49.7	15.2	808	0.90	22.4
45									15.2
46									14.4
47									14.7
48									14.8
49									13.4
56	73.4	96.7	7098	16.6	49.3	11.3	1329	1.311	19.8
57	72.3	99.9	7223	18.1	49.8	11.2	1034	1.129	20.3
58	68.8	97.1	6680	17.9	43.95	10.2	1227	1.181	20.4
59	66.6	99	6593	20.52	52.89	13.2	872	1.06	19.9
60	67.3	96.9	6521	19.53	50.82	13.6	1117	1.059	20.0
61	80.2	92.4	7415	12.50	47.46	14.0	932	1.247	19.7
62	80.6	91.5	7375	11.94	45.20	13.5	990	1.240	19.7
63	74.1	91.7	6792	12.66	50.83	13.2	910	1.140	19.7
64	79.9	92.5	7388	12.97	44.31	13.1	892	1.154	20.4

EX1001, Fig. 22E (cropped and annotated).

106. Notably, the ’475 Patent provides no discussion of what features of these samples drives their different TS7 and TS750 values. And, as I noted above, nor is there any real explanation of how these samples were made or whether any structural features introduced to the samples through the forming, molding with a

structuring fabric, or converting processes (e.g., embossing) that might impact the TS7 and TS750 measurements.

107. Moreover, as I explained above, for the multi-layered abaca-containing samples, the abaca was omitted from either the wire or fabric layers (i.e., exterior facing layers). Because TS7 and TS750 measurements are impacted by the surface being tested, the possibility that abaca-containing layers were isolated to the interior of the tested product could have skewed the measurements more favorably (i.e., softer) by omitting measurements of a surface with the coarser abaca fibers incorporated in favor of a layer with a more conventional wood fiber furnish.

108. This is all conjecture, however, because the ’475 Patent simply does not provide sufficient information to determine whether this is true or not. I therefore find the reported TS7 and TS750 data for these abaca-containing samples to have limited value to a POSITA in terms of demonstrating the impact on these measurements of incorporating abaca fibers in ***any*** layer because it is not clear that some of the surfaces that were tested actually contained abaca.

109. To summarize, I have collected the various data points for the abaca-containing samples provided across Figures 18A-2, 18B-1, 19, 20A, 21E-2, 21E-3, and 22E in the table below, noting with “?” where the ’475 Patent omits a given piece of information for a sample and using red text to indicate where a given data point means the sample does not meet requirements of the claims:

							Fabric Layer			Center Layer			Wire Layer			% of total Sheet			
Sample ID	Ply Count	Process	Crepe	TS7 Avg	TS750 Avg	#Unique Layers	EUC	NSK/SW	Abaca	EUC	NSK/SW	Abaca	EUC	NSK/SW	Abaca	EUC	NSK/SW	Abaca	FSO/WSO
28	?	?	?	6	41.7	2	100%	0%	0%	67%	33%	0%	67%	33%	0%	55%	37%	8.0%	FSO
29	?	?	?	5.9	39.6	2	100%	0%	0%	33%	50%	17%	33%	50%	17%	55%	22.5%	22.5%	FSO
30	?	?	?	5.4	36.8	2	100%	0%	0%	25%	38%	38%	25%	38%	38%	55%	22.5%	22.5%	FSO
31	2	TAD	Y	5.8	39.6	2	100%	0%	0%	25%	0%	75%	25%	0%	75%	55%	0%	45%	FSO
32	?	?	?	5.5	35.5	2	100%	0%	0%	25%	0%	75%	25%	0%	75%	55%	0%	45%	FSO
33	?	?	?	5.2	34.8	2	100%	0%	0%	25%	0%	75%	25%	0%	75%	55%	0%	45%	FSO
34	?	?	?	12.6	26.3	2	23%	65%	12%	23%	65%	12%	100%	0%	0%	50%	42.5%	7.5%	WSO
35	?	?	?	12.1	26.6	2	23%	54%	23%	23%	54%	23%	100%	0%	0%	50%	35%	15%	WSO
36	?	?	?	12	27.1	2	23%	38%	38%	23%	38%	38%	100%	0%	0%	50%	25%	25%	WSO
37	?	?	?	10.7	23.3	2	23%	38%	8%	23%	38%	8%	100%	0%	0%	50%	25%	25%	WSO
38	?	?	?	11.4	23.9	2	23%	0%	77%	23%	0%	77%	100%	0%	0%	50%	0%	50%	WSO
39	2	TAD	Y	11.4	22.7	2	23%	0%	77%	23%	0%	77%	100%	0%	0%	50%	0%	50%	WSO
49	?	?	?	?	?	1										40%	25%	35%	WSO
56	2	TAD	Y	16.6	49.3	1										35%	0%	65%	FSO
57	2	TAD	Y	18.1	49.8	1										34%	36%	30%	FSO
58	?	?	?	17.9	43.95	1										36%	33%	31%	FSO
59	?	?	?	20.52	52.89	1										36%	33%	31%	FSO
60	?	?	?	19.53	50.82	1										36%	33%	31%	FSO
61	2	TAD	Y	12.5	47.46	1										35%	0%	65%	FSO
62	?	?	?	11.94	45.2	1										40%	0%	60%	FSO
63	?	?	?	12.66	50.83	1										45%	0%	55%	FSO
64	2	TAD	Y	12.97	44.31	1										35%	0%	65%	FSO

3. The ’475 Patent’s Papermaking Examples

110. The ’475 Patent provides fifteen “Papermaking Examples” which provide some process conditions for making sanitary tissue products.[72]

111. Papermaking Examples 1 and 2 describe process conditions for making sanitary tissue products containing any “non-wood (e.g., bamboo, abaca, etc.)” fiber in one of the layers.[73] Papermaking Example 1 describes process conditions for a single-layer ply, while Papermaking Example 2 describes process conditions for a multilayer ply.[74] Notably, these examples do not provide any specific guidance to address the disparate morphologies of the vast genus of non-wood fibers they purport to describe. There is also no discussion of the properties or characteristics such as TS7 and TS750 acoustic softness of tissues made according to these examples.

[72] EX1001, 53:59-59:10.

[73] EX1001, 54:9-11, 55:61-64.

[74] *Compare* EX1001, 54:28-30 (“The NSK, non-wood, and eucalyptus fibers are combined in the head box at various ratios and deposited onto a Fourdrinier wire ….”) *with id.*, 56:18-21 (“The wet-laid papermaking machine has a layered headbox having a top chamber, a center chamber, and a bottom chamber where the chambers feed directly onto the forming wire (Fourdrinier wire).”).

