UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CLEARWATER PAPER CORPORATION,
Petitioner

v.

GRAPHIC PACKAGING INTERNATIONAL LLC,
Patent Owner

Case IPR2025-00878
U.S. Patent No. 8,637,126

DECLARATION OF DR. KARL ENGLUND

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I, Dr. Karl Englund, declare as follows:

I. INTRODUCTION

1. I have been retained by Lee & Hayes, P.C. as a technical expert for Clearwater Paper Corporation ("Clearwater" or "Petitioner"), who is the Petitioner in an *Inter Partes* review before the United States Patent and Trademark Office involving U.S. Patent No. 8,637,126 ("the '126 Patent," EX1001), which I understand has been assigned Case Number IPR2025-00878.

2. Specifically, I have been retained as an independent expert consultant by Petitioner to provide my opinions on the technology claimed in, and the patentability of claims 1-3 and 11 ("the challenged claims") of the '126 Patent. Although I am being compensated at my usual rate of $350 per hour for the time I spend on this matter, no part of my compensation depends on the outcome of this proceeding, and I have no financial interest in any of the parties. I have no affiliation with either party in this case besides having been retained as an independent consultant in this matter.

3. I have personal knowledge of the facts and matters in this declaration and believe them to be true.

II. BACKGROUND AND QUALIFICATIONS

4. My *curriculum vitae*, which I understand has been attached as EX1004 in this proceeding, provides full description of my background and technical

qualifications, as well as a list of publications that I have authored. In the following paragraphs I provide a brief overview of my background and qualifications relevant to this matter.

5. I received a B.S. in Forestry (1988) and an M.S. in Wood Science (1991) from West Virginia University and Ph.D. in Civil Engineering (2001) from Washington State University. I then remained at Washington State University as a Post-Doctoral Research Associate in the Wood Materials and Engineering Lab from 2001-2003.

6. I am a Professor at Washington State University. After finishing my post-doctoral position, I became a Research Engineer and Technical Director of Composites in the Wood Materials and Engineering Lab in 2004. In 2007, I became an Assistant Research Professor and Extension Specialist in the Composite Materials & Engineering Center. In 2014, I was promoted to a position as an Associate Research Professor within the Composite Materials & Engineering Center. In 2022, I was promoted to my current position as a Research Professor at the Composite Materials and Engineering Center.

7. My research is focused on polymer and natural fiber composite processing, and the evaluation of structural and physical performance of composite materials. In my career of over thirty years in this field, I have gained extensive experience in thermoplastic processing. My relevant expertise includes applied

research, material characterization, product development, commercialization, and problem solving with regard to markets, processing options, contamination, policies, procedures, and education.

8. Paper is a natural fiber composite, made usually in a wet lay-up with pulp cellulose. Much of the work I have performed in my research has been with the mechanical refinement of natural fiber. Although my research is not specifically in the field of paper, I have done quite a bit of research related to capping or laminating thin films on wood-based composites. Also, I have extensive work with biopolymers and am currently the WSU site director for the Center for Bioplastics and Biocomposites, which is an NSF I/UCRC with over 20 industry members.

9. I have served on many professional committees and supported professional organizations. For example, I am currently the Chair of the Advisory Board for the Recycling Development Center in the Washington State Department of Ecology and Chair of the Washington State University Intellectual Property Committee. In the past, I have served on the Advisory Board of the King County Solid Waste Carpet Recovery Program and the Composites Advisory Committee for Peninsula College, as well as the Education Committee for the Washington State Recycling Association, and served on search committees for faculty appointments. I have also been involved in Conference Session Planning and served as a Conference Session Moderator for the American Chemical Society, Building

Materials Reuse Association, Forest Products Society, and the WSU International Wood Composite Symposium. I have served as Reviewer for the National Science Foundation (NSF), Department of Energy (DOE), U.S. Department of Agriculture (USDA), Ontario Research Fund, Swiss National Science Foundation, Natural Sciences and Engineering Research Council of Canada (NSCERC), WSU Seed Grant, Christian Doppler Research Association, and The World Academy of Sciences (TWAS).

10. I have served as a Technical Reviewer for numerous journals, including FOREST PRODUCTS JOURNAL, COMPOSITES PART A, JOURNAL OF APPLIED POLYMER SCIENCE, JOURNAL OF THERMOPLASTIC COMPOSITE MATERIALS, WOOD AND FIBER SCIENCE, JOURNAL OF ZHEJIANG UNIVERSITY – SCIENCE B, MATERIALS TODAY, JOURNAL OF POLYMERS AND THE ENVIRONMENT, BIORESOURCES, MADERAS, THERMOCHIMICA ACTA, TRIBIOLOGY TRANSACTIONS, JOURNAL OF WOOD CHEMISTRY AND TECHNOLOGY, EUROPEAN POLYMER JOURNAL, FUEL PROCESSING TECHNOLOGY, JOURNAL OF BIOBASED MATERIALS AND BIOENERGY, and JOURNAL OF COMPOSITE MATERIALS.

11. I have authored or co-authored 63 refereed publications in the field, and have 6 patents and 2 book chapters. I have also provided over 63 oral presentation and 25 poster presentations.

12. In concert with my work at WSU, I have also been the technical expertise for a start-up company, Innovexx USA, that looks to recycle wind turbine blade and other thermoset glass fiber composite materials. My reach within this organization has been as a material breakdown, processing and composite expert, sales and marketing and product performance and compliance. I have also assisted our team with many investor relationship strategies.

In the previous five years, I have consulted as a technical expert and/or testified as a technical expert witness in the following legal matters:

- *Recycled Plastics Industries, LLC f/k/a Recycled Plastics Industries, Inc. v. Tangent Technologies, LLC*, IPR2024-00898 (PTAB May 8, 2024)
- During the last 5 years, I provided expert consulting related to physical and structural properties of plywood, and have consulted with composite manufacturers to improve their product output and quality.

III. MATERIALS CONSIDERED

13. In forming my opinions expressed in this declaration, I have considered, among other things, the following documents. I confirm that to the best of my knowledge the accompanying exhibits are true and accurate copies of what they purport to be, and that an expert in the field would reasonably rely on them to

formulate opinions such as those set forth in this Declaration. I understand the documents have been given the following exhibit numbers in this proceeding:

Exhibit	Description
1001	U.S. Patent No. 8,637,126 ("the '126 Patent")
1002	File History of the '126 patent
1005	U.S. Patent Application Publication No. US 2006/0051603 A1 to Cleveland ("Cleveland")
1006	U.S. Provisional Application No. 60/608,258 to Cleveland ("'258 Provisional")
1007	Japanese Patent Application Publication No. JP H6-62944 A to Nakagawa
1008	Certified Translation of Japanese Patent Application Publication No. JP H6-62944 A to Nakagawa
1009	U.S. Patent No. 5,213,858 to Tanner ("Tanner")
1010	All About Wax Coated Packaging, dated June 6, 2021 (downloaded from https://blendedwaxes.com/blog/all-about-wax-coated-packaging/)
1011	U.S. Patent Application Publication No. US2005/0008800 A1 to Andersson ("Andersson")
1012	U.S. Patent No. 6,183,814 to Nangeroni ("Nangeroni")
1013	U.S. Patent No. 3,984,940 to Reich ("Reich")
1014	U.S. Patent No. 6,040,063 to Doane ("Doane")
1015	U.S. Patent No. 6,025,028 to Asrar ("Asrar")
1016	U.S. Patent No. 6,645,584 B1 to Kuusipalo ("Kuusipalo")
1017	Japanese Unexamined Patent Application Publication No. JP 2003-13391 A to Yamawaki ("Yamawaki") and Certified Translation of Yamawaki
1018	U.S. Patent Application Publication No. 2004/0014883 A1 to Yamamoto ("Yamamoto")

Exhibit	Description
1019	Eastar Bio/Ecoflex Wikipedia page (https://en.wikipedia.org/wiki/Polybutylene_adipate_terephthalate) and ecoflex® - Certified Compostable Plastic brochure (downloaded from https://plastics-rubber.basf.com/global/en/performance_polymers/downloads#%7B%220%22:%5B%5B%22productId%22,%5B%228a8082c97eaf959c017ec37846992be7%22%5D%5D%5D%7D)
1020	Frederick Trinh Tan *et al*., *Biodegradation of a synthetic co-polyester by aerobic mesophilic microorganisms*, 93 Polymer Degradation & Stability, 1479-1485 (August 2008).
1021	Gaurav Kale *et al*., *Compostability of Bioplastic Packaging Materials: An Overview*, 7 Macromolecular Bioscience, 255-277 (March 2007).
1022	ASTM D6400 – 23: Standard Specification for Labeling of Plastics Designed to be Aerobically Composted in Municipal or Industrial Facilities
1023	ASTM D6868 – 21: Standard Specification for Labeling of End Items that Incorporate Plastics and Polymers as Coatings or Additives with Paper and Other Substrates Designed to be Aerobically Composted in Municipal or Industrial Facilities
1024	Ariagna L. Rivera-Briso and Ángel Serrano-Aroca, *Poly(3-Hydroxybutyrate-co-3-Hydroxyvalerate): Enhancement Strategies for Advanced Applications*. 10 Polymers, 732 (July 2018).
1025	Biomax PlasticsNet page (https://www.plasticsnet.com/doc/dupont-biomax-0001)

14. In forming my opinions, I have also relied on my education and experience.

IV. RELEVANT LEGAL STANDARDS

15. I am not an attorney. My analysis and opinions are based on my background and expertise in this technical field, as well as the instructions I have been given by counsel for the legal standards relating to patentability.

16. I have been informed by counsel for Petitioner that the following legal principles may apply to analysis of patentability based on pre-AIA 35 U.S.C. §§ 102 for anticipation and 103 for obviousness. I have also been informed that, in an *inter partes* review proceeding such as this one, a patent claim is unpatentable if it is shown by a preponderance of the evidence that the claim would have been anticipated by a prior art patent or publication, or obvious by one or more properly combined prior art patents or publications.

A. Level of Ordinary Skill in the Art

17. I have been instructed to consider patentability of the Challenged Claims through the lens of a person of ordinary skill in the art ("POSITA") at the time of the claimed priority date of the '126 Patent—February 6, 2006. I am familiar with the level of ordinary skill in the subject matter of the '126 Patent in 2006.

B. Anticipation

18. I have been informed a patent claim is unpatentable as anticipated under 35 U.S.C. § 102 if every limitation of the claimed invention is found in a single prior art reference--either expressly or required through inherency--as arranged in the claim.

C. Obviousness

19. I have been informed that, even if a single prior art reference does not disclose each and every element of a patent claim, the patent claim is still

unpatentable as obvious under 35 U.S.C. § 103. It is my understanding that a claimed invention is unpatentable as obvious over a combination of prior art references if the differences between the claimed invention and the prior art are such that a POSITA would have found the subject matter as a whole obvious.

20. I understand that obviousness is determined by evaluating: (1) the scope and content of the prior art, (2) the differences between the prior art and the claim, (3) the level of ordinary skill in the art, and (4) any secondary considerations of non-obviousness. To establish obviousness based on a combination of the elements disclosed in the prior art, it is my understanding that a challenger must provide a clear articulation of the reason(s) why the claimed invention would have been obvious. I understand this articulation may, but does not necessarily, require record evidence of an explicit teaching, suggestion, or motivation to combine the prior art in the way recited in a patent claim. Rather, prior art may be combined based on an express teaching, suggestion, or motivation from the prior art itself, or from a reasoned explanation of an expert witness or some other rationale.

21. For example, it is my understanding that this articulation can come from a number of rationales, which include but are not limited to (1) combining prior art elements according to known methods to yield predictable results; (2) simple substitution of one known element for another to obtain predictable results; (3) use of known technique to improve similar devices, methods, or products in the same

way; (4) applying a known technique to a known device, method, or product ready for improvement to yield predictable results; (5) choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success, e.g., the combination is "obvious to try"; (6) known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations are predictable to one of ordinary skill in the art; and (7) some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed limitation.

22. I further understand that these rationales may be found explicitly or implicitly: (1) in the prior art; (2) in the knowledge of those of ordinary skill in the art that certain references, or disclosures in those references, are of special interest or importance in the field; and/or (3) from the nature of the problem to be solved.

23. Additionally, I understand that the legal determination of the motivation to combine references allows recourse to logic, judgment, and common sense. For example, in order to resist the temptation to read into prior art the teachings of the '126 Patent, the expert should avoid conflating "common sense" with what appears obvious in hindsight. I understand that if the teachings of a prior art would lead a POSITA to make a modification that would render another prior art device inoperable, then such a modification may not be obvious. I also understand

that if a proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there may be no suggestion or motivation to make the proposed modification.

D. Claim Construction

24. Counsel has instructed me that, in this proceeding, the words of a claim are to be given their plain and ordinary meaning, which the meaning understood by a person of ordinary skill in the art after reading the entire patent. This analysis focuses on how the patentee used the claim term in the claims, specification, and prosecution history. Dictionaries or extrinsic sources may assist in determining the plain and ordinary meaning, but extrinsic evidence cannot override a meaning that is unambiguous from the intrinsic evidence.

25. In my opinion, no claim terms require express construction for purposes of evaluating the Grounds in my Declaration.

V. U.S. PATENT NO. 8,637,126

A. Background

26. Paper is a common base material for food packaging, such as cups, but paper has undesirable physical limitations such as "porosity to deleterious liquids or gases" and a lack of "tear resistance." EX1001, 1:15-18. To overcome these limitations, the '126 Patent explains it was conventional practice to laminate the

paper material with polymeric materials—typically low-density polyethylene (LDPE). *Id*., 1:19-35.

27. While paper is biodegradable, the LDPE coating is not, so an LDPE-coated paper "cup might remain in a landfill for many years without degrading." *Id*., 1:45-49. But the '126 Patent admits this was a known problem with a known solution: replace the non-degradable LDPE with a biodegradable polymer. *Id*., 1:49-51 ("The use of one or more biodegradable polymers instead of LDPE is desirable to render the used cups more 'environmentally friendly'.") The '126 Patent also acknowledges that such biodegradable polymers were known, including "polylactic acid (PLA) and "polyhydroxyalkanoates (PHA)." *Id*., 2:10-12. The purported invention of the '126 Patent merely replaced a known non-biodegradable material (LDPE) with a known biodegradable polymer (PLA or PHA).

28. When laminating a coating material to a paper substrate, the amount or thickness of the coating material is referred to as the "coat weight." *See* EX1001, 1:43-55, 2:52-54, 2:62-3:2, 3:12-14. An industry standard unit for describing the coat weight is pounds per 3,000 ft^2—the total surface area of a 24" x 36" ream of paper (250 sheets). This industry standard unit informs as to the amount in pounds of the coating material to be used for a ream of paper substrate. *See* EX1001, 1:43-44, 1:61-62; EX1009, 2:57-60; EX1010, 1.

29. For example, as acknowledged in the '126 Patent, 7.2-21.6 lbs./3000 ft^2 coat weights of LDPE were common for paper cups. EX1001, 1:40-44. In other words, it was known in the art to use between 7.2-21.6 lbs. of LDPE to coat an entire ream of paper substrate, which is then cut up and molded into paper cups. This known coat weight range falls completely within the '126 Patent's claimed range of 5 to 30 lbs. *Id*., claim 1.

B. Prosecution History

30. I understand that the '126 Patent was filed as Application No. 11/348,150 on February 6, 2006. EX1002, 1. It does not claim the benefit of any prior filings.

