

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

BILLERUD AKTIEBOLAG (PUBL),

Petitioner,

v.

WESTROCK MWV, LLC,

Patent Owner

Case No. IPR2023-01206

U.S. Patent No. 11,293,142 B2

SUPPLEMENTAL DECLARATION OF CHARLES P. KLASS

WESTROCK EXHIBIT 2004
BILLERUD V. WESTROCK
IPR2023-01206

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I. INTRODUCTION AND QUALIFICATION

1. I, Charles P. Klass, declare as follows:
2. I have prepared this report as an expert witness retained by WestRock MWV, LLC. (“the Patent Owner”). I understand Billerud Aktiebolag (Publ) (“the Petitioner”) has filed a petition requesting *Inter Partes* Review (“the Petition”) of Claims 1, 2, and 4-23 of U.S. Patent No. 11,293,142 (“the ’142 Patent”), which is assigned to the Patent Owner. I understand the Board has instituted *Inter Partes* Review, and that counsel for Patent Owner has deposed Carl Zotterman, expert for the Petitioner. I have been asked by the Patent Owner to provide my opinions as to the grounds set forth in the Petition for Claims 1, 2, and 4-23 of the ’142 Patent and as they relate to the substitute claims presented herewith, the reasoning provided by the Board in the Decision to Institute, the transcript of the deposition of Carl Zotterman, and the technical bases for these opinions as appropriate.
3. This Declaration contains statements of my opinions formed to date and the bases and reasons for those opinions. I may offer additional opinions based on further review of materials in this case, including opinions and/or testimony of other expert witnesses. I make this Declaration based upon my own personal knowledge and experience and, if called upon to testify, would testify competently to the matters contained herein.

4. As I explain more fully below, it is my opinion that the prior art references cited in the Petition, *Fugitt, Papermaking, Gratton*, and *Papermaking II*, whether they are considered individually or in combination with one another, do not teach, suggest, or disclose each and every element of Claims 1, 2, and 4-23 of the '142 Patent, nor do they teach, suggest, or disclose each and every element of Substitute Claims 24-27 as presented in the Motion to Amend (“MTA”) so as to render the claims obvious to one having ordinary skill in the art. Also, it is my opinion that it would not have been obvious to those of ordinary skill in the art at the time of the invention to combine *Fugitt, Papermaking, Gratton*, and *Papermaking II* with one another.

A. Background

5. A summary of my education background, career history, publications, and other relevant qualifications, along with compensation and my curriculum vitae are provided in my first declaration, Exhibit 2003.

II. DOCUMENTS AND MATERIALS

6. I have considered information from various sources in forming my opinions. I have reviewed and considered each of the exhibits listed in the attached Appendix 1 (Materials Considered) in forming my opinions. I have also reviewed and considered the Petition, the Declaration of Carl Zotterman that accompanied the Petition, the Board Decision to Institute, and the deposition

of Carl Zotterman. In forming my opinions, I have also relied on my experience and education.

III. UNDERSTANDINGS OF THE LAW

7. For purposes of this Declaration, Counsel has informed me of certain legal standards in patent law that are relevant to my opinions. I have applied these standards in forming opinions below.
8. I understand that in an *Inter Partes* Review, the Petitioner has the burden of proving unpatentability by a preponderance of the evidence and that the burden never shifts to the Patent Owner. I understand this standard is different from the standard that applies in a district court, where I understand a challenger bears the burden of proving unpatentability by clear and convincing evidence.
9. I understand that an invention that would have been obvious to a person of ordinary skill at the relevant time is not patentable, and that obviousness is a question of law based on underlying factual inquiries. I understand that the factual inquiries enunciated by the Court, as outlined in *Graham v. John Deere* and *KSR* are as follows: (A) Determining the scope and content of the prior art; (B) Ascertaining the differences between the claimed invention and the prior art; and (C) Resolving the level of ordinary skill in the pertinent art.

10. I understand a conclusion of obviousness based on a combination of references must be supported with explicit analysis of a reason to combine those references, including, what the prior art teaches, whether a person of ordinary skill in the art would have been motivated to combine references, and whether a reference teaches away from the claimed invention are questions of fact.
11. I understand that when a piece of prior art suggests that the line of development flowing from the reference's disclosure is unlikely to be productive of the result sought by the applicant' the piece of prior art is said to 'teach away' from the claimed invention. I understand that a reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant.
12. I understand that a reference may still teach away from the claimed invention even if that reference merely expresses a general preference for an alternative invention but does not criticize, discredit, or otherwise discourage investigation into' the claimed invention.
13. My opinions are based upon the information that I have considered to date. I reserve the right to supplement my opinions in the future to respond to any

arguments raised by the Petitioner and to take into account new information that becomes available to me.

IV. THE '142 PATENT

14. In this section, I provide my summary of the disclosure of the '142 Patent.

A. Summary of the '142 Patent

15. The application for the '142 Patent was filed May 7, 2020 and was assigned Serial No. 16/869,156 (“the '156 Application”) and included a priority claim to a previously filed provisional application, namely U.S. Provisional Patent Application Serial No. 62/846,278 filed May 10, 2019. The '142 Patent issued on April 5, 2022. The title of the '142 Patent is “Smooth and low density paperboard structures and methods for manufacturing the same.”

16. The “Background of the Invention” section of the '142 Patent explains that conventional paperboard manufacturing techniques achieved smoothness through a wet stack calendering process in which the paperboard is rewetted and passed through a calendering device having two or more hard rolls. The '142 Patent stated that while wet stack calendering smooths paperboard by compressing the fiber network through a nip load, the density of the paperboard is increased. (Ex. 1001, 1, 28-39). The patent explained that the increased density is not a desired characteristic for most paperboard structures, and that traditionally a tradeoff must be struck between

smoothness and density for paperboard. (*Id.* at 1:35-39). The '142 Patent represents an advance over prior conventional techniques, specifically, the '142 Patent provides for an improvement in the tradeoff between smoothness and density for paperboard, e.g., achieving greater smoothness with less density.

17. The “Detailed Description” of the '142 Patent explains the inventive process of manufacturing a paperboard substrate with reference to Fig. 2, which is reproduced below.

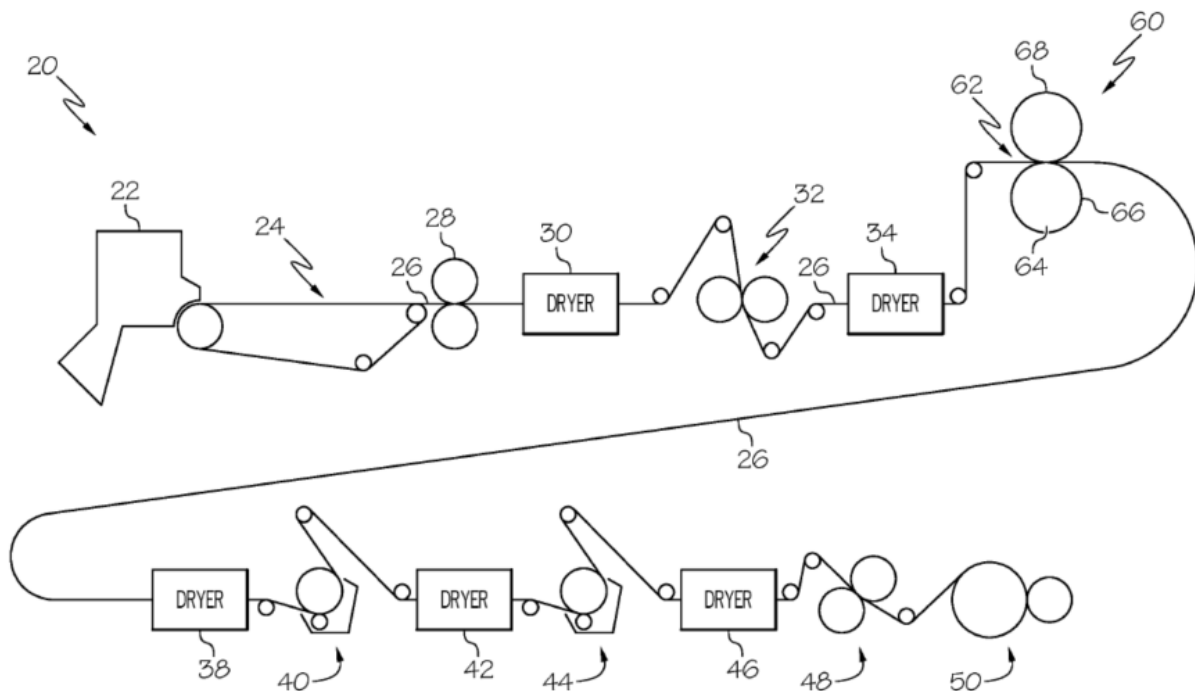


FIG. 2

18. Beginning from a headbox 22, which discharges a fiber slurry onto a Fourdrinier 24, a paperboard substrate 26 passes through one or more wet

presses 28, one or more driers 30, a size press 32, and an optional dryer 34. (*Id.* at 5:27-36). Then the paperboard substrate 26 passes through the hot-hard calender 60 to become a calendered paperboard substrate. (*Id.* at 5:37-38). It is this hot-hard calender 60 that is a point of much discussion in the present proceeding. After the hot-hard calender 60, the calendered paperboard substrate passes through one or more dryers 38, 46, and coaters 40, 44, then optionally through a gloss calender 48 and finally onto a reel 50. (*Id.* at 6:5-22).