112. Papermaking Examples 3-14 describe process conditions for making single-layer abaca-containing tissue webs at various compositions (e.g., 65% abaca to 35% eucalyptus;[75] 60% abaca to 40% eucalyptus;[76] 55% abaca to 45% eucalyptus;[77] 40% Eucalyptus, 50% Abaca, and 10% NSK/SSK;[78] and 40% Eucalyptus, 20% Abaca, and 40% NSK/SSK[79]), using different refining levels,[80] using different structured fabrics,[81] and including additional converting processes.[82]

[75] EX1001, 58:3-6 (Papermaking Example 3).

[76] EX1001, 58:31-36 (Papermaking Example 5).

[77] EX1001, 58:37-41 (Papermaking Example 6).

[78] EX1001, 58:42-48 (Papermaking Example 7).

[79] EX1001, 58:49-52 (Papermaking Example 8).

[80] EX1001, 58:28-30 (Papermaking Example 4).

[81] EX1001, 58:53-56 (Papermaking Example 9), 58:57-60 (Papermaking Example 10), 58:61-64 (Papermaking Example 11), 58:65-67 (Papermaking Example 12), 59:1-3 (Papermaking Example 13).

[82] EX1001, 59:4-7 (Papermaking Example 14).

Again, there is no discussion of the properties or characteristics such as TS7 and TS750 acoustic softness of tissues made according to these examples.

113. The remaining Papermaking Example 15 follows the process conditions of Papermaking Examples 1 and 2 but uses a 100% bamboo composition.[83] And, yet again, there is no discussion of the properties or characteristics such as TS7 and TS750 acoustic softness of tissues made according to this example.

114. There is no disclosure in the ’475 Patent that ties any of the Papermaking Examples to the bamboo-containing and abaca-containing Samples I discuss in Sections V.A.1 and V.A.2 above or any of the TS7 and TS750 data reported for those Samples.

115. The ’475 Patent, therefore, provides no disclosure about assessing the acoustic softness of any substrate made using any of these Papermaking Examples.

B. The Challenged Claims

116. The ’475 Patent contains 28 claims.

117. I understand that Kimberly Clark is challenging a subset of the claims, specifically claims 1, 3, 4, 9, 10-14, 15, 17, 18, 23, and 24-28 (collectively, the

[83] EX1001, 59:8-10 (Papermaking Example 15).

"Challenged Claims"). I understand that the remaining ten claims (2, 5-8, 16, and 19-22) are not being challenged in this proceeding.

118. Of the Challenged Claims, claims 1, 9, 15, and 23 are independent claims. These independent claims are fairly similar and generally claim sanitary tissue products comprising non-wood fibers "selected from the group consisting of bamboo, abaca, and mixtures thereof" at levels from "at least about 5% to about 100% by weight" with the sanitary tissue product meeting a particular acoustic softness threshold.

119. **Claim 1** recites: (1) a two-ply sanitary tissue product; (2) comprising at least about 5% to 100% by weight of non-wood fibers selected from bamboo, abaca, and mixtures thereof; (3) where all layers of at least one of the multi-layered fibrous structure plies comprise at least about 5% by weight of non-wood fibers, and (4) in which the product exhibits a TS7 of less than about 14 dB V^2 rms.

120. **Claim 9** recites a two-ply sanitary tissue product that only differs from the sanitary tissue product of claim 1 by requiring the product to exhibit a TS750 of less than about 45 dB V^2 rms.

121. **Claim 15** recites a multi-ply sanitary tissue product with the same fiber composition requirements of claims 1 and 9, with the additional requirement that at least one multi-layered fibrous structure ply forms an exterior ply of the product. Like claim 1, the product must exhibit a TS7 of less than about 14 dB V^2 rms.

122. **Claim 23** recites a multi-ply sanitary tissue product that only differs from the sanitary tissue product of claim 15 by requiring the product to exhibit a TS750 of less than about 45 dB V^2 rms.

123. I provide a side-by-side comparison of the limitations of these independent claims in the table below, highlighting the very few differences in the claim language in corresponding colors:

Claim 1	Claim 9	Claim 15	Claim 23
A **two-ply** sanitary tissue product, comprising:	A **two-ply** sanitary tissue product, comprising:	A **multi-ply** sanitary tissue product, comprising:	A **multi-ply** sanitary tissue product, comprising:
at least about 5% to about 100% by weight non-wood fibers selected from the group consisting of bamboo, abaca, and mixtures thereof;	at least about 5% to about 100% by weight non-wood fibers selected from the group consisting of bamboo, abaca, and mixtures thereof;	at least about 5% to about 100% by weight non-wood fibers selected from the group consisting of bamboo, abaca, and mixtures thereof;	at least about 5% to about 100% by weight non-wood fibers selected from the group consisting of bamboo, abaca, and mixtures thereof;
wherein the **two-ply** sanitary tissue product comprises at least one multi-layered fibrous structure ply comprising a plurality of layers, wherein all of the layers of the at least one multi-layered fibrous structure ply comprise at least about 5% by weight of the layer of the non-wood fibers; and	wherein the **two-ply** sanitary tissue product comprises at least one multi-layered fibrous structure ply comprising a plurality of layers, wherein all of the layers of the at least one multi-layered fibrous structure ply comprise at least about 5% by weight of the layer of non-wood fibers; and	wherein the **multi-ply** sanitary tissue product comprises at least one multi-layered fibrous structure ply comprising a plurality of layers, wherein all of the layers of the at least one multi-layered fibrous structure ply comprise at least about 5% by weight of the layer of the non-wood fibers and	wherein the **multi-ply** sanitary tissue product comprises at least one multi-layered fibrous structure ply comprising a plurality of layers, wherein all of the layers of the at least one multi-layered fibrous structure ply comprise at least about 5% by weight of the layer of non-wood fibers and
		wherein the at least one multi-layered fibrous structure ply **forms an exterior ply of the multi-ply sanitary tissue product**; and	wherein the at least one multi-layered fibrous structure ply **forms an exterior ply of the multi-ply sanitary tissue product**; and
wherein the **two-ply** sanitary tissue product exhibits a **TS7 of less than about 14 dB V2 rms**.	wherein the **two-ply** sanitary tissue product exhibits a **TS750 less than about 45 dB V2 rms**.	wherein the **multi-ply** sanitary tissue product exhibits a **TS7 of less than about 14 dB V2 rms**.	wherein the **multi-ply** sanitary tissue product exhibits a **TS750 less than about 45 dB V2 rms**.

124. As demonstrated above, each of the independent claims shares three critical features: (1) a ply comprising a plurality of layers, where (2) each of the plurality of layers has a fiber composition at any incorporation level from 5% to 100% of abaca, either alone or in combination with bamboo; and (3) a quantitative acoustic softness threshold (TS7 < ~14 dB V^2 rms or TS750 < ~45 dB V^2 rms) that the claimed product must achieve.