31. I understand that as originally filed, the application had 73 claims. *Id*, 15-30. On July 16, 2008, a restriction requirement was issued, as the Examiner had identified two claimed inventions: a laminate with oxygen barrier properties (claims 1-58), and a method for making biodegradable paper products (claims 59-73). EX1002, 260-267. Further, the Examiner identified several purportedly patentably-distinct species within the claim set. *Id*., 264. Applicant ultimately elected the species as defined by claims 1-35, 38 and 41-43 for prosecution—a laminate comprising a polymeric protectant layer, moisture protective layer, and degradable tie layer. EX1002, 281-282 (Dec. 30, 2008).

32. Following the Applicant's election, prosecution continued for five years, with extensive back-and-forth between the Applicant and the Examiner. Throughout the numerous office actions, Examiner repeatedly rejected the pending claims based on twelve different prior art references in various combinations. EX1011-EX1018. The primary areas of dispute during prosecution related to (1) degradability of the moisture protectant layers, (2) the coat weight of the moisture protectant layers, (3) the lack of an intervening layer between the moisture protectant layer and the paperboard substrate, and (4) the inclusion of a filler, such as calcium carbonate or starch, in the moisture protectant layer. Petitioner summarizes the prosecution history for each subject below.

1. Degradability of the moisture protectant layers.

33. I understand that as originally claimed, the '126 Patent required the use of a "degradable" materials for the various layers of its laminate. EX1002, 15-26. The Examiner first cited U.S. Patent Application Publication No. US2005/0008800 (EX1011, "Andersson") as disclosing a degradable polyethylene. EX1002, 285. In response, the Applicant argued that the polyethylene disclosed by Andersson, and other "normal" polyethylenes, are not degradable under Applicant's proposed definition:

> Degradability is defined as a >75-80% loss in molecular weight (MWT) in a relatively short amount of time (<9

> months) due to exposure to oxygen, water, and microbes in the environment. This process is the same as the degradation of other organic materials like food waste. Normal polyethylene is not considered to be degradable because it might take tens to hundreds of years to achieve the >75% loss in molecular weight. Standards and definitions for degradability are contained in ASTM D6400, ASTM D6868, and ASTM D5511. More specifically, degradable polyethylene is defined in ASTM D3826.

Id., 306.

34. In response to a subsequent office action, the Applicant argued that the degradable polymer disclosed in U.S. Patent No. 3,984,940 (EX1013, "Reich") was unsuitable for the purposes of the claimed invention because it degrades in sunlight instead of being biodegradable. *Id*., 330. The Examiner rejected this argument, as the pending claims did not delineate between "biodegradable" and "degradable." *Id*., 340-341. Applicant then amended the claims to specify that the polymers must be "biodegradable" – not just "degradable." *Id*., 345. As to the subsequent office action rejections, Applicant did not contest that the Examiner's cited prior art references taught biodegradable polymers.

2. Coat weight of the moisture protectant layers.

35. I understand that the Examiner repeatedly stated that although the prior art references it cited did not disclose the coat weight, it would have been obvious for one of ordinary skill in the art to use the claimed coat weight depending on the desired weight of the packaging. *See, e.g.*, EX1002, 286-287, 314, 381-382, 891, 1063-1064. The Applicant repeatedly argued that Examiner's statements were conclusory and unsupported. *See, e.g., id*. at 400, 907-908, 1016. Applicant argued that Examiner's statement that the coat weight would have been obvious must have been based on Examiner's personal knowledge, which was not provided to the Applicant, and therefore requested an affidavit/declaration under 37 C.F.R. § 1.104(d)(2) supporting the Examiner's purported personal knowledge. *See, e.g., id*. at 437, 439, 669-670, 673, 700, 705, 1016-1017, 1054-1055. The Examiner never provided an affidavit/declaration regarding their personal knowledge on the issue of coat weights, nor did they concede that it would not have been obvious for one of ordinary skill in the art to use the claimed coat weight depending on the desired weight of the packaging.

36. In the last office action rejection, the Examiner cited Japanese Patent No. JP 2003-13391 (EX1017, "Yamawaki") as disclosing the claimed coat weight. EX1002, 1092-1093. The Applicant argued that the coating weight disclosed in Yamawaki (5 to 30 g/m^2) was not equivalent to the claimed coating weight of 5 to

30 lbs./3000 ft^2. *Id*., 1135. The Applicant did not explain why the coating weights were not equivalent. This is of particular note as simple conversion of the coat weight disclosed in Yamawaki from g/m^2 to lbs./3000 ft^2 proves that the coat weight disclosed by Yamawaki (3.07 to 18.42 lbs./3000 ft²) overlaps significantly with the claimed coat weight (5 to 30 lbs./3000 ft²).[1] The Examiner subsequently allowed the claims, in part based on the prior art failing to disclose "a coat weight of from 5 to 30 lbs/3000 ft^2." EX1002, 1151.

3. Lack of intervening layer between the moisture protectant layer and the paperboard substrate.

37. I understand that near the end of the prosecution of the '126 Patent, the Applicant amended the claims so that the moisture protectant layers were "coated directly" on the interior and exterior surfaces of the substrate. EX1002, 1076. Examiner cited the combination of Yamawaki (EX1017) and U.S. Patent No. 6,645,584 (EX1016, "Kuusipalo") as disclosing the moisture protectant layers being coated directly on the substrate. *Id*., 1092-1093. The Applicant argued in response

[1] To convert g/m^2 into lbs./3000 ft^2, merely multiply the weight in pounds by 453.592 to get grams (1 lb. = 453.592 g) and multiply the square area by 278.709 (3000 ft^2 = 278.709 m^2). Simplified, **g/m^2 ≈ lbs./3000 ft^2 x 0.614** (Or g/m^2 ≈ lbs./3000 ft^2 / 1.628).

that Kuusipalo requires an intervening adhesive layer, therefore it does not teach coating the moisture protectant layer directly on the substrate. *Id*., 1136. The Examiner subsequently allowed the claims, in part based on the prior art failing to disclose the moisture protectant layers being "coated directly" the interior and exterior surfaces of the substrate. EX1002, 1151.

4. Filler content in the moisture protectant layer.

38. I understand that the Examiner cited several references as disclosing the use of a "filler," including specifically "calcium carbonate," in the moisture protectant layers. *See, e.g.,* EX1002, 381-382 (citing U.S. Patent No. 6,040,063 (EX1014, "Doane")), 411-412 (citing U.S. Patent No. 6,025,028 (EX1015, "Asrar")), 1034-1035 (citing U.S. Patent Application Publication No. 2004/0014883 (EX1018, "Yamamoto")), 1063-1064 (citing U.S. Patent No. 6,183,814 (EX1012, "Nangeroni")). Applicant's arguments against these "filler" references had the same theme: the disclosed uses of calcium carbonate were not as fillers but for other (non-filler) purposes.

39. Regarding Doane, Applicant argued the calcium carbonate was used as a "nucleating agent" for preparing a "foam." EX1002, 398-399, 663-665. Similarly, Applicant argued that Asrar taught using calcium carbonate to "improve nucleation activity." *Id*., 432. As to Yamamoto, Applicant conceded disclosure of a filler, but argued that the "reasons for incorporating" calcium carbonate as a filler in the

polyester film were "completely unstated." *Id*., 1056. Finally, for Nangeroni, Applicant argued that the purported filler was instead described as "a pigment." *Id*., 1139. The Examiner subsequently allowed the claims, but did not address the filler element in the statement of reasons for allowance. EX1002, 1151.

C. Petitioner's Prior Art Undercuts the Examiner's Reasons for Allowance.

40. I understand that per the Examiner's statement of reasons for allowance, the '126 Patent was allowed because:

> The prior art of record…fails to disclose a product in the form of a cup comprising a laminate comprising a paperboard substrate having an interior facing surface and an exterior surface, a first moisture protectant layer coated directly only on the interior surface and comprising at least one biodegradable polyester polymer having a coat weight of from 5 to 30 lbs/3000 ft^2 and a second moisture protectant layer coated directly only on the exterior surface comprising at least one biodegradable polyester polymer having a coat weight of from 5 to 30 lbs/3000 ft^2.

EX1002, 1151. In my opinion, the Petitioner presents prior art that (1) was not considered by the Examiner, and (2) discloses exactly what the Examiner based the allowance of the '126 Patent on. Thus, the Board should accept this Petition and not use its discretion under 35 U.S.C. § 325(d) to deny the Petition.

41. Petitioner presents Cleveland, Nakagawa, and Tanner, each of which I understand to be prior art known in the field before the effective filing date of the '126 Patent, and none of which were cited or considered by the Examiner during prosecution.

42. Cleveland, filed on September 7, 2005, discloses a paper-based substrate having moisture-protectant layers laminated on both sides, without intervening adhesive layers:

> biodegradable laminate suitable for use in shaped paper-based articles such as containers for liquid or solid… comprising a paper-based substrate having first and second copolyester layers deposited onto at least one surface of the substrate, in the substantial absence of intervening polymer layers between the substrate surface and the copolyesters deposited on the substrate surface.

EX1005, Abstract.

43. Nakagawa, filed on August 24, 1992, discusses an invention that "relates to a paper cup that is laminated with plastic. More specifically, it relates to a biodegradable paper cup" where a cup made of paper "is laminated with plastic on at least one side or both sides of the paper." EX1008, ¶¶[0001], [Claim 1].

44. Further, Tanner, which I understand to be a continuation of an application filed on April 4, 1990, discusses a "biodegradable paperboard-based

laminate structure for producing a degradable paperboard-based package" that comprises "a paperboard substrate having an interior side and an exterior side" with "biodegradable polymer resin applied on said exterior side of said paperboard substrate." EX1009, 5:1-12.

45. As an additional note, I understand that both Cleveland and Tanner were each originally assigned to International Paper Co., which is the same company that originally filed the '126 Patent. Cleveland shares two of the same inventors as the '126 Patent. I understand that neither Cleveland nor Tanner was cited in an Information Disclosure Statement during or after prosecution of the '126 Patent, as required by 37 C.F.R. § 1.56. EX1002, 59-64.

46. As another example of Petitioner's arguments being substantially different from those considered during prosecution, in the "Remarks/Arguments" section of Applicant's Response to a Final Office Action dated July 13, 2013 (Applicant's final Response filed in prosecution), Applicant asserted that the Office Action,

> **mischaracterizes** what **Yamawaki et al.** fairly teaches in paragraph 0022 regarding the coating amount of its biodegradable resin. What **Yamawaki et al.** teaches in paragraph 0022 is that coating amount is "*preferably 5 to 30* ***g/m²***." By contrast, amended Claim 76 recites that the coat weight for each of the first and second moisture

> protectant layers is from 5 to 30 **lbs./3000 ft^2.** Nowhere does [the Office Action] show how the coating amount disclosed in paragraph 0022 of **Yamawaki et al.** is equivalent to or even comparable to the coating weight recited for each of the first and second moisture protectant layers of amended Claim 76.

EX1002, 1135 (emphasis in original; italics added)[2].

47. For context, the claimed coat weight unit of pounds per 3000 ft^2 in the '126 Patent is an ordinary Imperial unit of measurement in the art, expressed as a weight (mass) per area. The same ordinary measurement in a metric system of measurement is g/m^2, also expressed as a weight (mass) per square area. In other words, lbs./3000 ft^2 and g/m^2 represent the same concept of coat weight applications, the former under an Imperial system and the latter under a metric system. Converting between the two is mathematically simple. To convert g/m^2 into lbs./3000 ft^2, merely multiply the weight in pounds by 453.592 to get grams (1 lb. = 453.592 g) and multiply the square area by 278.709 (3000 ft^2 = 278.709 m^2). Simplified, **g/m^2 ≈ lbs./3000 ft^2 x 0.614** (Or g/m^2 ≈ lbs./3000 ft^2 / 1.628).

[2] Emphasis added unless otherwise noted.

48. Applicant's assertion that Yamawaki's coat weight "preferably [between] 5 to 30 g/m^2" is "not equivalent to or even comparable to" the claimed coat weight recited for each of the first and second moisture protectant layers is incorrect and misleading. A simple conversion of Yamawaki's disclosed coat weight of 5 to 30 g/m^2 to imperial units results in a disclosed coat weight of 3.07 to 18.42 lbs./3000 ft^2. This falls within the claimed range of the '126 Patent. To the extent the Examiner relied on this argument in issuing the allowance, this was in error.

49. In my opinion, the Examiner apparently did not appreciate that the '126 Patent claims recited little more than applying a known polymer material in a known coat weight to the inside and the outside of a paper cup, or did not have the proper prior art references to demonstrate it. Had the Examiner appreciated the pertinent disclosures of the cited references, considered the uncited references introduced in this Petition, or been aware of the context surrounding the units claimed (metric) and differentiated from (Imperial), it is my opinion that the '126 Patent claims would not have issued.

D. The Level of Ordinary Skill in the Art

50. A person of ordinary skill in the art ("POSITA") at the time of the priority date of the '126 Patent would have at least a bachelor's degree in mechanical or chemical engineering, materials science, polymer science, or equivalent coursework, at least a year of experience developing paper-based laminates

involving the extrusion coating, lamination, or other application of polymer coatings to a substrate, and the appropriate industry knowledge of or familiarity with biodegradability standards and degradability techniques. Less work experience may be compensated by a higher level of education, such as a master's degree, and vice versa.

51. Based on my qualifications discussed above, I qualified at least as a POSITA of the '126 Patent by 2001.

52. My analysis below considers how a POSITA would have understood the references listed above with respect to the Challenged Claims of the '126 Patent.

VI. CLAIM CONSTRUCTION

53. Counsel has informed me that the claim construction standard defined in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) applies to this proceeding. 37 C.F.R. § 42.100(b). Under this standard, I am told, words in a claim are given their plain meaning, which is the meaning understood by a person of ordinary skill in the art after reading the entire patent, including the claims, specification, and prosecution history. *Phillips*, 415 F.3d at 1312-13. For purposes of this declaration, I have applied the plain meaning of the claim terms. However, I reserve the right to propose constructions if requested by the Board, raised by the Patent Owner, or if a related litigation is filed.

VII. GROUND 1: CLEVELAND ANTICIPATES CLAIMS 1-3 AND 11

A. Cleveland

54. It is my opinion that Cleveland anticipates claims 1-3 and 11. Below are my opinions regarding how Cleveland anticipates each element for claims 1-3 and 11.

1. Overview

55. It is my opinion that Cleveland is analogous art to the '126 Patent because it relates to the same field of endeavor – biodegradable laminated paper cups. Cleveland relates to "a biodegradable paper-based laminate" for use with "shaped paper-based articles such as containers for liquid or solid, hot or cool, food products." EX1005, Abstract; EX1006, 2. Cleveland's biodegradable paper-based laminate comprises "a paper-based substrate having first and second copolyester layers deposited onto at least one surface of the substrate, in the substantial absence of intervening polymer layers between the substrate surface and the copolyesters deposited on the substrate surface." EX1005, Abstract; EX1006, Abstract.

2. Dynamic Drinkware Analysis

56. Counsel has informed me that in a *Dynamic Drinkware* analysis, first, a patent challenger must demonstrate that the provisional application's written description provides support for the claims of the later patent or patent application.