19. The hot-hard calender 60 includes a nip 62, the gap defined between the rollers 64, 68, which can be loaded to apply a nip load to the paperboard substrate 26 passing therethrough. (*Id.* at 5:39-40). The two rollers 64, 68 include the thermo-roller 64 and the counter roller 68. (*Id.* at 5:40-42). The contact surface 66 of the thermo-roller 64, *i.e.*, the surface that contacts the paperboard substrate, is heated to an elevated temperature. (*Id.* at 5:45-47).
20. The '142 Patent provides Examples 1-6 for six different paperboard structures. (*Id.* at 6:40-10:5). The Examples provide the details of the coatings used, the basis weights of the paperboard substrate before calendering and coating, the nip loads used in the hot-hard calendering, the thermo-roller contact surface temperature for each example, and the resulting surface smoothness and basis weight for each example. The six

examples give thermo-roller contact surface temperatures of 480 °F for Examples 1-3 and 500 °F in Examples 4-6. For Examples 1-3, the initial paperboard substrate had a basis weight of 145 lbs/3000 ft², and for Examples 4-6, the initial paperboard substrate had a basis weight of 104 lbs/3000 ft².

21. The resulting surface smoothness, measured in Parker Print Surf (PPS 10S), ranged from 1.7 to 1.9 microns for Examples 1-3 where the contact surface temperature was 480 °F, and ranged from 1.3 to 1.4 microns for Examples 4-6, where the contact surface temperature was 500 °F. The resulting bulk, inferred from caliper points (where more points means less dense, more desirable paperboard), for Examples 1-3 ranged from 15.1 to 15.5 points, where the contact surface temperature was 480 °F, and ranged from 10.3 to 10.6 points, where the contact surface temperature was 500 °F.
22. The '142 Patent also gives six comparative examples, one for each of the six examples described above. The comparative examples each started with the same paperboard substrate as their respective one of the six examples, but were calendered with a traditional 4-nip calender with roller surface temperatures of 200 °F and considerably higher nip loads. By comparison, the comparative examples ended up with higher density paperboard structures over a comparable range of smoothness. This can be seen in

TABLE 2 of the '142 Patent. To a person of ordinary skill in the art, this proves that the hot-hard calendering disclosed in the '142 Patent yields a better tradeoff between density and surface smoothness than with traditional calendering.

23. Fig. 4 in the '142 Patent, reproduced and annotated below, shows caliper density versus caliper points for Examples 1-6 and for numerous prior art points. Notice the separate groupings of data points for Examples 1-3 and for Examples 4-6 which both show lower density than the prior art data points of comparable caliper. Thus, Fig. 4 shows an advance into an area of density/caliper space that was previously unattained.

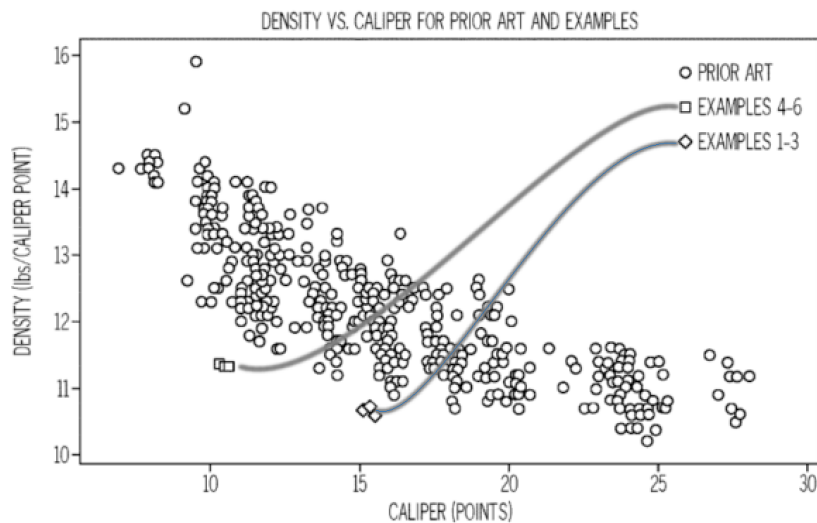


FIG. 4

24. Fig. 7 in the '142 Patent, reproduced and annotated below, shows two parabolic curves of basis weight as a function of caliper points. Basis weight is related to density such that a lower basis weight is desirable. Notice in

particular that the curve labeled Y_2 is recited as an element in Claim 1, *i.e.*, $Y_2=3.71+13.14X-0.1602X^2$. As shown in the annotated version of Fig. 7 below, all six of the examples in the '142 Patent are *below* the Y_2 curve. In Fig. 8, reproduced below, the Y_2 curve is shown again, this time with the prior art data points, which all lie *above* the Y_2 curve.

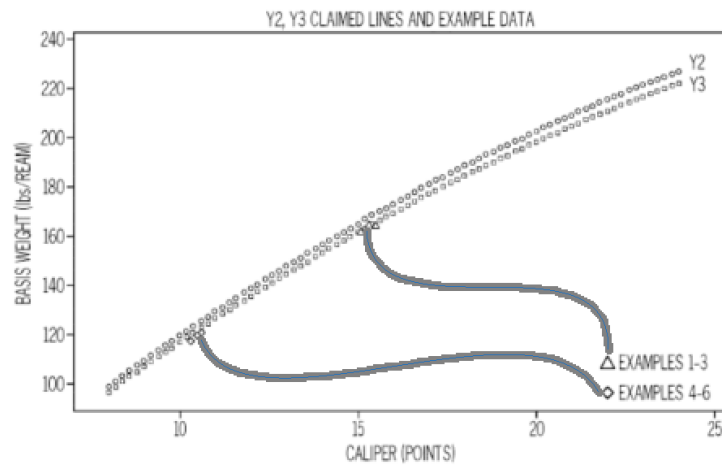


FIG. 7

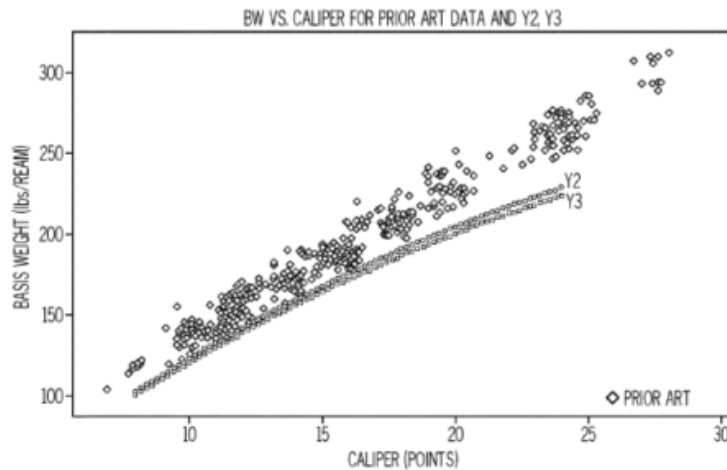


FIG. 8

V. CLAIM CONSTRUCTION

25. For purposes of this Motion, Patent Owner adopts the claim construction as set forth in the Decision to Institute, therefore I do not provide an opinion on claim construction in this declaration.

VI. SUMMARY OF THE PRIOR ART

26. The Petition and the Zotterman Declaration assert various patents and publications. I have reviewed and considered each of these, along with the materials in Appendix 2 of the Zotterman Declaration that are not asserted *per se*, namely *Crotogino* and *Paperboard Examples*. In addition, I have also reviewed one prior art reference for which the Petition and the Zotterman Declaration failed to account, namely *Mohan*.