125. The remaining fourteen dependent claims can be grouped accordingly:

a. **Claims 3, 11, 17, and 25** require that the product is a toilet tissue.

b. **Claims 4, 12, 18, and 26** increase the minimum non-wood fiber content from 5% to "greater than about 30% to about 100% by weight."

c. **Claims 10 and 24** require the product to comprise a "structured fibrous structure."

d. **Claims 13, 14, 27, and 28** require the product to have even lower acoustic softness values. Claims 13 and 27 require a TS750 of less than 40 dB V^2 rms, while claims 14 and 28 require a TS750 of from about 25 to about 35 dB V^2 rms.

VI. INVALIDITY OF THE '475 PATENT CLAIMS UNDER 35 U.S.C. § 112

A. Ground 1: The Challenged Claims Are Unpatentable under 35 U.S.C. § 112 as Lacking Written Description

126. As discussed further and in more detail below, it is my opinion that, based on the disclosures in the'475 Patent, the inventors failed to demonstrate that they possessed the full scope of the claimed genus of sanitary tissue products containing bamboo, abaca, and mixtures thereof in each layer and which meet the claimed acoustic softness requirements.

127. In particular, the '475 Patent merely discloses a handful of bamboo-containing examples that meet the requirements of the claims, but fails to provide any disclosure of abaca samples that meet the requirements of the claims or any guidance on how to generate such sanitary tissue products. I understand that in order to demonstrate possession of the full genus of claimed sanitary tissue products, the inventors must have described at least a representative number of species within that genus or identified the structural features common to the members of the genus. In my opinion, the bamboo-containing examples are not sufficiently representative to demonstrate possession of the full genus of sanitary tissue products with at least one multi-layer ply where each layer includes bamboo, abaca, and mixtures thereof that also meet the claimed acoustic softness requirements. And no structural features common to the genus are identified.

1. The Claims Define a Broad Genus of Products Containing Abaca

128. As a starting point, it is important to appreciate the enormous breadth of the genus of products that the ’475 Patent attempts to claim.

129. Each of the four independent challenged claims defines the genus of sanitary products using three parameters: (1) fiber composition (“non-wood fibers selected from the group consisting of bamboo, abaca, and mixtures thereof” at levels from “at least about 5%” to “about 100% by weight”); (ii) structural requirements (two-ply or multi-ply configurations with the non-wood fiber content in all layers); and (iii) functional acoustic softness thresholds (TS7 less than 14 dB V^2 rms or TS750 less than 45 dB V^2 rms).

130. While the claims treat bamboo and abaca as interchangeable, the specification provides far more guidance regarding bamboo than abaca, and specifically points out that bamboo and abaca are ***not*** interchangeable.

131. As I discussed above, the specification does provide multiple examples of sanitary tissue products with bamboo incorporated into every layer and which meet the claimed acoustic softness thresholds.[84] These samples, however, do not indicate the origin of the bamboo fibers (i.e., whether they originate from a single

[84] *See supra* paragraph 91 and annotated figures.

species of bamboo or are a mix of multiple different species) and cover only a handful of different incorporation levels of bamboo fibers. Nonetheless, the inventors did demonstrate possession of at least the specific multi-layer bamboo products described in these samples with acoustic softness characteristics that meet the claim requirements.

132. In light of these bamboo-containing samples with the claimed properties, it is notable that the specification provides no support for any claimed abaca-containing sanitary tissue product, let alone support for the entire genus of such products.

133. The genus of abaca-containing products encompassed by the claims is broad—spanning abaca content levels from 5% to 100% where the remainder could be any other type of fiber, every conceivable combination of process parameters (e.g., refining levels, furnish compositions, structuring approaches, drying methods, chemical treatments), multiple ply configurations, and both toilet tissue and facial tissue formats.

134. More specifically, the ***only*** parameters disclosed by the claims are the structure (multi-layer ply), the fact that each layer includes at least 5% of abaca, and the acoustic softness outcomes. The claims do not specify the remaining fiber content, how the slurry is prepared, how the tissue is formed and processed, or how the resulting web is converted into a finished product. Instead, the claims include

within their scope all the near incalculable number of combinations of various paper-making variables that a POSITA may employ when seeking to make a tissue product.

135. I next turn to examine whether there is adequate written description for this broad genus of abaca containing products.

2. The Specification Does Not Disclose Sanitary Tissue Products with a Multi-Layer Ply with Abaca in Every Layer that Achieves the Claimed Acoustic Softness Properties

136. I understand that a genus may be sufficiently disclosed if the specification discloses a representative number of species that fall within that genus.

137. However, in contrast to the expansive genus claimed by the ’475 Patent, it is my opinion that the accompanying disclosure does not demonstrate possession of the claimed genus of abaca products.

138. Indeed, the ’475 Patent provides relatively limited disclosure regarding abaca scattered throughout the specification and no disclosure regarding how to achieve the claimed acoustic softness thresholds in a claimed abaca-containing product.

139. Below, I summarize the mentions of abaca in the specification.

140. First, the specification provides some description of the physical characteristics of abaca fibers such as its coarseness (>16 mg/100m) and fiber length

(2.5–2.8+ mm).[85] The specification also notes that abaca may "replac[e] refined long fiber northern and southern softwood kraft" as abaca's properties lend themselves towards imparting strength to the resulting tissue product.[86] The specification does not, however, explain how these strength characteristics lend themselves towards softness. Indeed, there is no mention of softness (acoustic or otherwise) in the entire section of the specification under the "Abaca" heading.[87] Rather, the '475 Patent warns that "regarding using abaca for its strength characteristics … it is desirable to keep it from collapsing into a tightly bonded, rough, thin network with little variation in pore size."[88] The '475 Patent suggests overcoming this by combining abaca with a "sustainable hardwood (e.g., eucalyptus)" or by forming the tissue product with "patterns comprising higher

[85] EX1001, 26:38-42.

[86] EX1001, 49:67-50:5; *see also id.*, 27:4-7 ("Further, abaca's length, width, and coarseness make it a more suitable softwood replacement, its higher fibrillation increases specific surface area of the fiber and its carboxyl groups make it better for attaching strength chemistries.").

[87] *See* EX1001, 26:30-27:7.

[88] EX1001, 50:5-9.

degrees of pillow modulation" and by "increasing molding conditions such as structuring belt pattern, belt overburden, crepe and/or wire to press draw."[89] While the '475 Patent claims that these proposed modifications can result in "surface texture with surface softness," there is no specific guidance regarding what fiber composition is needed or what processing steps must be employed to result in a multi-layered tissue product comprising abaca in every layer exhibiting a TS7 of less than about 14 dB V^2 rms and/or a TS750 less than about 45 dB V^2 rms.[90]

141. Second, while abaca is mentioned throughout the Papermaking Examples, these examples merely provide some process conditions for making sanitary tissue products. They do not address any properties of the resulting products other than Papermaking Example 1's passing remark that the resulting sanitary tissue product is "soft, flexible, and absorbent."[91] But "soft," without more, does not provide any explanation of how soft or what measure of softness is even being

[89] EX1001, 50:3-16

[90] EX1001, 50:9-14.