Second, a petitioner must show that the subject matter relied upon for prior art was effectively filed in the provisional application. *Id*.

a. The Cleveland Provisional's written description supports at least one claim of Cleveland

57. It is my opinion that the Cleveland Provisional's written description is virtually identical to that of Cleveland itself. *Compare* EX1005 *with* EX1006. I provide the below chart to demonstrate that the Cleveland Provisional's written description supports at least claim 1 of Cleveland:

Claim Element	'258 Provisional's Disclosure
[1.pre] A biodegradable laminate, comprising:	"**A biodegradable laminate** suitable for use in containers for liquid or solid, hot or cool, food products." EX1006, 2; *see also id*., 3 ("the present invention provides a biodegradable laminate.").
[1.1] a paper-based substrate	"A biodegradable laminate…comprising **a paper-based substrate**." EX1006, 2; *see also id*., 3 ("the substrate 12 of the laminate comprises **paper**, commonly a **paper-based stock** known as SBS cupstock or SUS (natural) kraft folding carton board), 4 ("In a preferred embodiment, the paper-based substrate of the laminae…"), 5 ("there is applied to at least one flat surface of the **paper-based substrate**…"), 6 ("the coextrusion is applied to the … **paper-based substrate**.").

Claim Element	'258 Provisional's Disclosure
[1.2] having laminated thereto at least one layer of a first copolyester and at least one layer of a second copolyester;	"A biodegradable laminate…comprising a paper-based substrate **having first and second copolyester layers coextruded onto at least one surface of the substrate**." EX1006, 2; *see also id*., 4 ("the laminate of the present invention includes…**a first copolyester** 26 and **a second copolyester** 28."), 5 ("in a preferred embodiment…a paper-based substrate is provided on one flat surface thereof with a coextruded layer of **Ecoflex** and **Biomax**.").
[1.3] said layers being deposited onto at least one surface of said substrate,	"A biodegradable laminate…comprising a paper-based substrate having first and second copolyester layers coextruded **onto at least one surface of the substrate**." EX1006, 2; *see also id*., 5 ("in a preferred embodiment…**a paper-based substrate is provided on one flat surface thereof** with a coextruded layer of Ecoflex and Biomax.").
[1.4] wherein a first layer is an inner layer providing adhesion to the paper-based substrate,	"…the coextrusion of two copolyesters provides multiple benefits. For example, Eastar Bio and Ecoflex adhere well to paper, resulting in 100% fiber tear… Thus, in the present invention, **the Eastar Bio or Ecoflex layer of the coextrusion is disposed directly adjacent to the paperboard substrate to gain good adhesion**." EX1006, 9.

Claim Element	'258 Provisional's Disclosure
[1.5] and a second layer is an outer layer preventing chill roll sticking and blocking in the roll and providing greater thermal stability compared to said first layer.	"Further, it has been found that use of either of the copolyesters as **a monolayer** in a laminate for biodegradation purposes **typically requires slip/antiblock additive packages to prevent chill roll sticking and blocking in the roll** of finished laminate… Employing **a coextrusion of the noted copolyesters has been found effective in overcoming the shortcomings of the copolyesters** when applied as a monolayer." EX1006, 6. "…the coextrusion of two copolyesters provides multiple benefits…Biomax has a significantly higher melting point than either Eastar Bio or Ecoflex…so that the positioning of the **Biomax as the outermost layer of the laminate** in contact with the hot food product **allows a container formed from the laminate to better withstand deterioration and softening of the coating** by the hot food product." EX1006, 9.

b. The subject matter relied upon was effectively filed in the '258 Provisional

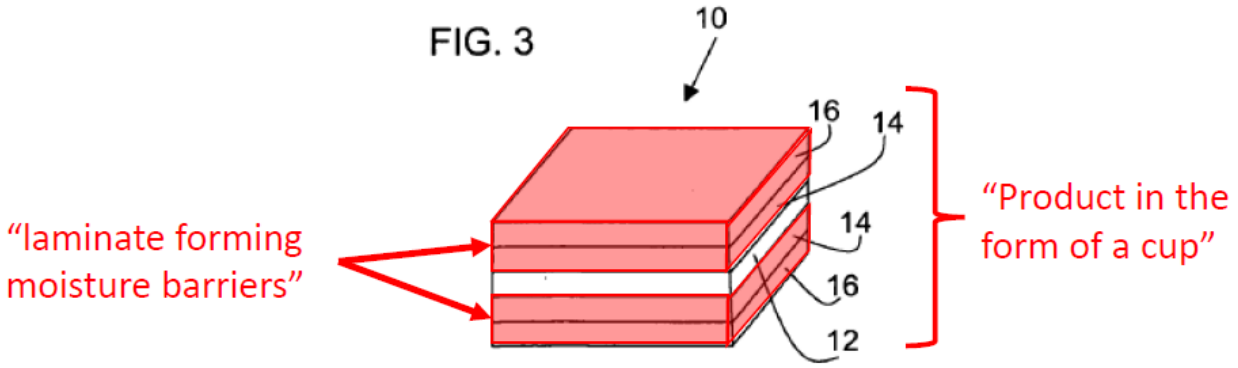
58. For Ground 1, I rely on Cleveland's disclosure as anticipating claims 1-3 and 11 of the '126 Patent. *Infra* Sections VII.B-E. This subject matter was

effectively filed in the Cleveland Provisional, as evidenced by my parallel citations to both Cleveland and the Cleveland Provisional. *Infra* Sections VII.B-E.

B. Independent Claim 1

1. [1.pre] "A product in the form of a cup comprising a laminate forming moisture barriers, said laminate comprising:"

59. To the extent the preamble is limiting, it is my opinion that Cleveland discloses this element. Specifically, Cleveland discloses *a product* (paper-based biodegradable laminate 10) *in the form of a cup* (paper-based drinking cup) *comprising a laminate forming moisture barriers* (coextruded biodegradable laminate 14, 16):



Cleveland, FIG. 3*[3]

60. The coextruded "biodegradable laminate [is] suitable for use…containers for liquid or solid, hot or cool, food products." EX1005, Abstract;

[3] I identify annotated or otherwise modified Figures with "*".

EX1006, 2. Such containers include "paper-based cup[s]." EX1005, ¶[0019], claim 17 ("biodegradable shaped article" can be a "cup[]"); EX1006, 4. Because the biodegradable laminate is intended for paper-based cups or other containers, the laminate must act as a moisture barrier "in order to hold liquids for a longer period of time without leaking or becoming soft." EX1005, ¶[0003]; EX1006, 1.

61. I rely on Cleveland's Figure 3 embodiment—showing a laminate 10 for "[c]ontainers for cool food products"—as anticipating '126 Patent claims 1-3 and 11. EX1005, ¶[0032]; EX1006, 7. Cleveland's Figure 3 embodiment includes all elements of claims 1-3 and 11, as arranged in these claims. Regarding Element [1.pre], specifically:

62. ***Product in the form of a cup*:** As highlighted above, Cleveland Figure 3 shows "a biodegradable laminate 10 which is paper-based ... , commonly a paper-based stock known as SBS cupstock." EX1005, ¶[0024]; EX1006, 3. Entitled "[b]iodegradable **paper-based cup** or package and production method," EX1005, 1; EX1006, 1, Cleveland explains that its laminates "were converted into cups." EX1005, ¶[0037]; EX1006, 8. Thus, Cleveland's Figure 3 biodegradable laminate 10 corresponds to the claimed *product in the form of a cup*.

63. ***Laminate forming moisture barriers*:** Also highlighted in Cleveland Figure 3, layers 14 and 16 correspond to the claimed *laminate forming moisture barriers*. Cleveland explains that the laminate 10 "further includes first and second

layers 14 and 16, respectively, of copolyesters which are coextruded onto one 18 of the surfaces of the paper-based substrate." EX1005, ¶[0025]; EX1006, 3-4. The coextrusion includes Eastar Bio (or Ecoflex) 14 and Biomax 16, with Biomax 16 disposed further from the substrate 12[4] -- i.e., on the outside:

> Containers for cool food products preferably are formed from a laminate as depicted in FIG. 3. This depicted laminate includes a paper-based substrate having a first layer of coextruded Eastar Bio or Ecoflex (preferably Ecoflex) and Biomax provided on one flat surface of the substrate, the Biomax being disposed outermost from the substrate. Further a second layer of coextruded Eastar Bio or Ecoflex (preferably Ecoflex) and Biomax is provided on the opposite flat surface of the substrate, the Biomax again being disposed outermost from the substrate.

[4] As Cleveland explains, "ECOFLEX" or "EASTAR BIO" is the trade name for a "copolymerization of benzene-1,4-dicarboxylic acid with adipic acid and 1,4-butanediol" and "BIOMAX" is the trade name for a "copolymerization of benzene-1,4-dicarboxylic acid with ethylene glycol and 1,4:3,6-dianhydro-D-sorbitol" EX1005, ¶¶ [0011]-[0012]; EX1006, 5.

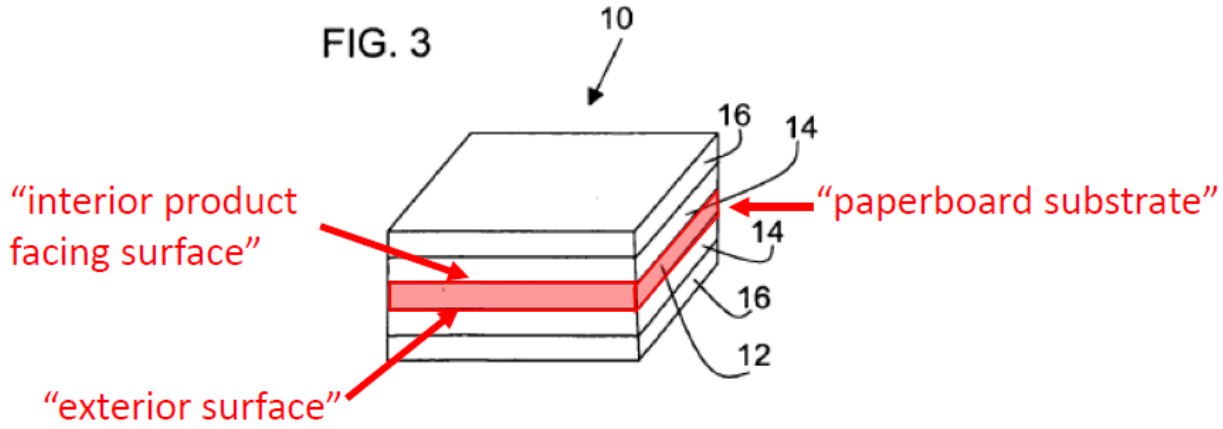
EX1005, ¶[0032]; EX1006, 7. Eastar Bio, Ecoflex, and Biomax are biodegradable, water-resistant polymers used in food packaging, and thus provide a *moisture barrier*, as claimed. *See* EX1005, ¶¶[0028]-[0040]; EX1006, 5-8; EX1019, 3, 6; EX1025.

64. As explained below for elements [1.2] and [1.3], it is my opinion that Cleveland anticipates the Challenged Claims under two separate views: (1) the top and bottom coextruded layers 14, 16 together correspond to the claimed *first* and *second moisture protectant layers*, respectively; and (2) the top and bottom layer 14 alone corresponds to the claimed *first* and *second moisture protectant layers*, respectively.

65. Accordingly, it is my opinion that Cleveland discloses element [1.pre].

2. [1.1] "a paperboard substrate having a separate interior product facing surface and a separate exterior surface;"

66. It is my opinion that Cleveland discloses this element. Specifically, Cleveland discloses *a paperboard substrate* (substrate 12 made of paper-based SBS cupstock) *having a separate interior product facing surface* (surface) *and a separate exterior surface* (opposite surface):



Cleveland, FIG. 3*

67. ***Paperboard substrate*:** As highlighted in Figure 3 above, substrate 12 corresponds to the claimed *paperboard substrate*. Cleveland explains that "the substrate 12 of the laminate comprises paper, commonly a paper-based stock known as SBS cupstock or SUS (natural) kraft folding carton board[.]" EX1005, ¶[0024]; EX1006, 3; *see also* EX1006, 2; EX1005, ¶[0009] (explaining that the invention of Cleveland is "a biodegradable laminate suitable for use in shaped **paper-based** articles.").

68. ***Separate interior product facing surface and a separate exterior surface:*** As highlighted in Figure 3 above, Cleveland's substrate 12 has two opposing surfaces: the claimed *interior product facing surface* (i.e., surface facing the inside the cup) and *separate exterior surface*. Describing the substrate 12, Cleveland explains that the laminate is deposited onto "a paper-based substrate having **two or more surfaces**." EX1005, ¶[0009]; *see also id.*, Claim 14

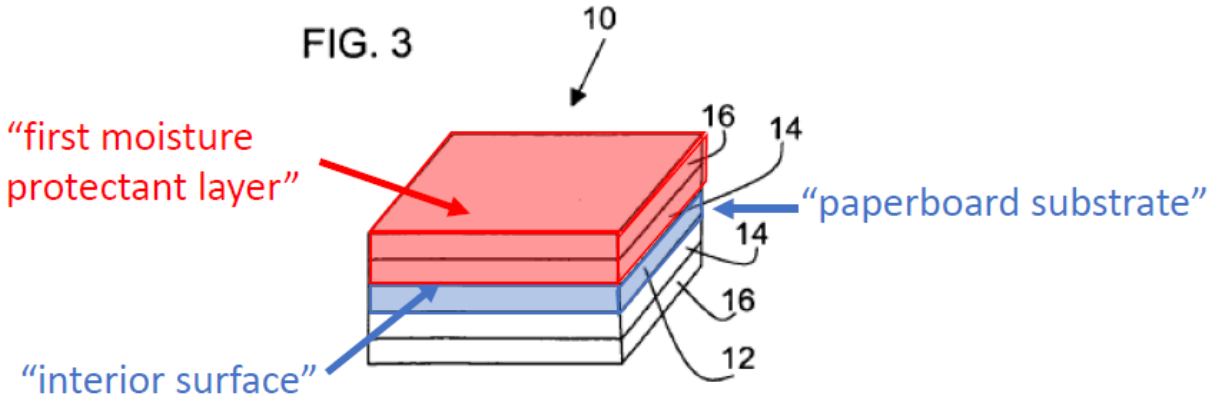
("biodegradable paper-based shaped article comprising a paper-based substrate having at least two surfaces"), ¶ [0032] (laminate is "provided on one flat surface of the substrate" and "on the opposite flat surface of the substrate."); EX1006, 2 ("at least one surface of the substrate…[and] the opposite flat surface of the paper-based substrate.").

69. Accordingly, it is my opinion that Cleveland discloses or suggests element [1.1].

3. [1.2] "a first moisture protectant layer is coated directly only on said interior surface of said paperboard substrate"

70. It is my opinion that Cleveland discloses this element under two separate views. I address each below.

71. **View 1: Top coextruded layers 14, 16 together disclose the first moisture protectant layer.** Cleveland discloses *a first moisture protectant layer* (top coextruded laminate layers 14, 16 together) *is coated directly only on said interior surface* (surface) *of said paperboard substrate* (substrate 12):



Cleveland, FIG. 3*

72. ***First moisture protectant layer*:** As highlighted above, the upper coextruded layer 14, 16 in Cleveland Figure 3 corresponds to the claimed *first moisture protectant layer*. The laminate 10 "includes first and second layers 14 and 16, respectively, of copolyesters which are coextruded onto one 18 of the surfaces of the paper-based substrate [12]." EX1005, ¶ [0025]; EX1006, 3-4. The coextrusion is *moisture protectant*, as claimed, because it comprises Eastar Bio/Ecoflex 14 and Biomax 16. *See* EX1005, ¶¶ [0025], [0029], [0032], [0033]; EX1006, 5, 7. Both materials 14, 16 are biodegradable moisture-resistant polymers. *See* EX1005, ¶¶[0028]-[0040]; EX1006, 5-8; EX1019, 3, 6; EX1025. Indeed, Cleveland teaches that this "biodegradable laminate [is] suitable for use in shaped paper-based articles such as containers for liquid or solid, hot or cool, food products." EX1005, ¶[0009]; EX1006, 2; *see also* EX1005, ¶[0003]; EX1006, 1 (the purpose of the biodegradable laminate is to provide "liquid resistance" so that the paper-contain can "hold liquids for a longer period of time without leaking or becoming soft.").