A. *Fugitt*

27. *Fugitt* is a patent application about coatings for paperboard. *Fugitt* discloses a method for coating dry finish paperboard. (*See generally*, Ex. 1004). *Fugitt* explains the relationship between basis weight and density determines stiffness, *i.e.*, that generally stiffness increases with basis weight. (*Id.*, at [0003]-[0005]). However, increasing basis weight means adding fiber material, which adds to cost. (*Id.*). Thus, in order to increase stiffness without increasing the basis weight, density can be reduced. (*Id.*) One objective in *Fugitt* is to reduce density loss, expressed as avoiding reduction

in caliper thickness, to maintain stiffness without the increased cost of adding fiber to achieve stiffness through increasing basis weight. (*Id.* at [0026]). Another objective in *Fugitt* is to provide surface smoothness. (*Id.* at [0005]).

28. Smoothness and stiffness are both desirable for printing. Smoothness allows for high resolution printing. Normally, smoothness is achieved by reducing caliper thickness, *i.e.*, by compacting the paperboard as in newsprint and glossy paper used for books. However, compacting paperboard makes the paperboard less stiff. Flimsy paperboard tends to foul paperboard printers. Therefore, in *Fugitt*, the goal is to improve smoothness without sacrificing stiffness by using coatings on the paperboard surface. (*Id.*). *Fugitt* does not provide a numerical range of nip loads beyond an indication that nip loads and number of nips in the steam headed calender can be reduced. (Ex. 1004, [0026]). The equation for stiffness is:

$$S = kEc^3$$

where S = Stiffness, E = Young's modulus of elasticity, and c = Caliper. As I will explain in greater detail below, European mills and those in other regions of the world cannot achieve the needed stiffness (resistance to bending) with a single ply sheet.

29. *Fugitt* paragraph [0025] indicates the use of a dry stack calender instead of a wet stack calender, and paragraph [0026] indicates the rolls of the dry stack calender can be steam heated. That being said, *Fugitt* is primarily a document about coatings, whereas the '142 Patent is more about calendering. Despite this difference, it is my opinion that what attracted the attention of the Examiner to *Fugitt*, and also the interest of the Petitioner, is Example 3 in *Fugitt*. Example 3 is the only place in *Fugitt* (or in any of the prior art) where there is an example of a paperboard structure that falls under the Y₂ curve of Claim 1 of the '142 Patent.

B. *Papermaking*

30. *Papermaking* is a Finnish textbook or handbook-style treatise in English from 2010 (within a year of the publication of *Fugitt*), published as an update to an earlier edition from 1998-2000. (See Ex. 1005, pp. 2-3). *Papermaking*, which is an update of the original edition, is likely to be the largest and most comprehensive book series in the field of papermaking but I question whether it is universally considered to be the most authoritative textbook on papermaking. It is written from a European perspective and does not necessarily reflect the state of the art in USA especially in discussion of paperboard where the Patent Owner and other producers make single ply coated bleached (SBS) board – a product that is not manufactured

in Europe. European folding carton board (FBB) is a multi-ply sheet with mechanical pulp middle ply, which I describe in more detail below. The chapter of *Papermaking* that the Petition relies upon is organized in relevant part as follows. First there is an overview of calendering, the process of compressing a web of paper during its manufacture. (See Ex. 1005, pp. 14-35). Then there is an explanation of different kinds of papermaking calenders. (*Id.* at pp. 35-67). There is an explanation of applications for calendering, wherein various types of paper products are discussed with respect to the types of calenders used for making the same. (*Id.* at pp. 67-99). Finally, the relevant chapter of *Papermaking* ends with a discussion of construction consideration for making the various types of calenders. (*Id.* at pp. 84-99).

31. *Papermaking* lists various types of calenders including: hard-nip calenders, two-roll hard-nip calenders, soft calenders, gloss calenders, two-roll soft calenders, three-roll soft calenders, supercalenders, multi-nip calenders, Janus calenders, OptiLoad calenders, ProSoft calenders, show-nip calenders, metal belt calenders, wet stack calenders, breaker stack calenders, friction calenders, and embossing calenders. (*Id.* at pp. 35-67). *Papermaking* lists calendering methods for various applications for calenders including: newsprint, SC paper, coated wood containing paper grades, woodfree

uncoated papers, woodfree coated papers, containerboards, uncoated liquid packaging board, and release and coated label paper. (*Id.* at pp. 67-84).

Papermaking lists consideration for construction of various types of calenders at pages 84-99.

32. USA mills are the world's only producer of single ply coated SBS board. Three species of pine – Loblolly pine, slash pine, and long leaf pine—grow only in the southeast USA. These three species have thicker cell walls (4 – 11 µm) than the softwoods that grow in the Nordic countries (2 - 4 µm) where *Papermaking* was published. Southern US hardwood species including white oak and sweet gum have cell wall thickness of 5 - 8µm compared to birch and aspen at 2 - 3 µm. Stiffness is a critical property in folding cartons and other rigid packaging. The equation for stiffness is:

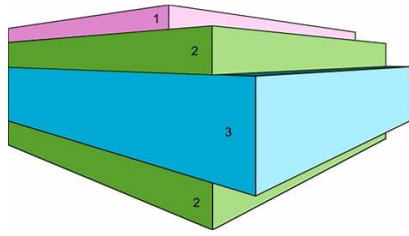
$$S = kEc^3$$

where S = Stiffness, E = Young's modulus of elasticity, and c = Caliper.

European mills and those in other regions of the world cannot achieve the needed stiffness (resistance to bending) with a single ply sheet. European mills including those of the Petitioner do not make single-ply coated SBS.

They make a grade called FBB (Folding boxboard) that is a 3-ply sheet with kraft pulp top and bottom plies and a mechanical pulp middle ply, as shown below, where the numbered layers are identified below the image.

FBB – Folding Boxboard



1 – Pigment coating

2 – Bleached kraft pulp – top ply

3 – Mechanical pulp – middle ply

2 – Bleached kraft pulp – bottom ply

The mechanical pulp in the middle ply provides bulk for stiffness, but it reacts differently to conventional and hot hard calendering than a single ply coated SBS sheet.

33. At the time of the invention, hot hard nip calendering with only one roll heated was not in use in coated paperboard mills in the temperature ranges in the '142 Patent. There was use of soft nip calenders and gloss calenders with only one roll heated for finish calendering after coating but no use of a hot hard calender with only one roll heated to an elevated temperature for pre-calendering prior to coating, and the use of a hot hard nip calender with only one roll heated to the elevated temperature was neither known nor obvious to one of ordinary skill in the art.

C. Gratton

34. *Gratton* is a January 1988 article in the TAPPI Journal. It compares temperature gradient (“TG”) calendering at 210 °C with more conventional calendering at 50 °C. (Ex. 1006, p. 82). In both cases, both rolls were heated to the same temperature. (Ex. 1006, Fig. 1). That is to say in the 210 °C case, both rolls were heated to 210 °C, so the paper web was heated on both sides. (*Id.* at p. 82). There is no thermo-roller versus counter roller in *Gratton* as there is in the ’142 Patent. *Gratton* is a research paper typical of the research work referred to in *Papermaking*, “[h]eating up both nip rolls, however, is complicated because the other roll is a deflection-compensated roll. Because of the benefits of soft-calender technology, this kind of calendering has remained very rare in spite of the amount of research work done.” (See Ex. 1005, p. 40).
35. It appears that the authors of *Gratton* believed their innovation was to reduce the number of nips the web had to pass through by heating the one nip in the TG calendering to 210 °C, to obtain better final properties, *i.e.*, the roller temperature and the number of nips appear to be the only meaningful difference between TG and conventional calendering. (Ex. 1006, p. 86). Notably, the nip loads used in both TG and conventional calendering were in the same range, *i.e.* 20, 40, 60, 80, and 100 kN/m. (*Id.*)

36. It is worth noting that based on the Table II of *Gratton*, *Gratton* is not in the same class as *Fugitt* or the '142 patent in terms of basis weight, thickness (caliper), or Parker Print-Surf (S10) smoothness. For basis weight (where less is better), *Gratton* ranges from 358 g/m² to 381 g/m², whereas *Fugitt*'s Example 3 is at 130.0 lbs/3000 ft² (which converts to 211.6 g/m²) and the basis weight in Claim 1 at *Fugitt*'s caliper thickness (using the equation in Claim 1) is 138.3 lbs/3000 ft² (which converts to 225.1 g/m²). (Ex. 1006, p. 84; Ex. 1004, [0057]). For thickness (caliper) *Gratton* ranges from 0.522 mm to 0.716 mm,¹ whereas *Fugitt*'s Example 3 is at a caliper thickness of 12 points, which converts to 0.3048 mm, and the examples in the '142 Patent range from 10.3-15.5 points, which converts to 0.261-0.3937 mm. (Ex. 1006, p. 84, Ex. 1004, [0057]; Ex. 1001, col. 11-12 Table 2). Finally for smoothness Parker Print-surf (S10) (where less is better), *Gratton* ranges from 4.17 to 8.32 microns, whereas Claim 1 recites at most 3 microns, and Example 3 in *Fugitt* yielded 1.5 microns. (Ex. 1006, p. 84, Ex. 1004, [0057]; Ex. 1001, col. 11-12 Table 2). Both *Fugitt* and the '142 patent seriously outclass *Gratton* where the examples are for a much thicker, heavier,