[91] EX1001, 55:14-15.

used.[92] Tellingly, none of these examples report any TS7 or TS750 measurements for the resulting products. Without such data, it is my opinion that there is no basis for concluding that any of the abaca-containing substrates produced by these Papermaking Examples would meet the claimed TS7 and TS750 thresholds.

142. Moreover, with regards to Papermaking Examples 1 and 2 specifically, there is only a passing mention of abaca as an exemplary non-wood fiber.[93] The lack of any teachings, examples, or disclosures regarding the characteristics of abaca fibers specifically does not demonstrate that Papermaking Examples 1 and 2 could actually be used with abaca, much less what the result would be. Moreover, Papermaking Example 1 does not describe making a multilayer sanitary tissue product, and so its disclosures are largely irrelevant to the question of whether the inventors demonstrated possession of sanitary tissue products with a ***multi***-layer ply that incorporates at least 5% by weight of abaca in every layer.

143. Third, while the specification reports data for various abaca-containing sanitary tissue examples, none of these examples are multilayered with abaca in

[92] And in any event, Papermaking Example 1 describes process conditions for making a product with ***single layer*** plies.

[93] EX1001, 54:9-11, 55:61-64.

every layer.[94] Samples 28-33 all have three layers, but the "Fabric Layer" comprises 100% eucalyptus fibers.[95] Samples 34-39 similarly have three layers, but the "Wire Layer" comprises 100% eucalyptus fibers.[96] And, finally, samples 49 and 56-64 have only a single layer.[97] The TS7 and TS750 results reported for these samples[98] are therefore irrelevant to the question of whether the inventors demonstrated possession of tissue products with a multilayer ply that incorporates abaca in every layer and meet the claimed acoustic softness thresholds.

144. Fourth, the specification remarks that "[i]t has surprisingly been found that, despite the often non-desirable … characteristics of non-wood fibers, it is still possible to achieve high levels of wet strength and dry softness in a non-wood (e.g., abaca) containing substrate" with a reference to Figure 2G.[99] "Figure 2G is a graph illustrating TS7 (y-axis) and total wet tensile (x-axis) values of inventive and

[94] *See supra* paragraph 99 and annotated figures.

[95] EX1001, Fig. 18A-2.

[96] EX1001, Fig. 18B-1.

[97] EX1001, Fig. 19.

[98] EX1001, Figs. 21E-2, 21E-3, 21J.

[99] EX1001, 48:58-64.

comparative non-wood (paper) towel samples of FIGS. 22A, 22B, 22C, 22D, 22E, 22R."[100] But all of the abaca-containing towel samples of Figs. 22A *et seq*. are single layer products that do not meet the claims' *multi*-layer with abaca in each layer requirement.[101] As such, these samples are irrelevant to the written description of the challenged claims because they do not meet the claims' structural requirements

145. Fifth, general statements about "non-wood fibers" do not impart any guidance about abaca specifically given the wide range of non-wood fibers each with their own morphological characteristics and properties that can impact the properties of a sanitary tissue product incorporating those fibers.[102]

146. In summary, it is my opinion that these limited disclosures regarding abaca are insufficient to demonstrate that the inventors actually possessed the alleged invention of sanitary tissue products with a multilayer ply that incorporates abaca in every layer and meets the claimed acoustic softness requirements.

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[100] EX1001, 3:46-49.

[101] Samples 56-64 are the only abaca-containing samples who have TS scores reported in Figs. 22A *et seq*, and those samples are all single layer substrates. EX1001, Fig. 22E.

[102] *See supra* Section IV.B.

3. The Specification Does Not Provide Blaze Marks to Direct a POSITA to Abaca-Containing Products with the Claimed Properties

147. I understand that a genus may be sufficiently disclosed if the specification provides sufficient "blaze marks" to direct one of ordinary skill in the art to the specific subset of a large genus that meet the requirements of the patent's claims.

148. In my opinion, the '475 Patent provides no such blaze marks for abaca-containing products.

149. Rather, the specification warns that incorporating any non-wood fiber, including abaca, into a sanitary tissue product is exceedingly difficult.[103] And then goes on to emphasize that abaca specifically "comprises characteristics that can make it challenging (especially at higher incorporation levels) for incorporating into sanitary tissue products of the present invention …."[104]

150. Critically, nowhere in the specification do the inventors provide any guidance on how to overcome the specific challenges raised by abaca. The specification does not provide a single disclosure of any combination of abaca content level, refining parameters, furnish composition, structural features, or

[103] EX1001, 1:27-31.

[104] EX1001, 26:43-47.

converting processes that might be utilized to achieve the claimed acoustic softness thresholds in a sanitary tissue product containing abaca in every layer.

151. The lack of blaze marks is significant since abaca, notably, is not well suited to incorporation into sanitary tissue products that are also soft. For example, abaca fibers have a coarseness exceeding 16 mg/100m,[105] which is much coarser than the hardwood fibers typically used in sanitary tissue products to impart softness.[106] Coarser fibers tend to result in less soft tissue products and incorporating coarser fibers into a tissue product typically would cause the tissue surfaces to exhibit higher (i.e., less soft) TS7 and TS750 values.[107]

152. Indeed, the ’475 Patent’s description of abaca fibers as being “better known for being used to produce thin, strong, and porous paper capable of withstanding hard use” is consistent with a fiber associated with strength and

[105] EX1001, 26:38-39.

[106] EX1001, 48:51-53 (“Hardwood fibers are desirous for improving softness when dry, due to their low coarseness and length.”); EX1013, 8 (Fig. 1).

[107] *See* EX1014, 32 (“Lower coarseness contributes to improved softness.”).

durability.[108] As the '475 Patent acknowledges, strength is often in direct contradiction with softness:

> A contradiction that paper (fibrous structures and, more particularly, sanitary tissue products) makers contend with is how to design a strong, yet soft substrate. This has previously been achieved through the judicious choice and layering of wood-based fibers. Long and easily bonded fibers such as softwoods are used in a sheet for strength, while short, thin, and low coarseness fibers such as eucalyptus are used for softness.[109]

153. Moreover, the mere suggestion to use abaca as a "softwood replacement" given its coarseness does not address the challenge of incorporating abaca "at higher incorporation levels."[110] The genus claimed by the '475 Patent encompasses sanitary tissue product compositions comprising abaca that span far more than simple replacement of conventional softwood fibers in a product. Moreover, that guidance says nothing about how using abaca to replace softwood fibers would impact TS7 and TS750 acoustic softness results.

154. In sum, the '475 Patent contains no disclosures of any working examples of a claimed abaca-containing product, nor does it describe what parameters would be needed to achieve such a product. To the contrary, the patent

[108] EX1001, 26:43-47.

[109] EX1001, 43:44-51.