73. Moreover, though it includes two materials, a POSITA would reasonably view the coextruded Eastar Bio/Ecoflex 14 and Biomax 16 as a single moisture protectant **layer** because Cleveland describes the combination as a single "coextruded **layer**." EX1005, ¶[0029]; EX1006, 5. This is because, in coextrusion, both materials are applied to the substrate simultaneously, in a single step. Thus, it is my opinion that Cleveland's top coextruded layer 14, 16 discloses a *first moisture protectant layer*, as claimed.

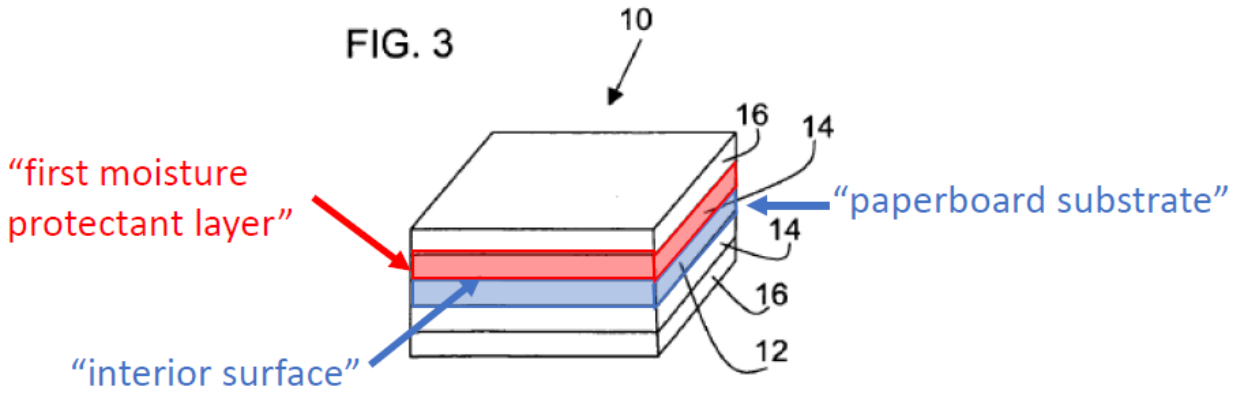
74. ***Coated directly only on said interior surface of said paperboard substrate*:** As shown in Figure 3 above, coextruded laminate 14, 16 is coated directly onto both surfaces of Cleveland's paper substrate – including the *interior surface*. EX1005, ¶ [0029] ("a paper-based substrate is provided on one flat surface thereof with a coextruded layer of Ecoflex and Biomax."); EX1006, 2. Cleveland confirms that the "biodegradable laminate [is] provided on at least one surface of said [paper-based] substrate." EX1005, Claim 14; EX1006, 2. Further, there is an "absence of intervening polymer layers between the [paper] substrate surface" and Cleveland's coextruded biodegradable laminate 14, 16—unlike the Kuusipalo reference applied during prosecution that the Applicant criticized for having an intervening adhesive layer. EX1005, ¶ [0009]; EX1006, 2.

75. During prosecution, Applicant argued Kuusipalo's moisture protectant layer was not coated "*directly only on*" the substrate because of an intervening

adhesive layer. EX1002, 1136. Cleveland, however, explicitly states there is an "absence of intervening polymer layers between the [paper] substrate surface" and Cleveland's coextruded biodegradable laminate 14, 16. EX1005, ¶[0009], EX1006, 2. While Cleveland notes that the Eastar Bio/Ecoflex portion (14) "adhere[s] well to paper,"[5] this does not change the fact that Eastar Bio/Ecoflex functions as a *moisture protectant material*, as claimed. Therefore, Cleveland's *moisture protectant layer*—comprising Eastar Bio/Ecoflex 14 and Biomax 16—is coated "*directly only on*" substrate 12.

76. **View 2: Top Eastar Bio/Ecoflex 14 portion alone discloses the first moisture protectant layer:** Alternatively, the Eastar Bio/Ecoflex portion 14 by itself is a *moisture protectant layer* that is *coated directly only on said interior surface of said paperboard substrate*:

[5] EX1005, ¶[0039]; EX1006, 9.



Cleveland, FIG. 3*

77. Eastar Bio and Ecoflex are both moisture-resistant polymer materials. EX1019, 3, 6. As shown above in Figure 3, the Eastar Bio/Ecoflex 14 material is "deposited" directly "onto at least one surface of the substrate" with an "absence of intervening polymer layers between the substrate surface and" the Eastar Bio/Ecoflex portion 14. EX1005, ¶ [0009]; EX1006, 2. In fact, no intervening adhesive layer is required because the Eastar Bio/Ecoflex layer 14 "provid[es] adhesion to the paper-based substrate." EX1005, ¶¶ [0009], [0039]; EX1006, 9. And the claim language does not preclude the claimed *first moisture protectant layer*—Eastar Bio/Ecoflex portion 14—from having further layers (moisture protectant or otherwise) coated on it.

78. Accordingly, it is my opinion that Cleveland discloses element [1.2].

4. [1.3.1] "and comprising at least one biodegradable polyester polymer,

79. It is my opinion that Cleveland discloses this element. Specifically, Cleveland discloses that the *first moisture protectant layer* (coextruded biodegradable laminate 14, 16 or Eastar Bio/Ecoflex 14 alone) *comprises at least one biodegradable polyester polymer* (Eastar Bio/Ecoflex 14 and/or Biomax 16).

80. As explained for element [1.2], Cleveland's top coextrusion 14, 16 (*first moisture protectant layer*) in Figure 3 includes Eastar Bio/Ecoflex 14 and Biomax 16. *Supra* Section VII.B.3. The former is a "copolymerization of benzene-1,4-dicarboxylic acid with adipic acid and 1,4-butanediol" and the latter is a "copolymerization of benzene-1,4-dicarboxylic acid with ethylene glycol and 1,4:3,6-dianhydro-D-sorbitol." EX1005, ¶¶[0011]-[0012]; EX1006, 5. Individually, each of these copolyesters are biodegradable in a compost environment. EX1005, ¶ [0029]; EX1006, 5; EX1019, 1; EX1020; EX1021, 6; EX1025. And, together, "the coated laminate biodegrades in about 88 days, meeting the criteria for biodegradability/compostability according to ASTM standards D6400-99 and D6868." EX1005, ¶ [0029]; EX1006, 2; EX1022; EX1023.

81. Thus, it is my opinion that Cleveland's Eastar Bio/Ecoflex 14 and Biomax 16 are biodegradable. Further, it is my opinion that Cleveland's Eastar Bio/Ecoflex 14 and Biomax 16 meet the "degradable" definition mentioned by

Applicant during prosecution and comply with Applicant's cited ASTM degradability standards. *See* EX1002, 306 ("Degradability is defined as a >75-80% loss in molecular weight (MWT) in a relatively short amount of time (<9 months) due to exposure to oxygen, water, and microbes in the environment" and "Standards and definitions for degradability are contained in **ASTM D6400**, **ASTM D6868**, ..."). *See*, EX1022, EX1023. Thus, Cleveland discloses this element even under a construction that expressly incorporates the definition provided by the ASTM standards.

82. Accordingly, it is my opinion that Cleveland discloses element [1.3.1].

5. [1.3.2] "wherein the first moisture protectant layer has a coat weight of from 5 to 30 lbs./3000 ft^2"

83. It is my opinion that Cleveland discloses this element. Specifically, Cleveland discloses that the *first moisture protectant layer* (coextruded biodegradable laminate 14, 16 or Eastar Bio/Ecoflex 14 alone) *has a coat weight of from 5 to 30 lbs./3000 ft^2* (coat weight of between about 10 and about 40 lbs./3000 ft^2).

84. Under the first view, Cleveland discloses a total coat weight range and preferred total coat weight value for the coextruded biodegradable laminate 14, 16 of the Figure 3 embodiment:

	Total Coat Weight (lbs./3000 ft^2)	**80% Eastar Bio/Ecoflex (lbs./3000 ft^2)**	**20% Eastar Bio/Ecoflex (lbs./3000 ft^2)**	**Citation**
Min	10	8	2	"In this embodiment for cool food containers, the coextruded layer of copolyester (irrespective of which side of the substrate the layer is disposed) is of a total coat weight of between about 10 and about 40 lbs./3000 ft^2" EX1005, ¶ [0032]; EX1006, 7.
Max	40	32	8	

	Total Coat Weight (lbs./3000 ft^2)	**80% Eastar Bio/Ecoflex (lbs./3000 ft^2)**	**20% Eastar Bio/Ecoflex (lbs./3000 ft^2)**	**Citation**
Preferred	25	20	5	"A total coat weight of about 25 lbs./3000 ft^2 is preferred." EX1005, ¶ [0032]; EX1006, 7.

85. The disclosed total coat weight range of 10-40 lbs./3000 ft^2 falls almost entirely within the claimed range, and the preferred total coat weight of 25 lbs./3000 ft^2 falls squarely within the claimed range. Thus, it is my understanding that Cleveland discloses element [1.3.2].

86. Cleveland also anticipates element [1.3.2] under the second view that only the Eastar Bio/Ecoflex 14 portion of the coextrusion—immediately adjacent substrate 12—corresponds to the claimed *first moisture protectant layer*. Cleveland explains that the "total coat weight" can be allocated "in any combination of between

about 80/20 to 20/80 parts by weight of Ecoflex [14] to Biomax [16]."[6] EX1005, ¶ [0032]; EX1006, 7. Following this, the minimum total coat weight (10 lbs./3000 ft²) corresponds to a coat weight range for Eastar Bio/Ecoflex 14 only of 2 to 8 lbs./3000 ft² (substantially overlapping claimed range). And the maximum total coat weight (40 lbs./3000 ft²) corresponds to a Eastar Bio/Ecoflex 14 coat weight range of 8 to 32 lbs./3000 ft² (substantially overlapping the claimed range). Similarly, if the total coat weight is 25 lbs./3000 ft^2, the coat weight of Eastar Bio/Ecoflex 14 would range from 5-20 lbs./3000 ft^2, which is completely within the claimed range.

87. Accordingly, it is my opinion that Cleveland discloses element [1.3.2].

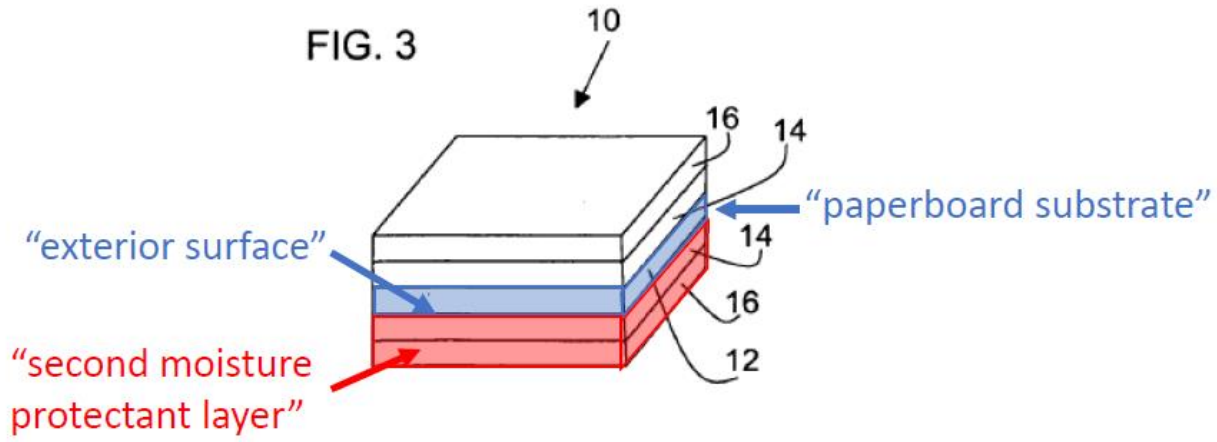
6. [1.4] "a second moisture protectant layer is coated directly only on said exterior surface of said paperboard substrate"

88. It is my opinion that Cleveland discloses this element. Specifically, Cleveland discloses a *second moisture protectant layer* (bottom coextruded biodegradable laminate 14, 16 or bottom Eastar Bio/Ecoflex 14 portion alone) *coated directly only on said exterior surface* (bottom surface) *of said paperboard substrate* (substrate 12).

[6] Cleveland explains that Eastar Bio can be used in place of Ecoflex, but that Ecoflex is preferred. EX1005, ¶ [0032]; EX1006, 7.

89. **View 1: Coextruded layers 14, 16 together disclose the *second moisture protectant layer***. In the same way that Cleveland's top coextrusion 14, 16 discloses the claimed *first moisture protectant layer*, Cleveland's bottom coextrusion 14, 16 discloses *a second moisture protectant layer* that is *coated directly only on said exterior surface* (bottom surface) *of said paperboard substrate* (substrate 12):

90.

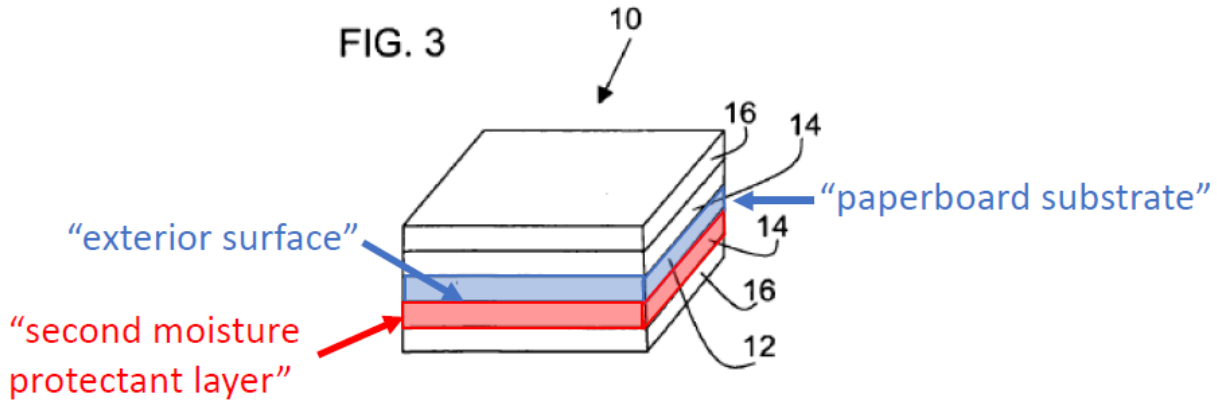


Cleveland, FIG. 3*

91. The bottom coextruded laminate 14, 16 has the same composition and configuration as the top coextruded laminate 14, 16 discussed above in Section VII.B.3, except that it is coated directly on the lower (*exterior*) surface of substrate 12. *See, e.g.*, EX1005, ¶¶ [0003], [0009], [0013], [0015], [0032], [0033], Claim 15; EX1006, generally. Thus, for the same reasons discussed above for the *first moisture protectant layer*, Cleveland's bottom coextruded laminate 14, 16 of Figure 3

discloses a *second moisture protectant layer* that *is coated directly only on said exterior surface of said paperboard substrate*, as claimed.