¹ There is clearly a typographical error in *Gratton* because the caliper numbers are off by a factor of 1,000. Perhaps the millimeters (mm) were intended to be stated as nanometers (nm), i.e. "n" in "nm" was transposed to "m". In my comparison of *Fugit* and the '142 Patent above, I am correcting for *Gratton*'s error.

rougher paperboard. In the foregoing metrics, *Fugitt* and the '142 Patent both outclass *Gratton* by so great a margin, it leads me to conclude that *Gratton* is not a likely source from which one of ordinary skill in the art would draw to try to improve over *Fugitt* to arrive at what is claimed in the '142 Patent.

D. *Papermaking II*

37. *Papermaking II* is an excerpt dated to 2000 from the same series of books as *Papermaking*. The excerpt relates to board coating for containerboard and linerboard, and includes mention of carrier board, liquid board, boxboard, and solid bleached sulphate (“SBS”). (*See generally* Ex. 1007). The first paragraph of Section 2.1 indicates there is a size press before coating, and states that low-consistency starch is applied on the board surface in association with the size press. (Ex. 1007, p. 583).
38. I note that I was the book reviewer for the volume from which *Papermaking II* was excerpted. My name appears on Page 2 of Exhibit 1007 accordingly.

VII. PETITIONER’S OBVIOUSNESS GROUNDS

39. In this section, I compare the claims of the '142 Patent to the disclosure of the materials cited herein and present my analysis for the patentability of the challenged claims. Based on my review and analysis of those materials, my opinions regarding the understanding of a person of ordinary skill in the art

in the 2019 timeframe, and my training and experience, it is my opinion that it would not have been obvious to a person of ordinary skill in the art to arrive at Claims 1, 2, and 4-23 of the '142 Patent or the Substitute Claims presented in the MTA. The reasons for this conclusion are explained below.

A. Ground 1: Claims 1, 2, and 5-23 are not Obvious Under 35 U.S.C. § 103 over *Fugitt* in view of *Papermaking*

40. In my opinion, *Fugitt* and *Papermaking* do not describe each and every element recited in Claims 1, 2, or 5-23 of the '142 Patent, and it would not be obvious to one of ordinary skill in the art to combine *Fugitt* and *Papermaking* to arrive at the features claimed.

1. Claims analysis

41. In the sections below, I provide my response to the feature-by-feature analysis in the Petition, Zotterman Declaration, and the Decision to Institute.

a. Claim 1

42. Claim 1 recites a method for manufacturing a paperboard comprising passing a paperboard substrate through a hot-hard calender, said hot-hard calender comprising a nip defined by a thermo-roller and a counter roller, where a contact surface of said thermo-roller is heated to an elevated temperature of at least 250° F. (Ex. 1001, 12:35-40). In its Decision granting institution of *inter partes* review, the Board stated with regard to

this limitation that “it was not necessary under a theory of using steam-heated rollers for Petitioner to show that the paperboard substrate properties disclosed in *Fugitt* would still be achieved after increasing temperature.” (Paper 14, p. 26).

43. However, as I understand, if a proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. Thus, Petitioner was required to show that the paperboard substrate of *Fugitt* would still be satisfactory for its intended purpose, *i.e.*, that the substrate properties disclosed in *Fugitt* would still be achieved after elevating the contact surface temperature of the calender rolls to at least 250° F. While *Fugitt* discloses in [0026] that the rolls of the calender may be heated using steam (“steam heated”), this is not the same as elevating the contact surface temperature of the rolls **to at least 250° F**. Nowhere does *Fugitt* contemplate elevating the contact surface temperature of its calender rolls to at least 250° F.
44. *Papermaking* discloses steam heated calender roll surface temperatures up to 170° C (338° F). (Ex. 1005, p. 98). But *Papermaking* does not disclose a low end for contact surface temperature range with steam heating. A steam heated roller can be run as low as ambient temperature if the steam is shut

off, as low as about 212° F to about 220° F contact surface temperatures with saturated steam. There is no evidence that the steam heating referred to in *Fugitt* can achieve a set contact surface temperature of at least 250° F. In my opinion, *Fugitt* and *Papermaking*, even considered in combination, do not provide sufficient specificity to render the at least 250° F contact surface temperature of Claim 1 obvious.

45. *Fugitt* specified smoothness, caliper, and basis weight measurements for paperboard produced in its process, but did not specify a roller contact surface temperature of at least 250° F, or any other temperature. Thus, it is my understanding that in order to meet its burden, Petitioner was required to proffer proof that the process in *Fugitt* could be used with, and could achieve, a roller contact surface temperature of at least 250° F. Moreover, Petitioner was required to proffer evidence that at a contact surface temperature of at least 250° F, the process specified in *Fugitt* would yield the smoothness, caliper, and basis weight specified in *Fugitt*. For example, Petitioner could have run a test mill with the conditions set forth in *Fugitt*, and with a roller contact surface temperature of at least 250° F. Petitioner could then measure the smoothness, caliper, and basis weight of the paperboard output from the test mill. If the measurements supported Ground 1, Petitioner could have offered the measurements as evidence in this

proceeding. Petitioner has not done so. Nor has Petitioner shown anywhere in the asserted art that a roller contact surface temperature of at least 250° F has yielded the smoothness, caliper, and basis weight described in *Fugitt*. In short, Petitioner has not offered any evidence sufficient to carry its burden.

46. Accordingly, it is my opinion that Claim 1 is patentable over each of *Fugitt* and *Papermaking*, and any combination thereof.

b. Claim 2

47. Claim 2 depends from Claim 1 and further recites “a nip load ranging from about 20 pli to about 500 pli.” (Ex. 1001, 12:56-59). With the proper unit conversion from kN/m to pli, *Papermaking* discloses nip loads ranging from 57.1 to 228.6 pli, which is not stated as being particularly relevant to cartonboard. (See Ex. 1005, p. 72; Ex. 2003, ¶105). Additionally, *Papermaking* gives a nip load value that can be exceeded, 100 kN/m (571 pli), on page 82, which may be relevant to cartonboard, but this value is far outside the range recited in Claim 2. (*Id.*).
48. In my opinion, it is improper to combine the *Papermaking* nip load range of 57.1 to 228.6 pli with *Fugitt*. Specifically, *Fugitt* teaches a basis weight of 130 lbs/3000 ft², a bulk of 12 points, and a smoothness of PPS 10S of 1.5 microns in Example 3. (Ex. 1004, [0057]). This is the only place in *Fugitt* that discloses these properties with specific values. (*Id.*). Furthermore,

Example 3 in *Fugitt* pertains to solid bleached sulfate (SBS) board. (Ex. 1004, [0054]). Thus, the only paperboard properties in *Fugitt* that are relevant to the Y_2 equation recited in Claim 2 (by way of depending from Claim 1) pertain to SBS board.

49. In contrast, the nip load range 57.1 to 228.6 pli from *Papermaking* pertains to wood-containing paper grades, a completely different kind of paper product from the wood-free SBS board used in Example 3 of *Fugitt*. (See Ex. 1005, p. 72 and Ex. 2005, p. 32, ll. 22-24). Petitioner has not given any justification for using a nip load range for wood-containing paper grades, while using a basis weight, bulk, and smoothness for SBS board. (*Id.*; see also, Ex. 1004, [0053] and [0057]). In view of this, I believe Petitioner and Zotterman are relying on impermissible hindsight reasoning.
50. In his deposition, Petitioner's expert, Carl Zotterman, gave testimony that underscores the inappropriateness of hindsight-guided picking, choosing, and mixing of physical properties from SBS board with nip loads for wood-containing paper grades. ("Zotterman Deposition") (Ex. 2005). Zotterman testified at length that SBS board is made by a kraft process, it is a wood-free paper product, and it has substantially different yield, bulk characteristics, and light fastness properties, compared to wood-containing paper products. (Ex. 2005, 32:15-34:24). I note that *Papermaking* gives the

same nip load range for WFC (woodfree coated papers, a third type of paper product that differs from wood-containing paper grades and from SBS) on page 76 as for wood-containing paper grades on page 72. (Ex. 1005, pp. 72, 76). WFC is also irrelevant to *Fugitt*'s SBS paperboard in Example 3, since WFC is in a completely different branch of the paper products family. This can be seen in the diagram in paragraph 57 of the Zotterman Declaration, where SBS, solid bleached board, as a member of the Paperboard Grades, but WFC is not. (Ex. 1003, ¶ 57).