[110] EX1001, 27:4-7, 26:43-47.

identifies problems specific to abaca but presents no solutions to those problems. As such, it does nothing to direct one of ordinary skill in the art to any portion of the large abaca-genus that meets the requirements of the patent's claims.

4. Disclosures Regarding Bamboo Are Not Representative of the Abaca Genus

155. As I noted, the specification does provide 12 examples of bamboo-containing multilayer products with bamboo in every layer that also have measured TS7 values below 14 dB V² rms and TS750 values below 45 dB V² rms.[111] These examples, however, are not "representative" of the abaca genus.

156. Bamboo and abaca are fundamentally different fibers with distinct morphological and chemical properties that lead to different tissue-making behaviors and product characteristics. For example, bamboo fibers are generally finer and more flexible, making them more similar to hardwood fibers used to impart softness in tissue products.[112] In comparison, abaca fibers are much coarser, longer, and stiffer, making them function more like softwood fibers, which are typically used for strength (as opposed to softness) in tissue products.[113]

[111] *See supra* paragraph 91 and annotated figures.

[112] EX1013, 7-8.

[113] *See* EX1001, 27:4-7.

157. Particularly when considering TS7 and TS750 values, a surface incorporating coarse, stiff fibers like abaca would be expected to have much different acoustic softness properties than a surface incorporating fine, flexible fibers like bamboo. There is no disclosure in the specification or even in the general knowledge of the art that would indicate that the acoustic softness of a tissue incorporating bamboo could be reliably replicated when substituting abaca.

158. In short, it is my opinion that the disclosure of bamboo examples alone is insufficient to convey to a person of ordinary skill in the art that the inventors possessed the full scope of the claimed invention, which encompasses tissue products incorporating a fundamentally different fiber—abaca.

5. The Dependent Claims Lack Written Description

159. For all the reasons discussed above with respect to the independent claims and the specification's failure to provide adequate disclosure for abaca-containing products, it is my opinion that the dependent claims also lack adequate written description support. While the dependent claims do introduce additional limitations, none of these limitations corrects the fundamental lack of disclosure regarding abaca.

a. Claims 3, 11, 17, and 25 (Toilet Tissue)

160. Claims 3 (dependent on claim 1), 11 (dependent on claim 9), 17 (dependent on claim 15), and 25 (dependent on claim 23) each add the limitation that the sanitary tissue product is "a toilet tissue product."

161. The added requirement that the sanitary tissue product is a "toilet tissue product" does not change that the specification is devoid of any examples of a sanitary tissue product with a multilayer ply containing abaca in every layer and which achieves the claimed acoustic softness thresholds.

b. Claims 4, 12, 18, and 26 (Greater than 30% Non-Wood Fibers)

162. Claims 4 (dependent on claim 1), 12 (dependent on claim 9), 18 (dependent on claim 15), and 26 (dependent on claim 23) require that the product comprise "greater than about 30% by weight non-wood fibers."

163. This added limitation does not remedy the lack of sufficient disclosure regarding abaca, if anything, it only aggravates the issue. Indeed, the '475 Patent specifically warns that abaca is "challenging (especially at higher incorporation levels)" to incorporate into sanitary tissue products.[114] Given that it is my opinion that there is insufficient disclosure for sanitary tissue products with a multilayer ply containing ***any*** abaca in every layer, the increased difficulty posed by ***higher***

[114] EX1001, 26:43-47.

incorporation levels of abaca required by claims 4, 12, 18, and 26 certainly is not addressed by the specification.

c. Claims 10 and 24 (Structured Fibrous Structure)

164. Claims 10 (dependent on claim 9) and 24 (dependent on claim 23) require that the product comprise "a structured fibrous structure."

165. The addition of a structured fibrous structure limitation does not establish that an abaca-containing product achieves a TS750 of less than 45 dB V^2 rms required by the claims. While Papermaking Examples 9-13 discuss the use of various structured fabrics, there is no disclosure linking the use of these fabrics to any impact on TS750 acoustic softness of the resulting products or reporting any TS750 for the resulting products.[115] Therefore, it is my opinion that the specification fails to describe the claimed sanitary tissue products incorporating abaca in every layer, a structured fibrous structure, and the claimed TS750 of less than 45 dB V^2 rms.

[115] EX1001, 58:53-56 (Papermaking Example 9), 58:57-60 (Papermaking Example 10), 58:61-64 (Papermaking Example 11), 58:65-67 (Papermaking Example 12), 59:1-3 (Papermaking Example 13).

d. Claims 13, 14, 27, and 28 (Narrower TS750 Ranges)

166. Claims 13 and 27 require a TS750 of "less than about 40 dB V^2 rms" and claims 14 and 28 require a TS750 of "from about 25 to about 35 dB V^2 rms."

167. Again, it is my opinion that the specification fails to disclose a single example of a sanitary tissue product with a multilayer ply containing abaca in every layer, making any TS750 data reported for examples containing abaca in some, but not all, layers irrelevant to whether the inventors were in possession of the claimed abaca-containing tissue products that meet the TS750 requirements.

6. Conclusion

168. Identifying abaca as a potential fiber choice while raising the challenge of incorporating such a fiber into sanitary tissue products without providing a single example of a sanitary tissue product with a multilayer ply containing abaca in every layer and meeting the acoustic softness requirements of the claims is insufficient to demonstrate that the inventors were in possession of such products.

169. It is my opinion, therefore, that the specification of the '475 Patent fails to convey to a person of ordinary skill in the art that, as of the filing date, the inventors were in possession of the full scope of the claimed genus insofar as it encompasses sanitary tissue products with a multilayer ply with abaca in every layer that achieves the recited TS7 and TS750 values.

B. Ground 2: The Challenged Claims Are Unpatentable under 35 U.S.C. § 112 as Not Enabled.

170. As discussed further and in more detail below, it is my opinion that the specification of the ’475 Patent fails to enable a person of ordinary skill in the art to make and use the full scope of the claimed invention without undue experimentation.

171. In particular, the claims encompass a wide range of abaca-containing products, yet the specification provides no meaningful guidance for creating a sanitary tissue product containing abaca in every layer that achieves the claimed TS7 and TS750 thresholds. Rather, it would require undue experimentation to practice the full scope of the claims, particularly for any product containing abaca.

1. The Scope of the Claims Is Extremely Broad

172. As discussed above in Section VI.A.1, the claims encompass a wide range of sanitary tissue products comprising abaca.

173. The Challenged Claims all claim sanitary tissue products that comprise “at least about 5% to about 100% by weight non-wood fibers selected from the group consisting of bamboo, abaca, and mixtures thereof.” The claimed products can therefore incorporate abaca as a relatively minor component at only 5% all the way to the entirety of the fiber furnish at 100%.