92. **View 2: Eastar Bio/Ecoflex 14 portion alone discloses the *second moisture protectant layer.*** Likewise, in the same way that Cleveland's top Eastar Bio/Ecoflex 14 layer alone discloses the claimed *first moisture protectant layer*, the bottom Eastar Bio/Ecoflex 14 layer alone can be considered the *second moisture protectant layer*, which is *coated directly only on said exterior surface* (bottom surface) *of said paperboard substrate* (substrate 12):



Cleveland, FIG. 3*

93. The *second moisture protectant layer* 14 highlighted above in Figure 3 is also comprised of either Eastar Bio or Ecoflex. EX1005, ¶ [0032]; EX1006, 7. This highlighted layer is identical to the Eastar Bio/Ecoflex *moisture protectant layer* discussed above in Section VII.B.3, except that it is coated directly on the bottom (*exterior*) surface of substrate 12. *See, e.g.*, EX1005, ¶¶ [0003], [0009],

[0013], [0015], [0032], [0033], Claim 15; EX1006, generally. Thus, for the same reasons discussed above in Section VII.B.3, the Eastar Bio/Ecoflex layer 14 of Figure 3 discloses a *second moisture protectant layer is coated directly only on said exterior surface of said paperboard substrate*, as claimed.

94. Accordingly, it is my opinion that Cleveland discloses element [1.4].

7. [1.5.1] "and comprising at least one biodegradable polyester polymer"

95. It is my opinion that Cleveland discloses this element. As explained, the bottom coextruded laminate 14, 16 (*second moisture protectant layer*) has the same composition as the top coextruded laminate 14, 16 (*first moisture protectant layer*) detailed above: Eastar Bio/Ecoflex 14 and Biomax 16. *Supra* Sections VII.B.3-5; EX1005, ¶¶ [0011]-[0012], [0029], [0032]; EX1006, 2, 5, 7. Thus, for the same reasons discussed above for element [1.3.1], it is my opinion that Cleveland discloses element [1.5.1].

8. [1.5.2] "wherein the second moisture protectant layer has a coat weight of from 5 to 30 lbs./3000 ft^2"

96. It is my opinion that Cleveland discloses this element. As explained, the bottom coextruded laminate 14, 16 (*second moisture protectant layer*) has the same composition as the top coextruded laminate 14, 16 (*first moisture protectant layer*) detailed above. *Supra* Sections VII.B.3-5; EX1005, ¶¶ [0011]-[0012], [0029], [0032]; EX1006, 2, 5, 7. And, as explained above for element [1.3.2], Cleveland

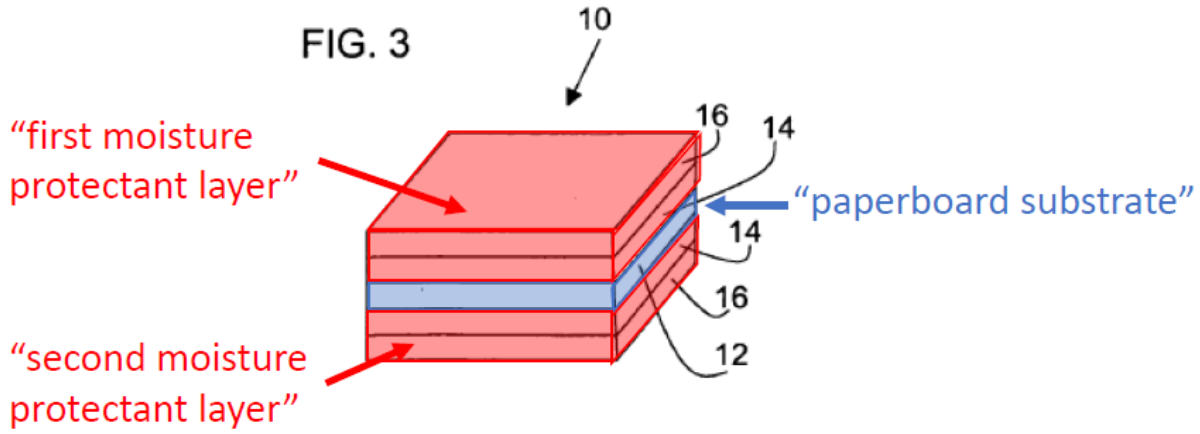
discloses the following total coat weights and individual Eastar Bio/Ecoflex 14 coat weight for the Figure 3 coextruded laminates 14, 16:

	Total Coat Weight (lbs./3000 ft^2)	**80% Eastar Bio/Ecoflex (lbs./3000 ft^2)**	**20% Eastar Bio/Ecoflex (lbs./3000 ft^2)**	**Citation**
Min	10	8	2	EX1005, ¶ [0032]; EX1006, 7.
Max	40	32	8	
Preferred	25	20	5	

Supra Section VII.B.5. Accordingly, for the same reasons discussed above for element [1.3.2], it is my opinion that Cleveland discloses element [1.5.2] whether the entire bottom coextruded laminate 14, 16—or only the Eastar Bio/Ecoflex portion 14—is viewed as the claimed *second moisture protectant layer*.

9. [1.6] "and is separate from the first moisture protectant layer coated on and directly adhered to said interior surface of said substrate"

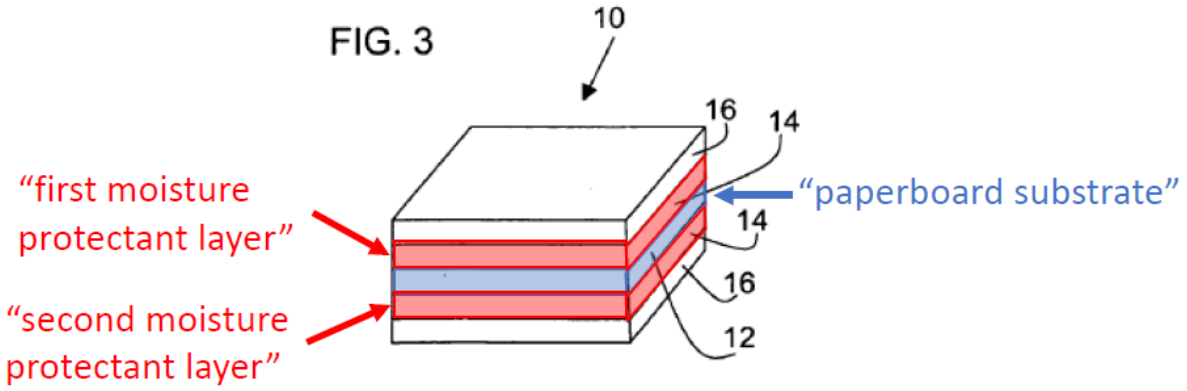
97. It is my opinion that Cleveland discloses this element. Specifically, as shown in Figure 3 below, Cleveland's bottom biodegradable coextruded laminate 14, 16 (*second moisture protectant layer*) *is separate from the first moisture protectant layer* (top biodegradable coextruded laminate 14, 16) *coated on and directly adhered to said interior surface* (bottom surface) *of said substrate* (substrate 12):



Cleveland, FIG. 3*

98. As explained, Figure 3 shows two separate biodegradable laminates (the *first* and *second moisture protectant layers*) coated on opposite sides of the paperboard substrate, separated by the paperboard substrate 12 itself. Cleveland discloses that the biodegradable laminates are coextruded onto "one flat surface of the substrate" and "on the opposite flat surface of the substrate." EX1005, ¶¶ [0025], [0032]; EX1006, 2, 7. It is also axiomatic that any paper cup would comprise an interior surface and an exterior surface, and any coatings applied to the two surfaces would be separate from each other.

99. Alternatively, when the Eastar Bio/Ecoflex layer 14 alone is considered the *second moisture protectant layer*, then for the same reasons explained above, it is *separate from the first moisture protectant layer* (top Eastar Bio/Ecoflex layer 14) *coated on and directly adhered to said interior surface* (bottom surface) *of said substrate* (substrate 12):



Cleveland, FIG. 3*

100. Thus, it is my opinion that Cleveland discloses element [1.6].

101. Accordingly, it is my opinion that Cleveland anticipates claim 1.

C. Dependent Claim 2

1. [2.1]: "The product according to claim 1, wherein the second moisture protectant layer further comprises from 5 to 20 percent by weight of at least one filler selected from the group consisting of calcium carbonate and starch."

102. As explained above, it is my opinion that Cleveland anticipates the subject matter of claim 1. *Supra* Section VII.B. Moreover, it is my opinion that Cleveland discloses the additional subject matter of claim 2 because, in Cleveland, *the second moisture protectant layer* (bottom biodegradable coextruded laminate 14, 16) *further comprises from 5 to 20 percent of at least one filler* (organic or inorganic filler) *selected from the group consisting of calcium carbonate* (calcium carbonate) *and starch* (starch).

103. Specifically, Cleveland discloses that "calcium carbonate may be added to any or all of the copolyester extrusions as a cost savings measure and to provide increase in the degradation rate by displacement of some of the biodegradable resin material." EX1005, ¶ [0034]; EX1006, 8. This means that calcium carbonate may be added to both the Eastar Bio/Ecoflex 14 and Biomax 16 sublayers, and therefore calcium carbonate may be added to both the *first* and *second moisture protectant layers*, whether they are defined as both Eastar Bio/Ecoflex 14 and Biomax 16 or only the Eastar Bio/Ecoflex sublayer 14.

104. Cleveland further notes that other "possible organic and inorganic fillers may be employed with, or in lieu of, calcium carbonate, including starch." *Id*. Other inorganic fillers could include talc, mica, and diatomaceous earth. Other organic fillers could include wood or cellulose based materials, but these fillers would not be used for this use case.

105. Though Cleveland does not prescribe a specific percentage of filler to use, a POSITA would have known and appreciated that 5-20% by weight of calcium carbonate and/or starch is a suitable amount to decrease costs without reducing the desirable features of a biodegradable laminate for a paper cup.

106. Accordingly, it is my opinion that Cleveland anticipates claim 2.

D. Dependent Claim 3

1. [3.1] "The product according to claim 1, wherein the first moisture protectant layer further comprises from 5 to 20 percent by weight of at least one filler selected from the group consisting of calcium carbonate and starch."

107. It is my opinion that Cleveland discloses the subject matter of claim 3 for the same reasons as explained above for claim 2, because Cleveland discloses the use of the same biodegradable laminate for both the interior and exterior surfaces of the paper substrate. EX1005, ¶ [0032] (Ecoflex and Biomax are "coextruded… on one flat surface of the [paper] substrate… [and] on the opposite flat surface of the [paper] substrate."); EX1006, 7; *supra* Section VII.C. Further, Cleveland discloses the use of fillers in "any or all of the copolyester extrusions." EX1005, ¶ [0034]; EX1006, 8.

108. Accordingly, it is my opinion that Cleveland anticipates claim 3.

E. Dependent Claim 11

1. [11.1] "The product according to claim 3, wherein the first moisture protectant layer comprises from 5 to 20 percent by weight of calcium carbonate as the filler."

109. As explained above, it is my opinion that Cleveland anticipates the subject matter of claim 3. *Supra* Section VII.D. Claim 11 only differs from claim 3 in that the filler must be calcium carbonate, not either calcium carbonate or starch. *Compare* EX1001 Claim 3 with Claim 11. Because Cleveland discloses the use of

calcium carbonate as a filler, it is my opinion that Cleveland discloses or suggests Claim 11. *Supra* Section VII.C.

VIII. GROUND 2: NAKAGAWA ALONE OR IN VIEW OF APPLICANT'S ADMITTED PRIOR ART RENDERS OBVIOUS CLAIMS 1-3, 11

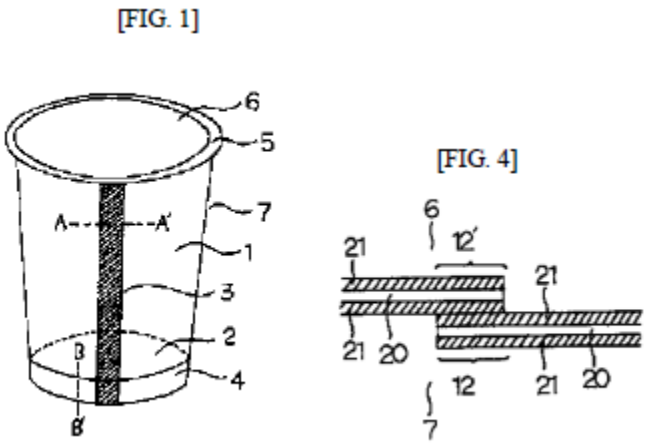
A. Overview of Nakagawa

110. In my opinion, Nakagawa is analogous art to the '126 Patent because it relates to the same field of endeavor – biodegradable laminated paper cups. Nakagawa is directed to "a paper cup using a biodegradable plastic that has the same performance as a conventional paper cup…and a manufacturing method thereof." EX1008, Abstract. Nakagawa describes a paper cup that is laminated with "a biodegradable plastic" on either "one side or both sides" of the paper cup, where the biodegradable plastic's "main component is a biodegradable microbially produced polyester or an aliphatic polyester." *Id*.; *see also id*., Claim 1.

111. Nakagawa explains that "microbially produced polyester is a general term for polyesters obtained by cultivating microorganisms such as bacteria or yeast, and isolating and purifying the polyester compounds that accumulate within the cells or culture medium, and is characterized by being derived from microorganisms." *Id*., ¶ [0012]. Additionally, "aliphatic polyester refers to polyesters produced by chemical synthesis, in which the polymer consists only of carbon, hydrogen and oxygen atoms and does not have a cyclic structure such as in aromatic polyesters."

Id. The biodegradable plastic of Nakagawa has the same, or better, biodegradability as paper, with the biodegradable plastic fully degrading after being buried in soil for three months. *Id*., ¶ [0035].

112. Figures 1 and 4, reproduced below, show Nakagawa's paper cup using a biodegradable plastic:



Nakagawa, FIGS. 1 and 4

113. Figure 1 shows "a perspective view illustrating one embodiment of the paper cup of the present invention," while Figure 4 depicts a "cross-sectional view of the side surface sealing part illustrating one embodiment of the paper cup." EX1008, [0040].

114. As shown in Figure 4, the biodegradable plastic 21 is laminated on both the inner surface 6 and outer surface 7 of the paper cup 20. Nakagawa states that in such embodiments where biodegradable plastic is laminated to both the outer and inner surfaces 6, 7, the paper cup can be sealed without the use of an adhesive

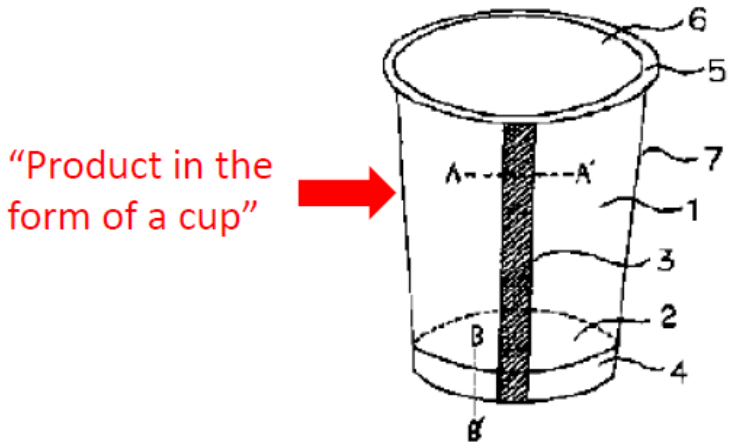
because the "[biodegradable] plastics 21 have heat-sealing properties" with "sufficient seal strength" to marry the paper with itself. EX1008, ¶[0022].