51. In view of the foregoing, it is my opinion that *Fugitt* and *Papermaking* do not render Claim 2 obvious. Claim 2 is patentable over *Fugitt* and *Papermaking*.

c. Claims 5-14 and 16-22

52. Each of Claims 5-14 and 16-22 depend from Claim 1 and therefore include all of the limitations of Claim 1. (Ex. 1001, 12:65-14:23). Accordingly, it is my opinion that Claims 5-14 and 16-22 are patentable over *Fugitt*, *Papermaking*, *Gratton*, and *Papermaking II*, and any combinations thereof.

d. Claim 15

53. Claim 15 depends from Claim 13 and further recites “wherein said ground calcium carbonate comprises at least about 10 percent by weight of said basecoat pigment and at most about 60 percent by weight of said basecoat

pigment.” Petitioner relies for this limitation upon *Fugitt*, paragraph [0044], which discloses 50:50 clay to calcium carbonate, but Petitioner has not explained how this number correlates to the range of 10-60 percent ground calcium carbonate by weight, as recited in Claim 15. (Pet., pp. 47-48).

54. In view of the foregoing, it is my opinion that Claim 15 would not have been obvious to one having ordinary skill in the art in view of *Fugitt* and *Papermaking*. Claim 15 is therefore patentable over *Fugitt* and *Papermaking*.

e. Claim 23

- i. The use of 12.2 caliper points requires impermissible hindsight.*

55. Claim 23 depends from Claim 1 and further recites “wherein said paperboard structure has a basis weight, a caliper thickness and a Parker Print Surf (PPS 10S) smoothness, said Parker Print Surf (PPS 10S) smoothness being at most 3 microns, said basis weight being at most Y_3' pounds per 3000 ft², wherein Y_3' is a function of said caliper thickness (X) in points” and is calculated as set forth in the claim. (Ex. 1001, 14:25-32). In its challenge to Claim 23, Petitioner cites to Example 3 in *Fugitt*. (Pet. pp. 53-54). Example 3 in *Fugitt* yields a paper product with a caliper thickness of 12 points. (*Id.*). Calculating the value of Y_3' in Claim 23 using a caliper of 12 as the value for X gives a calculated basis weight of 128.7.

(See Ex. 2006). In short, Claim 23 recites a basis weight below 128.7 for paperboard with 12 caliper points. But Example 3 in *Fugitt* yielded a basis weight of 130.0, which is greater than 128.7 and therefore lies outside the range recited in Claim 23. (Ex. 1004, [0057]). This inescapable mathematical reality was confirmed by Mr. Zotterman:

Q. Is 128.69 greater than or less than 130?

A. It's less.

(Ex. 2005, 62:17-20; *see also* Ex. 2006).

56. To achieve a calculated Y_3 ' basis weight above the 130.0 basis weight value from Example 3 of *Fugitt*, Petitioner arbitrarily increased the 12 caliper points by 1.6% to make the X value 12.2 when calculating the Y_3 ' basis weight for Claim 23. (Pet. pp. 53-54). During his deposition, Mr. Zotterman was given the opportunity to prove that he was not employing hindsight reasoning when he picked using a 12.2 caliper value for (X) in the Y_3 ' equation of Claim 23, but instead he justified his use of hindsight by referring to the basis weight of 130 as merely "an example" of a basis weight that could be used in the Y_3 ' equation. (Ex. 2005,50:22-51:4).
57. A pattern appears in the Petition and in the Zotterman Declaration. The pattern is in Ground 1, where for each of Claims 1, 21, and 22, Petitioner used the 12 caliper points from Example 3 of *Fugitt* as the X value for calculating basis weights per the Y_2 , Y_2' , and Y_3 curves, respectively, and

130 as the basis weight from Example 3 of *Fugitt* for comparison with the calculated basis weights. (See, e.g., Pet., pp. 35-36; 51-52). But when it came to Claim 23, Petitioner broke with this pattern. The Petition formed the grounds against Claim 23 using 12.2 caliper points as the X value instead of the 12.0 caliper value used in each of the previous calculations. (*Id.* at 53-54). And as the measured basis weight for comparison with the basis weight calculated from the Y_3' equation, Petitioner kept the 130 value. (*Id.*). But according to Zotterman, for Claim 23 the 130 basis weight value is not from *Fugitt*—it is just an example of a basis weight that could be used. (Ex. 2005, 50:22-51:4; 52: 2-6).

58. When I work backwards from the 130 basis weight given in *Fugitt*, and algebraically solves the Y_3' equation to calculate the X value (caliper) for the Petitioner's desired result, the answer would be 12.2, rounded up to the nearest tenth of a caliper point. But doing this is literally following hindsight reasoning, i.e., starting with the basis weight given in *Fugitt*, then determining what is the smallest X value, rounded to a tenth of a caliper point, that will satisfy the requirement of falling under Y_3' curve.
59. The following demonstrates two points in the Zotterman Deposition that state the compulsion to resort to hindsight reasoning related to the 12.2 points used in Ground 1 for Claim 23.

Q. So if you used 12.0 caliper for Claim 21, and you used a 12-point caliper for Claim 22, why didn't you also use a 12-point caliper for Claim 23?

A. Because to show that was nothing unique in the numbers for SBS, that there were examples of paperboard substrates that would have a higher bulk.

(Ex. 2005, 57:22-58:4).

Q. Why didn't you use 12.2 for Claim 22 then?...

A. Okay. Because I think there – there were already numbers given at *Fugitt*.

(*Id.* at 68:12-18).

In other words, unlike Claim 22, *Fugitt* did not give Zotterman the numbers he needed for Claim 23, so Zotterman worked backwards to find numbers that would work. There is nothing in the Petition, Zotterman Declaration, or Zotterman Deposition, that I can see, that provides a convincing alternative to the foregoing conclusion of hindsight reasoning related to the 12.2 points caliper used in Ground 1 for Claim 23.

ii. *The use of 14.2 caliper points requires impermissible hindsight.*

60. I also see a similar problem in the Zotterman Declaration, where he uses data from *Papermaking* relating to folding boxboard (“FBB”), not SBS. In particular, he uses FBB data from Fig. 62 of *Papermaking* to derive 2.0 PPS

S10 smoothness and a bulk of $1.7 \text{ cm}^3/\text{g}$. (Ex. 1003, p. 56). Zotterman associates a caliper of 14.2 points with this FBB example, which he claims he converted from the $1.7 \text{ cm}^3/\text{g}$ value shown in *Papermaking* Fig. 62. (Ex. 2005, 52:24 – 53:3). But Zotterman has not shown how he converted $1.7 \text{ cm}^3/\text{g}$ into 14.2 points. Moreover, Fig. 62 of *Papermaking* does not provide a basis weight associated with the $1.7 \text{ cm}^3/\text{g}$ value.