174. The scope of the claims only expands further when considering compositions where abaca fibers are incorporated at less than 100% by weight. The claims place no requirements on the fibers used in addition to the claimed non-wood

fibers. Thus, the claims encompass sanitary tissue products that incorporate any additional non-wood fibers, including wide-ranging fiber types such as kenaf, hemp, jute, flax, sisal, and many others, or wood fibers used in addition and in any proportion to the claimed abaca fibers.[116]

175. Nor do the claims place any requirements on the manner of processing and refining the abaca fibers used to create the sanitary tissue products. The claims therefore encompass products made with abaca pulped in any manner, with any level of refining, and with any kind of chemical additives or treatments (e.g., wet-strength resins, debonders, softening agents, etc.), and with any combination of such conditions. As I explained above, all of these variables can impact the softness of the final product.

176. The claims also place no requirements on the manufacturing process (and the resulting product features introduced by said processes) used to create the sanitary tissue products. The claims therefore encompass products made by any of the many papermaking processes (e.g., CTAD, UCTAD, etc.), any structural

[116] The '475 Patent identifies "non-wood" fibers as "naturally-occurring fibers derived from non-wood plants, including animal fibers, mineral fibers, plant fibers and mixtures thereof, and specifically excluding non-naturally-occurring fibers (e.g., synthetic fibers)." EX1001, 24:14-19.

features introduced by any pattern of structuring fabric, any converting processes (e.g., embossing, calendaring, etc.), and with any combination of such conditions and features. As I explained above, all of these things can impact the acoustic softness of the resulting product independent of the fiber composition.[117]

177. The vast expanse of different combinations of abaca content, process parameters, and product configurations encompassed by the claims requires an immense amount of experimentation to determine which combinations can achieve the claimed product with a TS7 of less than 14 dB V^2 rms or TS750 less than 45 dB V^2 rms. Because the specification does not provide a starting point other than to use abaca, the entire range of abaca-containing products is left to be explored to find those that can accomplish the claimed acoustic softness thresholds.

2. The Specification Lacks Working Examples of Abaca-Containing Products with the Claimed Features

178. I understand that a working example is based on work actually performed, in comparison to a prophetic example that merely describes an embodiment of the invention based on predicted results rather than work actually conducted or results actually achieved.

[117] *See supra* Sections IV.A & IV.C.

179. In my opinion, the specification of the ’475 Patent contains zero working examples of a claimed abaca-containing tissue product.

180. The Papermaking Examples are not working examples because they do not demonstrate that the resulting sanitary tissue products actually achieve the claimed acoustic softness thresholds. Instead, all these examples serve to do is provide potential processes for making tissue products. Indeed, Papermaking Examples 3-14 (which explicitly discuss the use of abaca) only describe the process for making single-layer abaca-containing substrates (not multi-layer, as the claims require).[118] None of the Papermaking Examples report TS7 or TS750 values for the resulting products, and without that data, following these Papermaking Examples is just as likely to produce a product with acoustic softness characteristics that fall well above the claimed thresholds.

181. The description of product samples containing abaca with accompanying TS7 and TS750 data reported in the figures similarly fail to provide any working examples of the claimed product. As I explained above, none of the samples are multi-layer products with abaca in every layer.[119] Therefore, there is

[118] *See supra* paragraph 112.

[119] *See supra* paragraphs 99-106 and annotated figures.

nothing to suggest that the inventors actually made a product containing abaca in every layer and which met the claimed acoustic softness thresholds.

3. The Specification Provides No Meaningful Guidance for Abaca

182. It is my opinion that the specification fails to provide adequate guidance on how to make multilayered sanitary tissue products with abaca in every layer which achieve the claimed acoustic softness thresholds.

183. First, the ’475 Patent does not provide any explanation of how compositions containing abaca might achieve any particular acoustic softness outcome.

184. While the Papermaking Examples provide process conditions for making abaca-containing products, nothing in the specification provides any guidance regarding whether products made according to those process conditions would achieve any particular acoustic softness property. Moreover, only Papermaking Example 2 describes making a multilayer product and only mentions abaca as an exemplary non-wood fiber—it does not provide any guidance specific to abaca.[120] Without any data or guidance regarding the acoustic softness properties of products made according to the Papermaking Examples, they are not a viable

[120] *See* EX1001, 55:16-57:52.

starting point for optimization because there is no indication that the Papermaking Examples would necessarily result in a product containing abaca that meets the claimed acoustic softness thresholds.

185. The abaca-containing samples disclosed in the figures only further highlight the lack of guidance on how to achieve the claimed acoustic softness properties. Samples 56, 61, and 64 (highlighted below) are each single-layer paper towel products with the same 35% eucalyptus and 65% abaca composition:[121]

					% of total Sheet			
Substrate	Type	Sample ID	# Unique Layers	Non-wood	Euc	Softwood	Non-wood	FSO/ WSO
Towel	Inventive	56	1	Abaca	35%	0%	65%	FSO
Towel	Inventive	61	1	Abaca	35%	0%	65%	FSO
Towel	Inventive	64	1	Abaca	35%	0%	65%	FSO

EX1001, Fig. 19 (cropped and annotated).

186. Yet, despite having the same fiber composition, the specification reports Sample 56's TS7 measurement as 16.6 dB V^2 rms (which is above the claimed 14 dB V^2 rms) while Sample 61's TS7 measurement is 12.5 dB V^2 rms and

[121] EX1001, Fig. 19.

Sample 64's is 12.97 dB V^2 rms (which are both below the claimed threshold for TS7).[122] Moreover, Sample 56's TS750 value is reported as 49.3 dB V^2 rms and Sample 61's TS750 value is reported as 47.46 dB V^2 rms (both above the claimed 45 dB V^2 rms threshold), yet Sample 64's reported TS750 value is 44.31 dB V^2 rms (which is below the claimed threshold).[123]

Sample ID	Stack Compressibility	Resilient Bulk	Stack Compressibility x Resilient Bulk	TS7 Avg	TS750 Avg	Plate Stiffness	Slip Stick CoF Avg	Kinetic CoF Avg	Bulk (cc/g)
56	73.4	96.7	7098	16.6	49.3	11.3	1329	1.311	19.8
61	80.2	92.4	7415	12.50	47.46	14.0	932	1.247	19.7
64	79.9	92.5	7388	12.97	44.31	13.1	892	1.154	20.4

EX1001, Fig. 22E (cropped and annotated).

187. In Samples 56, 61 and 64, products containing the exact same amount of abaca nonetheless achieved different TS7 softness values, with two samples falling within the claims and one outside the claims, and different TS750 values, with two samples falling outside the claims and one inside the claims. Yet, the specification provides no explanation for this difference or guidance as to how to achieve the results of Sample 64 instead of Samples 56 and 61.

[122] EX1001, Fig. 22E.

[123] EX1001, Fig. 22E.