B. Independent Claim 1

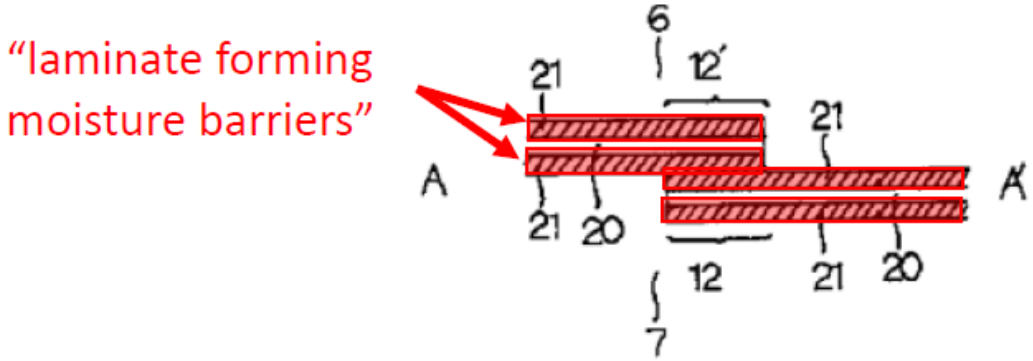
1. [1.pre] "A product in the form of a cup comprising a laminate forming moisture barriers, said laminate comprising:"

115. To the extent the preamble is limiting, it is my opinion that Nakagawa discloses or suggests this element. Specifically, Nakagawa discloses *a product in the form of a cup* (paper cup of Figure 1) *comprising a laminate forming moisture barriers* (waterproof laminated biodegradable plastic of Figure 4):

[FIG. 1]



[FIG. 4]



Nakagawa, FIGS. 1* and 4*

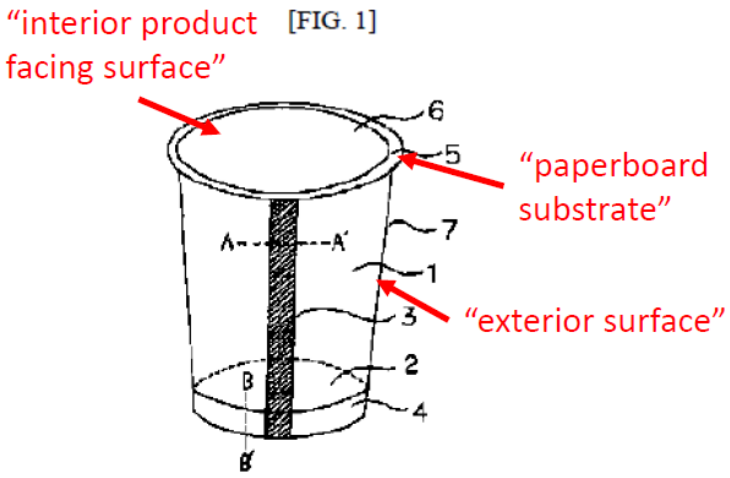
116. Nakagawa describes "a paper cup using a biodegradable plastic that has the same performance as a conventional paper cup." EX1008, Abstract. Paper cups, because they are used to contain "liquid or frozen liquid" contents "must be waterproof." *Id*., ¶ [0002]. In order to make a paper cup waterproof, at least the "inner surface 6 of the cup is laminated with plastic." *Id*. Nakagawa describes using

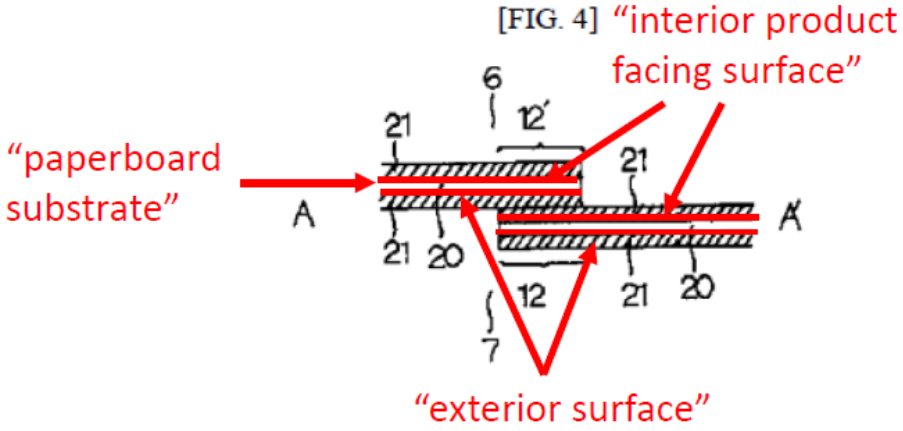
a biodegradable plastic to "laminate[]... one or both sides of the paper [cup]" in order to make the cup waterproof. *Id*., ¶ [0013].

117. Accordingly, it is my opinion that Nakagawa discloses or suggests element [1.pre].

2. [1.1] "a paperboard substrate having a separate interior product facing surface and a separate exterior surface;"

118. It is my opinion that Nakagawa discloses or suggests this element. Specifically, Nakagawa discloses *a paperboard substrate* (paper or paper cup) *having a separate interior product facing surface and a separate exterior surface*:





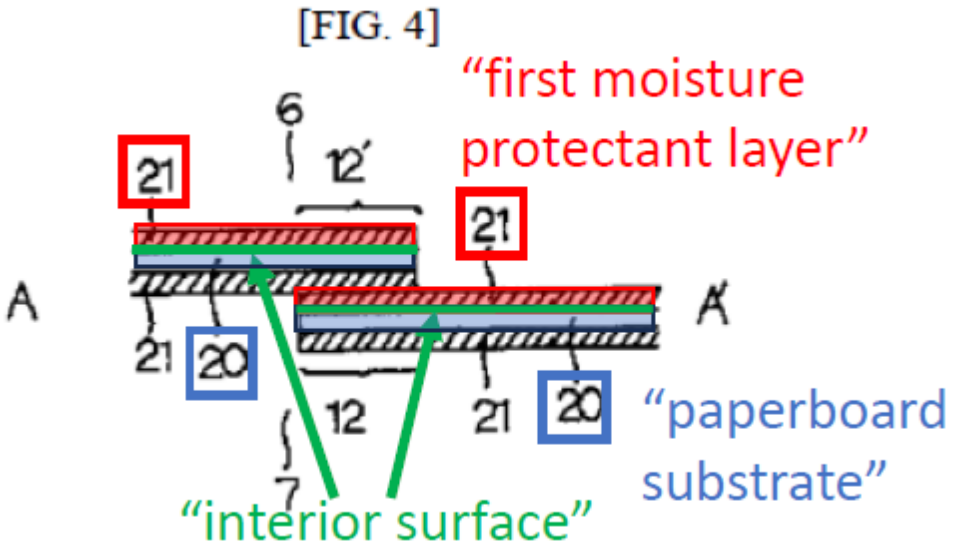
Nakagawa, FIGS. 1* & 4*

119. Figure 1 above is a perspective view of a "paper cup." EX1008, ¶ [0040]. As highlighted in Figure 1 above, the disclosed paper cup has both the *interior product facing surface* and *separate exterior surface* of claim element [1.1]. It is also axiomatic that any paper cup would have separate interior and exterior surfaces. Further, the interior surface in any cup would be *product facing* as it is the interior portion of the cup that holds the contents (i.e., liquids).

120. Accordingly, it is my opinion that Nakagawa discloses or suggests element [1.1].

3. [1.2] "a first moisture protectant layer is coated directly only on said interior surface of said paperboard substrate"

121. It is my opinion that Nakagawa discloses or suggests this element. Specifically, the paper cup of Nakagawa has *a first moisture protectant layer* (biodegradable plastic 21) that is *coated* (laminated) *directly on said interior surface of said paperboard substrate* (paper or paper cup):



Nakagawa, FIG. 4*

122. As highlighted in Figure 4 above, Nakagawa discloses that the biodegradable plastic 21 is laminated directly onto the paper 20 substrate—unlike the Kuusipalo reference cited during prosecution of the '126 Patent, which had an

intervening adhesive layer. This is clear from the lack of any intermediary layers between the biodegradable plastic 21 and the paper 20.

123. Further, Nakagawa expressly discloses multiple times that the biodegradable plastic is laminated directly onto the paper. *See, e.g.,* EX1008, Abstract ("the plastic laminated on the paper"), ¶¶[0009] ("the present invention provides a paper cup made of paper that is laminated with plastic on at least one side or both sides of the paper"), [0010] ("biodegradable plastic...can be sealed to paper by a heat fusion method"; [0013] ("lamination may be performed using a method such as laminating a plastic film onto the paper, or melt extrusion coating the plastic onto the paper...By using this lamination method, a biodegradable plastic may be laminated on one or both sides of the paper."). Moreover, Nakagawa discloses the use of a "manufacturing method…which uses melt extrusion coating ***without the need for an adhesive***." *Id*., ¶[0013]. Thus, Nakagawa does not disclose or require an intervening layer of adhesive between the paper substrate and the biodegradable plastic.

124. Accordingly, it is my opinion that Nakagawa discloses or suggests element [1.2].

4. [1.3.1] "and comprising at least one biodegradable polyester polymer"

125. It is my opinion that Nakagawa discloses or suggests this element. Specifically, Nakagawa discloses that the *first moisture protectant layer* (biodegradable plastic 21) is comprised of *at least one biodegradable polyester polymer* (biodegradable plastic or biodegradable microbially produced polyester or aliphatic polyester).

126. A polymer is a substance or material that consists of very large molecules, or macromolecules, that are constituted by many repeating subunits derived from one or more species of monomers. A polyester is a category of polymers that contain one or two ester linkages in every repeat unit of their main chain. Therefore, there is no distinction between a "polyester" and a "polyester polymer."

127. Nakagawa discloses that the "main component" of the biodegradable plastic that is laminated on one or both sides of the paper cup is either a "biodegradable microbially produced ***polyester***" or an "aliphatic ***polyester***." EX1008, Abstract, Claim 1. Nakagawa explains that microbially produced polyesters refers to "polyesters obtained by cultivating microorganisms such as bacteria or yeast, and isolating and purifying the polyester compounds that accumulate within the cells or culture medium." *Id*., ¶ [0012]. Nakagawa lists the

following as conventional prior art examples of microbially produced polyesters: "***polymers*** of 3-hydroxybutyric acid, 4-hydroxybutyric acid, 3-hydroxyvaleric acid, and the like, and ***copolymers*** made up of two or more of these." *Id*., ¶ [0010]. Aliphatic polyester refers to "polyesters produced by chemical synthesis, in which the ***polymer*** consists only of carbon, hydrogen and oxygen atoms and does not have a cyclic structure such as in aromatic polyesters." *Id*., ¶ [0012]. Nakagawa lists the following as examples of aliphatic polyesters: "***polymers*** of caprolactone, lactic acid, glycolic acid, and the like, and ***copolymers*** made up of two or more of these." *Id*., ¶ [0010]. Thus, the biodegradable plastics disclosed by Nakagawa are *polyester polymers*.

128. The above identified *polyester polymers* disclosed by Nakagawa are *biodegradable*. The purpose of Nakagawa was to, in part, provide a paper cup using a "biodegradable plastic having a biodegradability equal to or greater than that of paper." EX1008, ¶ [0010]. Nakagawa ran tests on various examples of biodegradable plastics[7] laminated on paper cups to determine the biodegradability.

[7] The example biodegradable plastics include: "a co-polymer of 3-hydroxybutryic acid and 3-hydroxyvalerate" (referred to as "P (3HB-3HV)");

Id., ¶ [0035]. The test involved burying the paper cups with laminated biodegradable plastics in soil for three months. *Id*. The results were that the biodegradable plastic "had completely disappeared ... confirming that the paper cup of the present invention is biodegradable." *Id*. Thus, Nakagawa's polyester polymers are *biodegradable*. Further, Nakagawa's polyester polymers meet the "degradable" definition used by Applicant during prosecution. *See* EX1002, 306 ("Degradability is defined as a >75-80% loss in molecular weight (MWT) in a relatively short amount of time (<9 months) due to exposure to oxygen, water, and microbes in the environment").

129. Moreover, Nakagawa's polyester polymers satisfy ASTM D6868, cited by Applicant during prosecution of the '126 Patent. EX1002, 306. ASTM D6868 establishes the requirements for labeling of paper-based materials and products wherein a biodegradable plastic film or coating is attached (either through lamination or extrusion directly onto the paper) to compostable substrates and the entire product is designed to be composted. EX1023. Although Nakagawa did not use the US-based ASTM D6868, they did expose their laminated paper cup to soil and determined only paper was remaining in the medium, indicating a

"polycaprolactone"; "poly-3-hydroxyvaleric acid" and "a mixture of ... P (3HB-3HV) and "poly-3-hydroxyvaleric acid". EX1008, ¶¶ [0024]-[0034].

biodegradation of the plastic laminate. Their testing procedure was not based upon ASTM D6868, however similar biodegradable polymers as used by Nakagawa, have been used by others with sufficient rates of biodegradation achieved for compostable status.

130. Accordingly, it is my opinion that Nakagawa discloses claim element [1.3.1].

5. [1.3.2] "wherein the first moisture protectant layer has a coat weight of from 5 to 30 lbs./3000 ft^2"

131. It is my opinion that Nakagawa discloses this element. Alternatively, it is my opinion that Nakagawa and the admitted prior art disclosed by the '126 Patent ("Applicant's Admitted Prior Art") render this element obvious. *Id*.

a. Nakagawa discloses coat weights of 5 to 30 lbs./3000 ft^2

132. Nakagawa discloses or suggests that *the first moisture protectant layer* (biodegradable plastic 21) *has a coat weight of from 5 to 30 lbs./3000 ft^2* (laminate thickness of 15 μm or 30 μm). Nakagawa discloses five examples of paper cups with biodegradable plastic coated on the paper substrate. EX1008, ¶¶ [0024]-[0034]. For each example, the specific polymers and the thickness of the coat are disclosed. *Id*. A POSITA would recognize that the disclosed polymers have a given density, and therefore the coat weight can be calculated by determining the total volume of polymer used (thickness multiplied by 3000 ft^2) and multiplying the volume by the

polymer's known density. The result is the total weight of polymer that was coated on 3000 ft^2 of paper substrate—i.e., the coat weight. *Id*.

133. For example, Nakagawa discloses a paper cup laminated with "a copolymer of 3-hydroxybutyric acid and 3-hydroxyvalerate (hereinafter indicated as P (3HB-3HV)) (manufactured by ICI, UK: 'Biopole', (hydroxyvalerate content: 10%))" at a "thickness of 30 μm." EX1008, ¶ [0024]. This copolymer has a density of 1.25 g/cm^3 at room temperature.[8] EX1024, 4. With these known parameters, the coat weight is easily calculated to be 23.04 lbs./3000 ft^2—falling squarely within the claimed range.