61. In order to convert $1.7 \text{ cm}^3/\text{g}$ into 14.2 caliper points, there must be a basis weight for the conversion. Zotterman did not admit this, but it is clear he used the measured SBS basis weight of 130 lbs/3000 ft^2 from *Fugitt* to convert the FBB bulk of $1.7 \text{ cm}^3/\text{g}$ from *Papermaking* into 14.2 caliper points. In the following, I will show the math that proves this. The formula for calculating bulk of paper in S.I. (metric) units is $\text{Bulk (cm}^3/\text{g)} = \text{Thickness (mm)} / \text{Basis Weight (g/m}^2) \times 1000$.
62. First, I will convert caliper points to S.I. units. For a caliper of 14.2 points, thickness in mm = 14.2 points = 0.0142 inch $\times$ 25.4 mm/inch = 0.361 mm.
63. Next, the basis weight of 130 lbs/3000 ft^2 , needs to be converted to S.I. units as follows. The mass in the numerator converts as 130 lbs $\times$ 453.6 grams/pound = 58,968 grams. The conversion of 3000 ft^2 is 3000 $\text{ft}^2/10.76$ square meters/square foot = 278.7 square meters. Now I can complete the

basis weight conversion using the S.I. values above as follows: 130 lbs/3000

$$\text{ft}^2 = 58,968 \text{ grams} / 278.7 \text{ square meters} = 211.6 \text{ g/m}^2.$$

64. Finally, I can bring the two S.I. values calculated above together into the original equation for bulk as follows: Bulk (cm^3/g) = $0.361 \text{ mm} / 211.6 \text{ g/m}^2 \times 1000 = 1.71$. Rounded to the nearest tenth, this is the $1.7 \text{ cm}^3/\text{g}$ Zotterman found in *Papermaking* for FBB. The foregoing all demonstrates that Zotterman started with $1.7 \text{ cm}^3/\text{g}$, a value for FBB from *Papermaking*, and used 130 lbs/3000 ft^2 , a measured SBS basis weight from *Fugitt*, to convert the $1.7 \text{ cm}^3/\text{g}$ into 14.2 caliper points. It is a mistake to mix the bulk of FBB and basis weight for SBS to determine a caliper bulk.
65. Zotterman used the caliper of 14.2 points as the X value in the Y_3' equation, which Zotterman's declaration values at 145.405252. (Ex. 1003, ¶¶153-155). He then compares the 145.405252 basis weight value against the 130 lbs/3000 ft^2 for SBS in Example 3 of *Fugitt*. (*Id.*). He is certain that 130 is less than 145.405252, but inexplicably compares a calculated basis weight of 145.405252 for an FBB caliper from *Papermaking* with a measured basis weight of 130.0 for SBS board from Example 3 of *Fugitt* in his comparison. (*Id.*). The fact that Zotterman freely picks and chooses to take a caliper for FBB from *Papermaking* but a measured value for SBS from *Fugitt* is unsupportable and demonstrates motivated, hindsight reasoning.

66. This topic was discussed at length during Zotterman's deposition, where the testimony transcript runs for roughly six pages about the 14.2 points figure. (Ex. 2005, 52:7-59:4). It is clear from this extensive discussion that a caliper of 14.2 points is related to an FBB product, not to SBS board. There is no justification other than hindsight to compare the Y_3' calculated FBB basis weight versus a measured SBS basis weight from Example 3 of *Fugitt* to satisfy the inequality in Claim 23. FBB and SBS have significantly different bulk properties from one another, because FBB is a wood containing board and SBS is not. (Ex. 2005; 34: 9-17; *see also* 25:5-26:11 regarding FBB; and *see* 32:3- 34:8 regarding SBS).
67. Calculating a Y_3' value for FBB, then comparing it against a measured basis weight value for SBS is an apples to oranges comparison based on hindsight. The Petition did not include the 14.2 value or the 145.405252 value from the Zotterman Declaration, but it does make the leap from FBB to SBS. (*See* Pet. pp. 53-54). Although the Petition mentions FBB as a substitute for SBS, it does not offer any justification for comparing a Y_3' calculated basis weight for an FBB caliper with a measured basis weight for SBS board from *Fugitt*. (*Id.*).
68. The petition includes a statement that "it would be obvious to exchanging [sic] the SBS in *Fugitt* for FBB to increase bulk, *i.e.*, decrease density at a

given caliper.” (Pet., p. 53). But there is no citation for this point in the Petition. (*Id.*) Even if the argument is accepted *arguendo* that FBB would be a substitute for SBS, it does not justify comparing the calculated basis weight for FBB versus a measured value for SBS board. To avoid a clear *non-sequitur*, the rationale would require comparing a calculated basis weight for FBB versus a measured value for FBB. The asserted art does not provide an applicable measured value for FBB.

69. To be consistent, Petitioner and Zotterman would have had to show in the art a teaching of an FBB caliper and measured basis weight that satisfy the Y_3 ' curve requirement in Claim 23, not that there is an FBB caliper and calculated Y_3 ' basis weight that is greater than the measured SBS value from Example 3 of *Fugitt*.

iii. Conclusion regarding Claim 23

70. Petitioner's reasoning for Ground 1 versus Claim 23 is based on hindsight and *non-sequitur* lack of logic. I cannot therefore give it any weight. In view of the foregoing, in my opinion, Claim 23 would not have been obvious to one having ordinary skill in the art in view of *Fugitt* and *Papermaking*. Claim 23 is therefore patentable over *Fugitt* and *Papermaking*.

f. Substitute Claim 24

71. In Ground 1, Petitioner challenges Claim 1 based on *Fugitt* and *Papermaking*. Petitioner contends *Fugitt* discloses hot-hard calendering because the dry stack calender 36 in *Fugitt* may be steam heated. (Pet., pp. 30-31; *see also* Ex. 1004, [0026]). Substitute Claim 24 recites that a contact surface of only the thermo-roller is heated to an elevated temperature and the counter roller is not heated to the elevated temperature.
72. It is my opinion that *Fugitt* does not disclose a calender where only the contact surface of the thermo-roller is heated to an elevated temperature or that the counter roller of the calender is not heated to the elevated temperature. Instead, *Fugitt* states that the rolls (plural) of the calender may be “steam heated.” (Ex. 1004, [0026])). There is nothing in *Fugitt* that suggests only one of the rolls in any of the nips of the calender is heated. *Papermaking* describes multi-nip calenders with several thermo-rolls, but it does not mention a multi-nip calender with only a single thermo-roll in any given nip. (Ex. 1005, p. 127, lns. 24-25). *Papermaking* includes a section that specifically discusses multi-roll hard-nip calenders like the one in *Fugitt*, but it does not mention heating or thermo-rollers. (Ex. 1005, pp. 54-60).
73. Petitioner argues that *Fugitt* discloses a thermo-roller, and indicates the roller arranged opposite the thermo-roller in *Fugitt*’s dry stack calender acts

as a counter roller. (Pet., p. 31). I disagree to the extent that Petitioner is implying the counter-roller in *Fugitt* is not heated. It is heated, because as pointed out above *Fugitt*, indicates the rolls (plural) can be heated, without any suggestion of deviating from the normal multi-nip calender with several thermo rolls described in *Papermaking*. (Ex. 1004, [0026] and Ex. 1005, p. 127, lns. 24-25).

74. *Fugitt* and *Papermaking* fail to disclose any calender nip wherein a contact surface of only the thermo-roller is heated to an elevated temperature and the counter roller is not heated to the elevated temperature, as recited in Substitute Claim 24. It is thus my opinion that a *prima facie* case of obviousness with respect to the combination of *Fugitt* and *Papermaking* cannot exist.
75. In addition, Substitute Claim 24 also recites applying a nip load to the paperboard substrate ranging from about 20 pli to about 500 pli. I have already addressed Petitioner's improper combination of *Fugitt* and *Papermaking* with respect to the nip load. The statements provided above with respect to the nip load of claim 2 readily applies to claim 24.
76. In view of the foregoing, it is my opinion that *Fugitt* and *Papermaking* do not render Substitute Claim 24 obvious. Substitute Claim 24 is therefore patentable over *Fugitt* and *Papermaking*.

g. Substitute Claim 25

77. Ground 1 challenges Claim 2 based on *Fugitt* and *Papermaking*. Substitute Claim 25 recites a nip load ranging from about 20 pli to about 90 pli. *Fugitt* does not specify any particular nip loads. Petitioner relied upon *Papermaking* for the nip load range recited in Claim 2. (Pet., p. 39-40). But *Papermaking* discloses nip loads ranging from 57.1 to 228.6 pli, which is not stated as being particularly relevant to paperboard or cartonboard but is instead relevant to coated wood-containing paper grades and woodfree coated (WFC), paper grades that are both outside of the SBS context of Example 3 in *Fugitt*. (See Ex. 1005, p. 72, 76; Ex. 1004, [0053] and [0057]; see also, Ex. 2003, ¶105). Relevant to cartonboard, *Papermaking* gives a nip load value that can be exceeded, 100kN/m (571 pli), on page 82, which is wholly outside the range recited in Claim 2 or Substitute Claim 25. (Ex. 2003, ¶105). For the only nip load range in *Fugitt* or *Papermaking* that even partially overlaps the range in Substitute Claim 25, namely 57.1 to 228.6 pli, Petitioner has cherry picked a nip load range out of context. (*Id.* at ¶106). That range is not relevant to paperboard and is thus irrelevant to the claims. (*Id.*). The range is for completely different paper products, i.e., wood-containing paper grades and WFC in *Papermaking*, than for the SBS of *Fugitt*. (*Id.*).