188. Second, the specification provides no guidance regarding any relationship between the structure of abaca fibers and the functional result of acoustic softness. The specification discusses abaca almost entirely in the context of strength properties and mechanical performance metrics rather than acoustic softness metrics like TS7 and TS750.[124] While the specification includes the inventors' hypotheses as to why abaca's chemical properties and certain processing methods might result in desired softness, these hypotheses (even if correct) are unhelpful.[125] The hypotheses ultimately do not account for all the process parameters needed to make the claimed product, and the claims encompass more than just the process parameters suggested in the inventors' hypotheses. There is simply no guidance in the specification as to how the physical characteristics of abaca fibers (i.e., high coarseness and stiffness, long length) correspond to or can be addressed through processing conditions to produce tissue products containing abaca that achieve specific acoustic softness measurements.

189. Third, the specification makes clear that abaca is challenging to incorporate in sanitary tissue products but provides superficial guidance as to how

[124] EX1001, 26:64-27:7, 49:67-50:3.

[125] EX1001, 50:17-42

to overcome these challenges.[126] When the '475 Patent does purport to provide such guidance, that guidance is vague. For example, the '475 Patent warns that "regarding using abaca for its strength characteristics … it is desirable to keep it from collapsing into a tightly bonded, rough, thin network with little variation in pore size."[127] The '475 Patent suggests overcoming this by combining abaca with a "sustainable hardwood (e.g., eucalyptus)" or forming the tissue product with "patterns comprising higher degrees of pillow modulation" and by "increasing molding conditions such as structuring belt pattern, belt overburden, crepe and/or wire to press draw."[128] While the '475 Patent claims that these proposed modifications can result in "surface texture with surface softness," there is no specific guidance regarding what fiber composition is needed or what processing steps must be employed to result in a multi-layered tissue product comprising abaca in every layer exhibiting a TS7 of less than about 14 dB V^2 rms and/or a TS750 less than about 45 dB V^2 rms.[129] Ultimately, such generalized, vague, guidance is nothing

[126] EX1001, 26:43-47.

[127] EX1001, 50:5-9.

[128] EX1001, 50:3-16

[129] EX1001, 50:9-14.

more than an invitation to experiment (e.g. regarding the overall furnish composition and processing steps) and fails to provide the sufficient, detailed guidance required to enable a person of ordinary skill in the art to practice the claims without undue experimentation.

190. Finally, despite claims spanning abaca incorporation from as little as 5% to as much as 100%, the specification fails to provide any direction regarding what incorporation levels of abaca are capable of achieving the claimed acoustic softness properties (let alone any guidance regarding how to achieve this when combining abaca with any of the sizable numbers of other fibers). If anything, the only guidance the specification provides is that abaca is even more challenging with higher incorporation levels.[130] But it is otherwise unclear from the specification whether the claimed acoustic softness properties are achievable at any of the levels of abaca incorporation from the Papermaking Examples (e.g., 65%, 40%, 20%) or even the lowest (5% abaca) or highest (100% abaca) ends of the claimed range. The entire 5-100% range is unexplored as far as the specification discloses, requiring experimentation to determine if a product incorporating every and any level of abaca is even capable of achieving the claimed acoustic softness properties.

[130] EX1001, 26:43-47.

191. In short, the ’475 Patent claims a wide range of abaca incorporation levels in sanitary tissue products but fails to provide any guidance about how to achieve the claimed acoustic softness properties at any level of abaca incorporation. In my opinion, this is insufficient to enable a person of ordinary skill in the art to make and use the full scope of the claimed invention.

4. The Relevant Field Is Unpredictable

192. Fiber selection alone cannot reliably predict many properties, including acoustic softness, in sanitary tissue products.[131] Multiple interacting variables such as fiber morphology (length, width, coarseness, flexibility, curl), sheet architecture (density, void volume, surface texture, fiber orientation), process conditions (forming consistency, refining energy, pressing pressure, structuring geometry, drying temperature and throughput), chemical treatments (wet-strength resins, debonders, softeners, lotions), and converting operations (embossing depth and pattern, ply-bonding adhesive type and pattern, calendering pressure) can impact a product’s resulting properties, including TS7 and TS750 measurements. Given the interconnected nature of all these variables, a change to any single variable can alter, e.g., acoustic softness properties in unpredictable ways. Empirical testing is simply

[131] *See supra* Section IV.C.

the only reliable way to determine the combination of variables that result in a sanitary tissue product with a particular acoustic softness measurement.

193. In particular, substituting one fiber for another, especially when the fibers are morphologically dissimilar, can have unpredictable consequences for the final sanitary tissue product.[132] For example, abaca is substantially different from bamboo. The differences between these fibers can impact many aspects of the papermaking process and resulting product—sheet formation, fiber-to-fiber bonding, sheet consolidation, surface smoothness, and compressibility. Each of these aspects can ultimately influence how the surface of the final product interacts with the blades of the Emtec TSA machine and the resulting TS7 and TS750 measurements.

194. Thus, the specification's data regarding bamboo would not make the acoustic softness properties of a sanitary tissue product incorporating abaca predictable. Again, bamboo and abaca are markedly different fibers, and abaca's high coarseness means that the fibers are larger and more rigid, resulting in a vastly different surface topography when incorporated into a tissue product. Without any data demonstrating that abaca-containing products can achieve the claimed acoustic

[132] EX1001, 8:49-64.

softness thresholds, it is uncertain whether the claimed invention would be achievable with abaca.

195. Finally, the specification's warning that abaca is "challenging" (without any explanation of how to overcome the challenges) makes it all the more unpredictable whether those challenges can be overcome to achieve the claimed acoustic softness thresholds in products containing abaca.

5. The Quantity of Experimentation Required Is Undue

196. In my opinion, the absence of working examples, the lack of guidance, and the overall unpredictability of acoustic softness properties in tissue products containing abaca makes the experimentation required to practice the full scope of the claims undue by any measure.

197. In order to practice the abaca embodiments of the claims, a person of ordinary skill in the art would, at minimum, need to (i) design a furnish composition of specific fibers and the relative amounts of each (ii) select an abaca source and preparation method (including the method of pulping and refining level) as well as sources and preparations for any additional fibers in the desired furnish; (iii) select papermaking process conditions (forming, pressing vs. TAD vs. hybrid drying, rush transfer, creping conditions); (iv) select chemical additives and application levels; (v) select a structuring approach (belt pattern, fabric type); (vi) produce a finished, converted product (embossing, ply-bonding, calendering); and then finally (vii)

measure TS7 and/or TS750 on the finished product. If the measured TS7 and/or TS750 values fell outside of the claims, then the most reasonable approach would be to adjust one of the many variables and repeat the process iteratively (without any guidance from the specification as to which variable to alter or how to alter it) until the claimed acoustic softness thresholds were achieved.