134. Accordingly, it is my opinion that Nakagawa discloses or suggests element [1.3.2].

b. Alternatively, Applicant's Admitted Prior Art discloses coat weights of 5 to 30 lbs./3000 ft^2

135. The '126 Patent admits that the use of a *coat weight of 5 to 30 lbs./3000 ft^2* (coat weight of 0.5-1.5 mils or 7.2-21.6 lbs./3000 ft^2) for polymer lamination of paper cups already existed in the prior art. Specifically, in the "Description of the

[8] If foaming of the laminate occurred, it is possible that the density of the laminate would be altered. Nakagawa does not disclose foaming, so a POSITA would assume there is no foaming.

Related Art," the '126 Patent states that "[p]aper-based laminates for food service uses" such as cups are typically coated with "low-density polyethylene (LDPE) or other similar polymers." EX1001, 1:52-60. Further, the '126 Patent admits that it was "common" to use a "coat weight of 0.5-1.5 mils (7.2-21.6 lbs./3000 ft^2)." *Id*., 1:61-62.

136. Accordingly, it is my opinion that the Applicant's Admitted Prior Art discloses the use of a *coat weight of 5 to 30 lbs./3000 ft^2*.

c. Nakagawa-'126 Patent's admitted prior art Combination

137. To modify Nakagawa to embody element [1.3.2], a POSITA would have modified Nakagawa's *first moisture protectant layer* (biodegradable plastic 21) to have a *coat weight of 5 to 30 lbs./3000 ft^2* (coat weight of 0.5-1.5 mils or 7.2-21.6 lbs./3000 ft^2) as disclosed in the '126 Patent's recitation of the prior art. As coat weight merely defines the thickness of the plastic layer to be laminated on the paper substrate, modifying the thickness of the biodegradable plastic layer disclosed in Nakagawa to be the thickness of the coat weight as disclosed in the Applicant's Admitted Prior Art would practice element [1.3.2].

d. Rationale to Combine Nakagawa and the prior art admitted by the '126 Patent

138. It is my opinion that a POSITA would have had motivation to modify Nakagawa to incorporate the *coat weight of 5 to 30 lbs./3000 ft^2* (coat weight of 0.5-

1.5 mils or 7.2-21.6 lbs./3000 ft^2) as disclosed in the Applicant's Admitted Prior Art. Petitioner addresses two examples below.

139. **Conventional coat weight for paper cups:** As stated in Nakagawa, the goal of the disclosed invention is "to provide a paper cup using a biodegradable plastic that has the same performance as a conventional paper cup." EX1008, ¶[0008]. Although biodegradable plastics have certain differing properties from traditional plastics used on paper cups –such as polyethylene[9]—Nakagawa discloses that the lamination of the biodegradable plastic on the paper can be accomplished using the same "ordinary method." *Id*., ¶[0013]. As Nakagawa prescribes no specific coat weight, a POSITA would have been motivated to use ordinary/conventional methods of biodegradable lamination—including the use of conventional coat weights. And the '126 Patent states that in the prior art, the common coat weight used for paper-based food service products—including paper cups—is "7.2-21.6 lbs./3000 ft^2." EX1001, 1:52-62. Accordingly, given Nakagawa's silence on a specific coat weight, a POSITA would have been motivated to incorporate the coat weights disclosed in the prior art admitted in the '126 Patent into Nakagawa.

[9] *See* EX1008, ¶[0002] (describing conventional paper cups as being "laminated with plastic – generally polyethylene.")

140. **Nakagawa describes the use of varying thicknesses of lamination:** Nakagawa does not focus on coat weight, and thus does not specifically prescribe a required range of coat weights for its biodegradable plastics. Nakagawa, however, does describe various examples of embodiments of paper cups laminated with different biodegradable plastics at different thicknesses—which directly correlates with coat weight. EX1008, ¶¶[0024]-[0034] (describing various examples with biodegradable plastic laminate thicknesses of 15μm or 30μm). With no prescribed coat weight, and instead examples of varying laminate thicknesses/coat weights, POSITA would have understood that other laminate thicknesses could be used. Thus, a POSITA would have been motivated to try various thicknesses and therefore various coat weights, including those commonly used in then-existing paper cups as described in the prior art admitted in the '126 Patent.

i. Obvious to try—Choosing from a Finite Number of Identified, Predictable Solutions, with a Reasonable Expectation of Success

141. My proposed modification of Nakagawa would have been obvious to try, as there are only a finite number of solutions for coat weight and there would have been a reasonable expectation that the coat weight discussed by the '126 Patent would have been successful. I analyze each relevant factor for the obvious to try rationale below:

142. **Recognized problem or need in the art:** Plastics, whether biodegradable or not, must be laminated onto food service paper products at a sufficient thickness in order to make the paper product moisture proof at variable temperatures. EX1008, ¶[0002]. This is particularly true for paper cups, as they must be able to hold liquid without the liquid seeping into the paper substrate, which would ultimately cause leakage and the deterioration of the paper cup. EX1008, ¶[0002]. The thickness of the laminated plastic directly corresponds to coat weight, and can be expressed in multiple different units. One such industry standard is lbs./3000 ft^2. As Nakagawa does not directly discuss what coat weight range would be acceptable for the disclosed biodegradable plastics, a POSITA would recognize that there is a need to determine an appropriate coat weight.

143. **Finite number of identified, predictable potential solutions:** There are only a finite number of potential solutions for coat weights of plastics on paper food service products, such as paper cups. Too low of a coat weight will result in the plastic laminate being too thin to sufficiently waterproof the paper product. It can also feel strange to a customer. Too high of a coat weight would be cost inefficient—using more plastic product than is necessary—and could cause problems with lamination, make the product take longer to degrade degradable, or feel strange in the customer's hand, or other unwanted side effects. For traditional, non-biodegradable plastics, the '126 Patent states that coat weights are generally between

7.2-21.6 lbs./3000 ft^2. EX1001, 1:40-44, 58-62. This is because coat weights below 7.2 lbs./3000 ft^2 risk failing to adequately waterproof the paper product, while coat weights above 21.6 lbs./3000 ft^2 have diminishing improvement in waterproofing. For the above reasons, a POSITA would recognize that there are only a finite number of potential coat weights for the biodegradable plastics disclosed in Nakagawa.

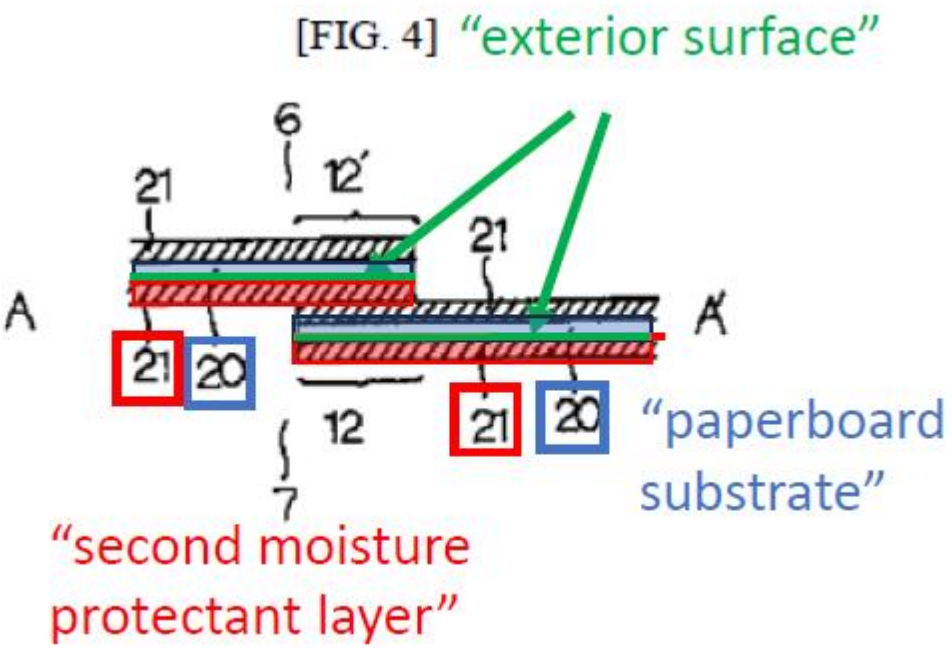
144. **POSITA could have pursued known potential solutions with reasonable expectation of success:** Nakagawa discloses that "the method for laminating the biodegradable plastic and the paper may be an ordinary method used for laminating plastic and paper." EX1008, ¶[0013]. Specifically, Nakagawa discloses "extrusion coating" the biodegradable laminate onto the paper substrate. *Id*. Therefore, a POSITA would have recognized that the ordinary coat weights used for laminating plastic and paper – and more specifically the coat weights used in extrusion coating, including the extrusion coat weights disclosed in the '126 Patent's discussion of the prior art[10] – could be tested with a reasonable expectation of success.

[10] "Paper-based laminates for food service uses are typically ***extrusion coated*** with low-density polyethylene (LDPE)…LDPE ***coat weight*** of 0.5-1.5 mils (***7.2-21.6 lbs./3000 ft^2***) are common." EX1001, 1:42-62.

145. Accordingly, it is my opinion that Nakagawa and the Applicant's Admitted Prior Art render obvious element [1.3.2].

6. [1.4] "a second moisture protectant layer is coated directly only on said exterior surface of said paperboard substrate"

146. It is my opinion that Nakagawa discloses or suggests this element. Specifically, Nakagawa discloses *a second moisture protectant layer* (biodegradable plastic 21) that is *coated directly only on said exterior surface of said paperboard substrate* (paper 20 or paper cup):



Nakagawa, FIG. 4*

147. As highlighted in Figure 4, the biodegradable plastic 21 is laminated on the exterior surface. *See also* EX1008, ¶ [0013] ("a biodegradable plastic may be laminated on one or **both sides of the paper**."). Moreover, it is clear that the plastic

layer is laminated or coated directly on the exterior surface of the paper 20 with no intervening layers or materials. *Id*., ¶¶ [0010] ("biodegradable plastic...can be sealed to paper by a heat fusion method."), [0013] ("biodegradable plastic" is "laminated on one or both sides of the paper."). When the biodegradable plastic is laminated on both the exterior and interior surfaces, the plastics can be heated and used to seal the cup without using an additional adhesive. *Id.*, ¶ [0022]. Moreover, Nakagawa discloses the use of a "manufacturing method…which uses melt extrusion coating ***without the need for an adhesive***." *Id*., ¶[0013]. Therefore, no intervening adhesive layer is required.

148. Accordingly, it is my opinion that Nakagawa discloses or suggests element [1.4].

7. [1.5.1] "and comprising at least one biodegradable polyester polymer"

149. It is my opinion that Nakagawa discloses this element for the same reasons as claim [1.3.1]. Nakagawa discloses that the same "biodegradable plastic may be laminated on one or both sides of the paper." EX1008, ¶[0013] ("when laminating on both sides, different types of biodegradable plastics ***may*** be used.")

150. Thus, for the reasons explained above in Section VIII.B.4., it is my opinion Nakagawa discloses element [1.5.1].

8. [1.5.2] "wherein the second moisture protectant layer has a coat weight of from 5 to 30 lbs./3000 ft2"

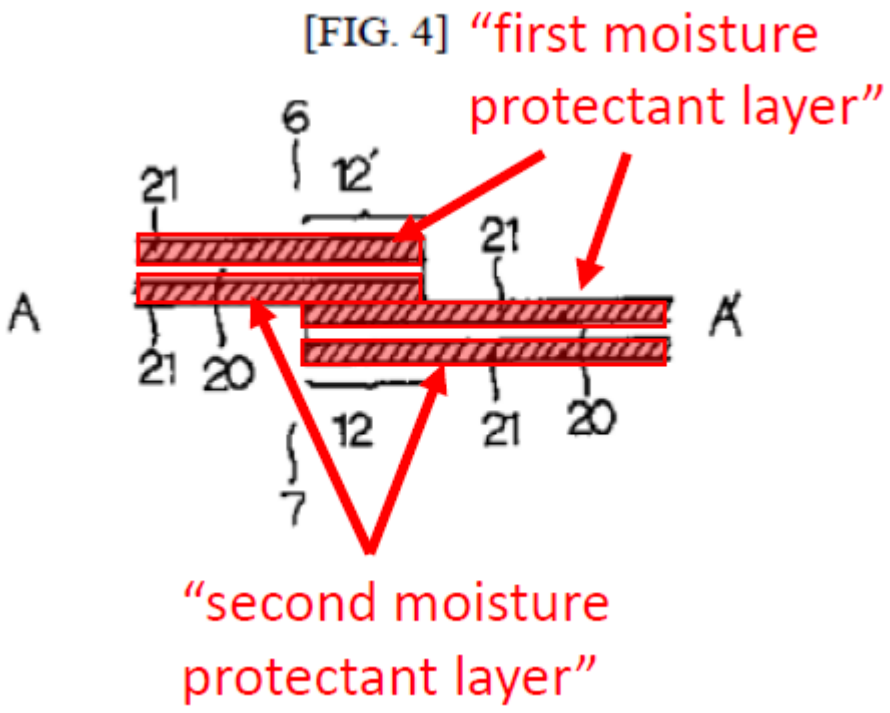
151. It is my opinion that Nakagawa discloses this element for the same reasons as claim element [1.3.2], as discussed above in Sections VIII.B.5.a. Alternatively, Nakagawa and Applicant's Admitted Prior Art render this element obvious for the same reasons as claim element [1.3], as discussed above in Section VIII.B.5.b-d.

152. Claim elements [1.3.2] and [1.5.2] are substantively identical except that element [1.5.2] refers to the second moisture protectant layer and element [1.3.2] refers to the first moisture protectant layer. *Compare* claim element [1.3.2] *with* claim element [1.5.2]. Nakagawa does not disclose the use of different coat weights for the biodegradable plastic 21 laminates depending on whether they are laminated to the interior or exterior surface. Thus, for the same reasons explained in Section VIII.B.5.a, Nakagawa discloses the *second moisture protectant layer having a coat weight of 5 to 30 lbs./3000 ft*^{2}. Alternatively, for the same reasons it would have been obvious to a POSITA to try the coat weights disclosed in the Applicant's Admitted Prior Art for the first moisture protectant layer, it would have been obvious to a POSITA to try those same known coat weights for the second moisture protectant layer. *See* Section VIII.B.5.b-d.

153. Accordingly, it is my opinion that Nakagawa, or alternatively Nakagawa in view of Applicant's Admitted Prior Art, render obvious element [1.5.2].

9. [1.6] "and is separate from the first moisture protectant layer coated on and directly adhered to said interior surface of said substrate"

154. Nakagawa discloses or suggests this element. Specifically, Nakagawa discloses that the *second moisture protectant layer* (biodegradable plastic 21) *is separate from the first moisture protectant layer* (biodegradable plastic 21):



Nakagawa, FIG. 4*

155. As highlighted above in Figure 4, the second moisture protectant layer is separated from the first moisture protectant layer by the paper 20. Through the

ordinary method of laminating, one side of the paper 20 (e.g., the side forming the interior surface) is laminated with a layer of biodegradable plastic, while the other side of the paper 20 (e.g., the side forming the exterior surface) is separately laminated with a layer of biodegradable plastic. The two biodegradable plastic layers are necessarily separate, as not only are they on opposing sides of the paper substrate, but the two biodegradable plastic layers may be of "different types of biodegradable plastics." EX1008, ¶[0013].[11]

156. Accordingly, Nakagawa discloses or suggests this element.

C. Dependent Claim 2

1. [2.1]: "The product according to claim 1, wherein the second moisture protectant layer further comprises from 5 to 20 percent by weight of at least one filler selected from the group consisting of calcium carbonate and starch."