78. The arguments provided above with respect to Claim 2, Substitute Claim 24 and Zotterman's testimony about wood-containing paperboard versus wood-free SBS can be readily applied to Substitute Claim 25.
79. In view of the foregoing, it is my opinion that *Fugitt* and *Papermaking* do not render Substitute Claim 25 obvious. Substitute Claim 25 is therefore patentable over *Fugitt* in view of *Papermaking*.

h. Substitute Claim 26

80. Ground 1 challenges Claim 6 based on *Fugitt* and *Papermaking*. Since *Fugitt* does not disclose any specific elevated temperatures in underlying Claim 1, Petitioner relied upon *Papermaking* for teachings of elevated temperatures. (Pet., p. 32-34). In Ground 1, Petitioner cites temperatures of 338° F, 392° F, and 428° F, from *Papermaking* which come from various contexts. (*Id.*). Zotterman testified that he is not aware of any reference in the prior art in this proceeding where hot oil is shown to be used for heating rollers to temperatures higher than 220° C, which converts to 428° F, and that regulations prohibit going above 204° C (399.2° F). (Ex. 2005, 76:17-78:8). In contrast to *Fugitt* and *Papermaking*, Substitute Claim 26 recites that the elevated temperature is at least about 480° F, which is clearly well above any of the temperatures disclosed in *Papermaking* and cited in Ground 1. Since *Fugitt* and *Papermaking* do not disclose the elevated

temperature as recited in Substitute Claim 26, it is my opinion that Substitute Claim 26 is not obvious and is patentable over *Fugitt* and *Papermaking*. Additionally, arguments are provided below for Substitute Claim 27 with respect to factual issues regarding paperboard properties and increased cost. These arguments also apply with even greater force of logic to Substitute Claim 26 with respect to factual issues regarding paperboard properties and increased cost.

i. Substitute Claim 27

81. Ground 1 challenges Claim 7 based on *Fugitt* and *Papermaking*. Since *Fugitt* does not disclose the specific elevated temperatures in underlying Claim 1, Petitioner relied upon *Papermaking* for teachings of elevated temperatures. (Pet., p. 32-34). *Papermaking* discloses temperatures of up to 338° F for steam heated rollers. (*Id.*) *Fugitt* states that the rollers can be steam heated, without ever giving a specific temperature in the range of temperatures achievable by steam. (Ex. 1004, [0026]).
82. Substitute Claim 27 recites the elevated temperature is at least 400° F, which is above 338° F. According to *Papermaking*, this is above the upper limit for steam heating and is instead in the temperature range provided for hot oil heating. (Ex. 1005, p. 98). The highest temperature stated in *Papermaking* for oil is 220° C, which converts to 428 °F. (*Id.*).

83. In my opinion, it would not have been obvious to modify the steam heating system disclosed in *Fugitt* with the oil heating system disclosed in *Papermaking*. In order for the modification to read on Substitute Claim 27, which depends from Claim 1, the output of the modified, oil-heated combination of *Fugitt* and *Papermaking* would have to comply with the Y_2 curve in terms of bulk and basis weight. (Ex. 1001, Claim 12:33-53). But such a change would affect *Fugitt*'s paperboard properties and increase cost, and thus would not be obvious to a person having ordinary skill in the art.
84. Regarding the paperboard properties, the Board has indicated "Patent Owner is correct that Petitioner relies on *Fugitt*'s disclosure of paperboard properties (smoothness and basis weight Y_2 as a function of caliper thickness) obtained without modifying the roller surface temperature." (Paper 14, p. 26). The Board has also indicated there is a factual issue as to whether a person of ordinary skill in the art would have expected to achieve the paperboard properties disclosed in *Fugitt* if the roller temperature were increased above the level achievable by steam-heated rolls. (*Id.*).
85. Petitioner has not proffered any proof that the *Fugitt* paperboard properties would be achieved, aside from unsubstantiated statements by Zotterman that it is well known. (*See, e.g.*, Ex. 2005, 71:19-72:16). I do not see any evidence in the asserted art that supports Zotterman's testimony, and indeed

there is strong evidence to the contrary. In the following paragraphs, I provide a physics-based explanation for what would happen to the paperboard structure in *Fugitt*, if the roller surface temperature were heated beyond the temperatures for steam heating, as suggested by the Petitioner's combination of *Fugitt* with the oil heating temperatures from *Papermaking*.

86. Specifically, if the process in *Fugitt* were modified with heating increased from the steam heating regime into the oil heating regime, caliper points in Example 3 of *Fugitt* would be reduced significantly. This phenomenon is well known, as shown, for example, by Zakaib et al., *Quality Improvements to Publication and Board Grades by Hot Calendering with Induction Heating*, presented at the 1997 TAPPI Newsprint Forum in Birmingham, Alabama in March 1997 (Exhibit. 2007). (See Ex. 2007, p. 61, Fig. 7). I note that this Figure 7 shows that increasing sheet temperature reduces caliper points. (*Id.*). The basic reason for higher sheet temperature reducing caliper points is explained *Papermaking*, and relates to the deformation and softening of polymers with increasing temperature. (Ex. 1005, pp. 23-27). Among the relevant polymers, cellulose is the most relevant to the present case. Dry cellulose softens at temperatures up to 250° C (482° F) as shown in Figure 12 of *Papermaking*. (*Id.* at p. 24). Softened cellulose results in

lower caliper as calendering temperature is increased. Zotterman should have known this – it is taught in basic college papermaking courses.

87. The only way to prevent this loss in caliper points would be to modify the nip loading. But Petitioner has not explained and Zotterman has not testified why that change would be obvious without undue experimentation. The inventors in *Fugitt* certainly did not raise the temperature higher than that attained by steam heating at the time they were preparing the application for the *Fugitt* patent. Petitioner has simply not provided any evidence that one of ordinary skill in the art would expect the same paperboard properties if *Fugitt* were modified to use oil heating, or that one of ordinary skill in the art would have known how to modify the nip load to do so without undue experimentation.
88. In addition, to make the proposed modification, there are practical considerations that would weigh on one of ordinary skill in the art. Specifically, there would be capital costs and ongoing energy costs that would deter one of ordinary skill in the art from making the proposed modification. Zotterman has testified the capital cost to do this would be about \$50,000. (Ex. 2005, 81:10-8:5). Zotterman offered this figure without evidence, without citing any of the asserted art, without any statement of underlying assumptions, without any cost breakdown, and without any

rationale to explain the figure. (*Id.*) Therefore, I see Zotterman's figure of \$50,000 as being off-the-cuff and not realistic. Zotterman also testified, again without evidence, that the energy cost increase would be negligible given there would be a savings in bulk. (*Id.* at 73:18-74:6).

89. First, I discuss the issue of capital expenditure. From my experience, Zotterman's \$50,000 capital cost figure is at least one order of magnitude low. In contrast to Zotterman, I provide the following cost estimate, which is formulated considering a typical SBS or FBB machine that is 7 meters (275 inches) wide and is equipped with a steam heated roll prior to modifying to heat with oil. Converting this calender to a high temperature oil heated calender would include:

- A new oil heater with temperature control in the range of \$500,000 to \$1 million. The information at the web site of Sigma Thermal helps to illustrate what is involved in an oil heating system. (*See Ex. 2008*).
- New high temperature rotary joints in the range of \$50,000 to \$100,000.
- Insulated supply and return piping between the oil heating device and the rotary joints on the heated calender roll in the range of \$100,000 to \$500,000 installed.
- If the oil heating source is gas, and if a gas supply is not already in place, addition of a new gas supply line at \$100,000 to \$300,000.

- If electric heating is used, there may or may not be a need for a new transformer or substation, which could be in the range of \$100,000 to \$250,000 or higher.
- I also include consideration of whether the existing calender roll is suitable for oil heating. It might be necessary to replace the calender roll with a new roll and spare at \$300,000 to \$500,000.

90. In view of this itemized breakdown, at the low end I estimate the capital expenditure for converting a calender from steam heating to oil heating would be about \$650,000 (assuming there is no need to add a new heat source like gas or electrical equipment, and no need for a new calender roll and spare). At the high end, I estimate the capital cost would be about \$2.4 million (assuming the worst-case scenarios for the operator based on my itemization above). This range of about \$650,000 to about \$2,400,000 is at least an order of magnitude higher than Zotterman's \$50,000 figure.
91. With respect to operating cost, there would be an ongoing incremental cost for heating the oil that is higher than the cost of heating steam, given the basic principle that higher temperatures require greater energy. I introduced this basic argument in my first declaration. (Ex. 2003, ¶96). Zotterman testified that ongoing energy cost increase would be "totally negligible" given the cost savings from increase bulk. (Ex. 2005, 73:18-74:6). But Zotterman's testimony puts the calender heating energy cost in the context of operating cost as a whole. The theory is that if an operator can increase

bulk, they therefore use less fiber, which saves some material cost and some energy cost in preparing the fiber. However, just as with the capital cost, the wholistic operating cost is not as simple as Zotterman has made it out to be.