198. It is my opinion that the ’475 Patent merely invites exploration of whether it is even possible to achieve the claimed acoustic softness thresholds in sanitary tissue products containing abaca. At any iteration, a person of ordinary skill in the art would be left to guess whether a changed variable would move them closer or further from the claimed acoustic softness thresholds because the specification does not provide a single data point showing that any combination of variables produces an acceptable result with abaca. In my opinion, this level of experimentation, which is needed to practice the full scope of the claims, is undue.

199. Moreover, the experimentation required is substantial from a practical perspective. Each iteration would require a person of ordinary skill in the art to fabricate a tissue product all the way through pulp preparation through converting and then perform TS7 and TS750 testing on the resulting product. Fabrication at even a pilot scale is time-consuming and resource-intensive. The hundreds or even thousands of iterations required to map the abaca design space (without any real direction from the patent) is unreasonable and undoubtedly undue.

6. The Required Experimentation Is Not Routine

200. In my opinion, the experimentation required to practice the full scope of the claims goes well beyond routine optimization. While papermaking is a well-established field, routine experimentation presupposes a known-working starting point and a defined objective achievable through predictable adjustments. In my opinion, the '475 Patent provides neither of these conditions.

201. First, the specification does not provide any sanitary tissue product with a multi-layer ply containing abaca in every level that meets the claimed acoustic softness thresholds and so there is no known working starting point for a tissue product containing abaca. Indeed, the specification does not even provide a starting point of a sanitary tissue product with a multi-layer ply containing abaca in every level, *regardless* of its acoustic softness threshold,

202. A person of ordinary skill in the art would not be starting, as with some of the bamboo examples, with a known fiber composition and acoustic softness and then merely trying to adjust variables while maintaining that acoustic softness. For abaca, a person of ordinary skill in the art would hope that they could even make a multi-layer ply containing abaca in every level and even if they could, it would have unknown acoustic softness characteristics to which they would attempt to make iterative changes in order to approach the target acoustic softness properties.

203. Second, even the specification of the ’475 Patent presents the incorporation of abaca as “challenging” and presents a novel materials science challenge for the person of ordinary skill in the art to solve.[133] Solving that problem to achieve sanitary tissue products containing abaca in every layer is not routine, let alone a product which meet the claimed acoustic softness properties. Indeed, the inventors themselves did not appear to solve this problem, as I have explained in detail above.

204. Finally, achieving a particular TS7 or TS750 measurement is not a result that can be dialed in through single variable optimization given that these measurements are the integrate result of a wide array of interacting variables. In my opinion, multi-variable, high-dimensional optimization without a predictive model or empirical starting point is not “routine.”

7. The Level of Skill in the Art Cannot Overcome the Specification’s Deficiencies

205. While a person of ordinary skill in the art would possess knowledge and experience in papermaking, fiber science, and product characterization, I understand that the specification, and not the knowledge of one skilled in the art, that must supply the novel aspects of an invention for the claims to be enabled.

[133] EX1001, 26:43-47.

206. In my opinion, the "novel" aspect of the claimed invention is achieving the claimed acoustic softness thresholds in tissue product with a multi-layer ply that contains abaca fibers in every layer. A person of ordinary skill in the art would not be able to supply this novel aspect because: (i) the relationship between abaca fiber properties and acoustic outcomes is not generally established in the art; (ii) the conditions under which abaca products might achieve these specific thresholds are not disclosed in the art; and (iii) the specification itself acknowledges difficulty in incorporating abaca, suggesting this is not routine knowledge.[134] Indeed, if the manner of creating multilayer plies with abaca in every layer were within the general knowledge of the art, it is unlikely that the '475 Patent would have described the incorporation of abaca fibers as challenging as a person of ordinary skill in the art would have been able to accomplish it.

8. The Dependent Claims Are Not Enabled

207. For all the reasons discussed above with respect to the independent claims and the specification's failure to enable the full scope of those claims, it is my opinion that the dependent claims are also not enabled. While the dependent claims do introduce additional limitations, none of these limitations corrects the deficiencies in enablement.

[134] EX1001, 26:43-47.

a. Claims 3, 11, 17, and 25 (Toilet Tissue)

208. Limiting the product to toilet tissue format does not provide the missing guidance for achieving the claimed acoustic softness thresholds in any sanitary tissue product containing abaca in all layers.

b. Claims 4, 12, 18, and 26 (Greater than 30% Non-Wood Fibers)

209. Requiring more than 30% non-wood fiber content (over the independent claims' lower limit of 5%) directly implicates the specification's warning about abaca being "challenging (especially at higher incorporation levels)."[135] The undue experimentation required to practice the independent claims is therefore only compounded by this limitation.

c. Claims 10 and 24 (Structured Fibrous Structure)

210. The specification does not disclose any correlation between specific structuring approaches (e.g., specific fabric patterns) and achieving a TS750 of less than 45 dB V^2 rms when using abaca fibers. Papermaking Examples 9-13 disclose the use of different structured fabrics when making single layer tissue products

[135] EX1001, 26:43-47.

containing abaca, but there is no disclosure regarding whether any particular structure helps, hurts, or is irrelevant to acoustic softness characteristics.[136]

d. Claims 13, 14, 27, and 28 (Narrower TS750 Ranges)

211. These claims narrow the acoustic requirement to TS750 less than 40 dB V^2 rms (claims 13, 27) or from about 25 to about 35 dB V^2 rms (claims 14, 28). Given that it is my opinion that the specification fails to enable the broader TS750 less than 45 dB V^2 rms threshold in products containing abaca in every layer, it is my opinion that the specification cannot enable these even more stringent sub-ranges. Dialing the TS750 measurement down and into a tighter target range would require more precise control of process variables, more specific guidance, and more demonstration of feasibility—none of which the specification provides for tissue products comprising abaca in every layer.

9. Conclusion

212. The ’475 Patent provides no working examples demonstrating that *any* multi-layer product with abaca in every layer achieves the claimed acoustic softness thresholds, there is no meaningful guidance for a person of ordinary skill in the art

[136] EX1001, 58:53-56 (Papermaking Example 9), 58:57-60 (Papermaking Example 10), 58:61-64 (Papermaking Example 11), 58:65-67 (Papermaking Example 12), 59:1-3 (Papermaking Example 13).

to determine how to achieve those acoustic softness thresholds in products containing abaca in every layer, and no basis for predicting whether the claimed acoustic softness results are even attainable with abaca-containing products.

213. It is therefore my opinion that the specification of the ’475 Patent fails to enable a person of ordinary skill in the art to make and use the full scope of the Challenged Claims for products containing abaca in every layer.

VII. CONCLUSION

214. For the reasons set forth above, it is my opinion that Claims 1, 3, 4, 9, 10-14, 15, 17, 18, 23, and 24-28 of the ’475 Patent lack adequate written description and fail to enable the full scope of the claims.

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

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

October 5, 2026
Dated

D. Steven Keller, Ph.D.