157. As explained above, it is my opinion that Nakagawa – or the combination of Nakagawa and the Applicant's Admitted Prior Art – renders obvious the subject matter of claim 1. *Supra* Section VIII.B. Moreover, it is my opinion that Nakagawa discloses or suggests the additional subject matter of claim 2 because, in

[11] Like all paper cups, the cup disclosed in Nakagawa includes a sealing part where the paper cup overlaps itself. In this limited portion, the two plastic layers touch. The two layers are still separate in this sealing portion.

Nakagawa, *the second moisture protectant layer* (biodegradable plastic) *further comprises from 5 to 20 percent* (50% or less) *of at least one filler* (non-degradable additives, polymers, or non-degradable substance) *selected from the group consisting of calcium carbonate and starch*.

158. Nakagawa discloses that the biodegradable plastics can be used in a mixture that contains "various non-degradable additives, polymers, and the like." EX1008, ¶[0011]. Such additives can include fillers, like calcium carbonate. The amount of filler added must have a "weight ratio [of] 50% or less," otherwise the biodegradability will be significantly reduced and it can "cause problems in processing." *Id*. As "50% or less" encompasses the claimed range of "5 to 20 percent," this portion of claim 2 is disclosed by Nakagawa. *In re Peterson*, 315 F.3d 1325, 1329 (Fed. Cir. 2003). And although Nakagawa does not explicitly disclose that the filler could be calcium carbonate, a POSITA would have known that calcium carbonate is a non-degradable additive that is commonly used as a filler in biodegradable plastics. Calcium carbonate is cheap, it is available in many locations, and is easy to obtain due to developed supply chains.

159. Accordingly, it is my opinion that Nakagawa – or Nakagawa and the Applicant's Admitted Prior Art – renders obvious claim 2.

D. Dependent Claim 3

1. [3.1] "The product according to claim 1, wherein the first moisture protectant layer further comprises from 5 to 20 percent by weight of at least one filler selected from the group consisting of calcium carbonate and starch."

160. It is my opinion that Nakagawa–or the combination of Nakagawa and Applicant's Admitted Prior Art – renders obvious the subject matter of claim 3 for the same reasons as explained above for claim 2. This is because claim 3 only differs from claim 2 in that claim 2 pertains to the *second moisture protectant layer*, while claim 3 pertains to the *first moisture protectant layer*. *Compare* Claim 2 *with* Claim 3. Nakagawa does not disclose that different biodegradable plastics must be used for the first and second moisture protectant layers, much less that the filler composition must be different. To the contrary, Nakagawa teaches that the "biodegradable plastic may be laminated on…both sides of the paper" and that "different types of biodegradable plastics ***may*** be used on both sides" – meaning that Nakagawa does not require different plastics to be used. EX1008, ¶[0013]. Thus, a POSITA would understand that for the same reasons explained above for claim 2, calcium carbonate could be used as the non-degradable additive in the *first moisture protectant layer* as disclosed by Nakagawa.

161. Accordingly, it is my opinion Nakagawa – or Nakagawa and the Applicant's Admitted Prior Art – renders obvious claim 3.

E. Dependent Claim 11

1. [11.1] "The product according to claim 3, wherein the first moisture protectant layer comprises from 5 to 20 percent by weight of calcium carbonate as the filler."

162. As explained above, it is my opinion that Nakagawa – or the combination of Nakagawa and the prior art discussed and recognized by the '126 Patent – renders obvious the subject matter of claim 3. *Supra* Section VIII.D. Claim 11 only differs from claim 3 in that the filler must be calcium carbonate, not either calcium carbonate or starch. *Compare* Claim 3 *with* Claim 11. Because a POSITA would have known that calcium carbonate is a non-degradable additive that is commonly used as a filler in biodegradable plastics, it is my opinion that Nakagawa discloses or suggests claim 11.

IX. GROUND 3: NAKAGAWA IN VIEW OF TANNER RENDERS OBVIOUS CLAIMS 1-3, 11

A. Overview of Tanner

163. Tanner is analogous art to the '126 Patent and Nakagawa because it relates to the same field of endeavor – biodegradable laminated paper cups. Tanner relates to a "biodegradable paperboard-based package" for liquid and non-liquid food products. EX1009, Abstract. Tanner's paperboard-based package comprises a "paperboard substrate," a layer of "polyethylene extrusion coated onto the product-contact side of the paperboard," and a layer of "a biodegradable thermoplastic material extrusion coated on the exterior of the paperboard." *Id*., 2:16-19. The

paperboard-based package may then be converted into packages such as "paper-based cups". *Id*., 2:24.

B. Independent Claim 1

1. [1.pre] "A product in the form of a cup comprising a laminate forming moisture barriers, said laminate comprising:"

164. To the extent the preamble is limiting, it is my opinion that Nakagawa discloses or suggests this element for the same reasons discussed in Section VIII.B.1.

2. [1.1] "a paperboard substrate having a separate interior product facing surface and a separate exterior surface;"

165. It is my opinion that Nakagawa discloses or suggests this element for the same reasons discussed in Section VIII.B.2.

3. [1.2] "a first moisture protectant layer is coated directly only on said interior surface of said paperboard substrate"

166. It is my opinion that Nakagawa discloses or suggests this element for the same reasons discussed in Section VIII.B.3.

4. [1.3.1] "and comprising at least one biodegradable polyester polymer"

167. It is my opinion that Nakagawa discloses or suggests this element for the same reasons discussed in Section VIII.B.4.

5. [1.3.2] "wherein the first moisture protectant layer has a coat weight of from 5 to 30 lbs./3000 ft^2"

168. It is my opinion that Nakagawa and Tanner render this element obvious. Specifically, Tanner discloses the use of *a coat weight of from 5 to 30 lbs./3000 ft^2*

(coating weight of 7 to 20 lbs./3000 ft^2). It would have been obvious to modify the biodegradable plastic layer of Nakagawa to have a coat weight as disclosed in Tanner.

a. Tanner discloses coat weights of 5 to 30 lbs./3000 ft^2

169. Tanner discloses the use of a *coat weight of 5 to 30 lbs./3000 ft^2* (coating weight of 7 to 20 lbs./3000 ft^2) for a biodegradable polymer resin laminated on paper cups. Tanner discloses a "biodegradable paper-board-based package for various food products." EX1009, Abstract. One disclosed food product package is a "paper-based cup." *Id*., 2:21-24. "A preferred embodiment" disclosed by Tanner comprises a "biodegradable two-side coated paperboard-based laminate structure." *Id*., 2:55-57. The paper board substrate is coated with "a degradable polymer resin [] in a coating weight of 7 to 20 lbs., preferably 9 lbs.," whereby the "weights given for particular laminate layers…are expressed in pounds per 3,000 square feet." *Id*., 2:57-68. Thus, Tanner discloses laminating a biodegradable polymer onto a paper-cup substrate at a coat weight of between 7 to 20 lbs./3000 ft^2—falling entirely within the claimed range.

170. Accordingly, it is my opinion that Tanner discloses the use of a *coat weight of 5 to 30 lbs./3000 ft^2*.

b. Nakagawa-Tanner Combination

171. To modify Nakagawa to embody element [1.3.2], a POSITA would have modified Nakagawa's *first moisture protectant layer* (biodegradable plastic) to have a *coat weight of 5 to 30 lbs./3000 ft²* (coating weight of 7 to 20 lbs./3000 ft²) as disclosed in Tanner. As coat weight merely defines the thickness of the plastic layer to be laminated on the paper substrate, modifying the thickness of the biodegradable plastic layer disclosed in Nakagawa to be the thickness of the coat weight as disclosed in Tanner would practice element [1.3.2].

c. Rationale to Combine Nakagawa and Tanner

172. A POSITA would have had motivation to modify Nakagawa to incorporate the *coat weight of 5 to 30 lbs./3000 ft²* (coating weight of 7 to 20 lbs./3000 ft²) as disclosed by Tanner. I address two examples below.

173. **Conventional coat weight for paper cups:** As stated in Nakagawa, the goal of the disclosed invention is "to provide a paper cup using a biodegradable plastic that has the same performance as a conventional paper cup." EX1008, ¶ [0008]. Tanner similarly has the goal of providing a "paperboard-based…package which will biodegrade…and be structurally strong enough to hold food products in an acceptable manner." EX1009, 1:66-2:2. Although biodegradable plastics have certain differing properties from traditional plastics used on paper cups –such as

polyethylene[12]—Nakagawa discloses that the lamination of the biodegradable plastic on the paper can be accomplished using the same "ordinary method" of "extrusion coating." EX1008, ¶[0013]. Likewise, Tanner discloses that the biodegradable polymer is "extrusion coated" onto the paperboard substrate. EX1009, 2:18-20, 2:39-40, 3:56-60. As no specific coat weight is prescribed by Nakagawa, a POSITA would have been motivated to use ordinary/conventional methods of lamination – including the use of known coat weights used in extrusion coating of paper-based cups. Moreover, because both Tanner and Nakagawa disclose extrusion coating of biodegradable polymers onto a paperboard substrate for paper cups, a POSITA would have been motivated to incorporate the coat weights disclosed in Tanner into Nakagawa.

174. **Nakagawa describes the use of varying thicknesses of lamination:** Nakagawa does not prescribe a required range of coat weights for its biodegradable plastics. Nakagawa does describe various examples of embodiments of paper cups laminated with different biodegradable plastics at different thicknesses. EX1008, ¶¶[0024]-[0034] (describing various examples with biodegradable plastic laminate

[12] EX1008, ¶[0002] (describing conventional paper cups as being "laminated with plastic – generally polyethylene.")

thicknesses of 15μm or 30μm). As explained above, the thickness of the biodegradable plastic laminate is directly proportional to the coat weight. *See* Section VIII.B.5.a. Therefore, a POSITA would have recognized that different thicknesses/coat weights could be used for the paper cup disclosed by Nakagawa. Thus, a POSITA would have been motivated to try various coat weights, including the coat weights for biodegradable polymers disclosed by Tanner.

i. Obvious to try – Choosing from a Finite Number of Identified, Predictable Solutions, with a Reasonable Expectation of Success

175. My proposed modification of Nakagawa would have been obvious to try, as there are only a finite number of solutions for coat weight and there would have been a reasonable expectation that the coat weights disclosed by Tanner would have been successful. I analyze each relevant factor for the obvious to try rationale below:

176. **Recognized problem or need in the art:** *See* discussion in Section VIII.B.5.d.i.

177. **Finite number of identified, predictable potential solutions:** *See* discussion in Section VIII.B.5.d.i.

178. **POSITA could have pursued known potential solutions with reasonable expectation of success:** Nakagawa discloses that "the method for

laminating the biodegradable plastic and the paper may be an ordinary method used for laminating plastic and paper," specifically "extrusion coating." EX1008, ¶[0013]. Therefore, a POSITA would have recognized that the coat weights used for extrusion coating biodegradable polymers onto paper substrates – including the coat weights disclosed in Tanner – could be tested with a reasonable expectation of success. More particularly, because Nakagawa and Tanner disclose paper cups with biodegradable polymers extrusion coated onto the paper substrate, a POSITA would have a reasonable expectation that the coat weight of Tanner could be used successfully with Nakagawa.

179. Accordingly, it is my opinion that Nakagawa and Tanner render obvious element [1.3.2].

6. [1.4] "a second moisture protectant layer is coated directly only on said exterior surface of said paperboard substrate"

180. It is my opinion that Nakagawa discloses or suggests this element for the same reasons discussed in Section VIII.B.6.

7. [1.5.1] "and comprising at least one biodegradable polyester polymer"

181. It is my opinion that Nakagawa discloses or suggests this element for the same reasons discussed in Section VIII.B.7.

8. [1.5.2] "wherein the second moisture protectant layer has a coat weight of from 5 to 30 lbs./3000 ft2"

182. It is my opinion that Nakagawa and Tanner render this element obvious for the same reasons as claim element [1.3.2], as discussed above in Section IX.B.5, because the claim elements are substantively identical except that element [1.5.2] refers to the second moisture protectant layer and element [1.3.2] refers to the first moisture protectant layer. *Compare* claim element [1.3.2] *with* claim element [1.5.2]. Nakagawa discloses that the same "biodegradable plastic may be laminated on one or both sides of the paper." EX1008, ¶[0013] ("when laminating on both sides, different types of biodegradable plastics ***may*** be used.")

183. Nakagawa does not disclose the use of different coat weights for the biodegradable plastic 21 laminates depending on whether they are laminated to the interior or exterior surface. Thus, for the same reasons it would have been obvious to a POSITA to try the coat weights disclosed in Tanner for the first moisture protectant layer, it would have been obvious to a POSITA to try those same known coat weights for the second moisture protectant layer. Section IX.B.5.

184. Accordingly, it is my opinion that Nakagawa and Tanner render obvious element [1.5.2].

9. [1.6] "and is separate from the first moisture protectant layer coated on and directly adhered to said interior surface of said substrate"

185. It is my opinion that Nakagawa discloses or suggests this element for the same reasons discussed in Section VIII.B.9.

C. Dependent Claim 2

1. [2.1]: "The product according to claim 1, wherein the second moisture protectant layer further comprises from 5 to 20 percent by weight of at least one filler selected from the group consisting of calcium carbonate and starch."

186. As explained above, it is my opinion that the combination of Nakagawa and Tanner renders obvious the subject matter of claim 1. *Supra* Section IX.B. Moreover, it is my opinion that Nakagawa discloses or suggests the additional subject matter of claim 2 for the same reasons discussed in Section VIII.C.

187. Accordingly, it is my opinion that the combination of Nakagawa and Tanner renders obvious claim 2.

D. Dependent Claim 3

1. [3.1] "The product according to claim 1, wherein the first moisture protectant layer further comprises from 5 to 20 percent by weight of at least one filler selected from the group consisting of calcium carbonate and starch."

188. As explained above, it is my opinion that the combination of Nakagawa and Tanner renders obvious the subject matter of claim 1. *Supra* Section IX.B.

Moreover, it is my opinion that Nakagawa discloses or suggests the additional subject matter of claim 3 for the same reasons discussed in Section VIII.D.

189. Accordingly, it is my opinion that the combination of Nakagawa and Tanner renders obvious claim 3.

E. Dependent Claim 11

1. [11.1] "The product according to claim 3, wherein the first moisture protectant layer comprises from 5 to 20 percent by weight of calcium carbonate as the filler."

190. As explained above, it is my opinion that the combination of Nakagawa and Tanner renders obvious the subject matter of claim 3. *Supra* Section IX.D. Claim 11 only differs from claim 3 in that the filler must be calcium carbonate, not either calcium carbonate or starch. *Compare* Claim 3 *with* Claim 11. As explained above for claim 3, a POSITA would have known that calcium carbonate is a non-degradable additive that is commonly used as a filler in biodegradable plastics. Section VIII.C.

191. Accordingly, the combination of Nakagawa and Tanner renders obvious claim 11.

X. CONCLUSION

For these reasons, it is my opinion that the Challenged Claims of the ’126 Patent are unpatentable.

I hereby declare that all statements made of my own knowledge are true and that all statements made on information and belief are believed to be true. I could testify to the matters in this declaration competently if called upon to do so. I further declare that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of the Title 18 of the United States Code.

Executed this 21st day of April 2025 in Pullman, WA.

Respectfully Submitted,

Dr. Karl Englund