92. Depending on the equipment, configuration, and utilities available for a given mill, the increase in overall operating cost for steam versus oil may or may not offset the increased calendering cost for oil heating versus steam heating. It is not a given that the increased calender heating energy cost would be offset, as it requires a coincidence of the right mill configuration. It would take a mill-specific, mill wide energy balance to determine how much cost offset there would be, if any, from reducing bulk. And all of the foregoing is taking Zotterman's assumption of increased bulk as a given. That would not be a given to one of ordinary skill in the art at the time of *Fugitt*, since the bulk levels achieved in *Fugitt* were already exceptional for their time. These matters are complicated enough for me to comfortably say one of ordinary skill in the art would not find it obvious that the increased energy cost for calender heating would be "totally negligible." Zotterman's testimony in this regard requires a coincidence of the right mill configuration which strongly indicates he formed his testimony in this regard with the luxury of hindsight.

93. In short, one of ordinary skill in the art wishing to make the proposed modification would face about \$650,000 to about \$2,400,000 in capital cost, and likely at least some ongoing incremental increase in the total operating cost due to gas or electricity to heat the oil. One of ordinary skill in the art at the time of *Fugitt* would be confronted with all of this cost to upgrade from steam to oil heating. Their only expectation of success would have been to produce paper that already complied with the bulk and weight basis per the Y_2 curve in Claim 1 prior to the extra costs. Modifying the calender heating in *Fugitt* to convert from steam to oil heating would simply not be an obvious choice.
94. Since the combination of *Fugitt* and *Papermaking* would not be obvious, *Fugitt* and *Papermaking* do not disclose the elevated temperature as recited in Substitute Claim 27, in my opinion, Substitute Claim 27 is patentable over *Fugitt* and *Papermaking*.

2. Non-obviousness of combining features

95. As explained above, I am not an attorney, and I offer no opinions of law in this declaration. But counsel for the Patent Owner has informed me of the legal standards that apply to the issue of obviousness, as I explained above. Based on this understanding, it is my opinion that it would not have been obvious to one of ordinary skill in the art to combine *Fugitt* and

Papermaking, nor would one of ordinary skill in the art have been motivated to combine *Fugitt* and *Papermaking*, to arrive at Claims 1, 15, or 23 of the '142 Patent, or Substitute Claims 24-27.

B. Ground 2: Claims 1, 2, and 4 are not obvious under 35 U.S.C. § 103 over *Fugitt* in view of *Papermaking*, or *Gratton*

96. In my opinion, *Fugitt* combined with *Papermaking* and *Gratton* do not describe each and every element recited in Claims 1, 2, or 4 of the '142 Patent, or substitute claims 24-27 presented in the accompanying MTA, and it would not be obvious to one of ordinary skill in the art to combine *Fugitt* and *Papermaking* and *Gratton* to arrive at the method claimed.

1. Claim-by-claim analysis

97. In the sections below, I provide my response to the feature-by-feature analysis in the Petition, Zotterman Declaration, and Decision to Institute.

a. Claim 1

98. The deficiencies in the combination of *Fugitt* and *Papermaking* with respect to Claim 1 have already been established above with respect to Grounds 1. *Gratton* does not remedy the deficiencies in disclosure in the combination of *Fugitt* and *Papermaking*. As best it is understood, Ground 2 appears to combine *Fugitt*, *Papermaking*, and *Gratton* versus Claim 1 by taking the

process described in *Fugitt*, citing *Papermaking* as disclosing using steam and oil heating, and using the temperatures disclosed in *Gratton*.

99. Specifically, Petitioner uses *Gratton* for its teaching of a roller temperature of 210 °C, which is cumulative to the teachings of *Papermaking* itself. (Ex. 2003, ¶137). I have already pointed out above that the temperature cannot simply be extracted from *Papermaking* and injected into *Fugitt* without reference to the equation in Claim 1, and the same applies to *Gratton*. The unmodified version of *Fugitt* (Example 3) already achieved a paperboard product having the Y₂ equation's quality. (*Id.*). Petitioner has not provided any evidence that a product having the same quality would be possible if *Fugitt* is modified with the extra heat in the combination of *Papermaking* and *Gratton*. (*Id.*). Where Claim 1 and *Fugitt* both outclass *Gratton* on every metric, I do not believe it would not be obvious to modify *Fugitt* with *Gratton* in the manner suggested by Petitioner because the extra heat would downgrade the paperboard structure of *Fugitt* Example 3 out of the Y₂ area of Claim 1. (*Id.*). This would all be in a hindsight-driven attempt to arrive at a product in league with *Fugitt* and the Y₂ equation in Claim 1. (*Id.*)
100. *Gratton* is a research paper typical of the research work referred to in *Papermaking*, “[h]eating up both nip rolls, however, is complicated because the other roll is a deflection-compensated roll. Because of the benefits of

soft-calender technology, this kind of calendering has remained very rare in spite of the amount of research work done.” (See Ex. 1005, p. 40). Given the level of one of ordinary skill in the art, it would not have been obvious to use the two-heated rollers of *Gratton* in any practical setting, let alone in combination with *Papermaking* and *Fugitt*. (Ex. 2003, ¶139). This is especially true since *Papermaking* teaches away from that combination by associating the very rare two-heated-rolls technique of *Gratton* with complications and research work. (*Id.*). *Papermaking* clearly teaches instead toward use of soft calendering. (*Id.*) It is my opinion that one of ordinary skill in the art possessing copies of *Fugitt*, *Papermaking*, and *Gratton* would ignore the teaching of *Gratton* and follow the suggestion in *Papermaking* to use a soft calendering technique, which is not relevant to Claim 1. (*Id.*).

101. The Board has also indicated there is a factual issue as to whether a person of ordinary skill in the art would have expected to achieve the paperboard properties disclosed in *Fugitt* if the roller temperature were increased above the level achievable by steam-heated rolls. (Paper 14, p. 26). The 410° F temperatures for which Petitioner is citing *Gratton* are clearly above the 338° F level achievable by steam-heated rolls according to *Papermaking*. (Ex. 1005, p. 98).

102. As I have already explained above in the discussion of Substitute Claim 27 in Ground 1, Petitioner has not proffered any evidence that raising the temperature so high in the *Fugitt* process would still yield the paperboard properties specified in Example 3 of *Fugitt*, aside from unsubstantiated statements by Zotterman during his deposition. (See, e.g., Ex. 2005, 71:19-72:16). With greater heat, caliper points in Example 3 of *Fugitt* would be reduced significantly.
103. As Counsel for Patent Owner has explained to me, in an IPR, the burden is on Petitioner, and Petitioner has not provided any evidence that one of ordinary skill in the art would expect the same paperboard properties if *Fugitt* were modified to use oil heating, nor that one of ordinary skill in the art would have known how to modify the nip loading to do so without undue experimentation.
104. In view of the foregoing, it is my opinion that Claim 1 is not obvious over *Fugitt*, *Papermaking*, and *Gratton*. Accordingly, Claim 1 is patentable over *Fugitt*, *Papermaking* and *Gratton*.

b. Claim 2 and claim 4

105. Claims 2 and 4 each depend from Claim 1, and therefore the same arguments provided above with respect to Claim 1 also apply to Claim 2. In view of the foregoing, Claims 2 and 4 are not obvious over *Fugitt*,

Papermaking, and *Gratton*. Claims 2 and 4 are each therefore patentable over *Fugitt*, *Papermaking*, and *Gratton*.

c. Substitute Claim 24

106. Ground 2 challenges Claim 1 based on *Fugitt*, *Papermaking*, and *Gratton*.

The deficiencies in the combination of *Fugitt* and *Papermaking* with respect to Substitute Claim 24 have already been established above with respect to Ground 1. *Gratton* does not remedy the deficiencies of the disclosures of *Fugitt* and *Papermaking*. I have also pointed out above that in Substitute Claim 24, the contact surface of only the thermo-roller is heated to the elevated temperature, and the counter roller is not heated to the elevated temperature. In *Gratton*, both rollers are heated to an identical temperature. (Ex. 1006, Fig. 1; p. 86).

107. It is my opinion that the combination of *Gratton* with *Fugitt* and *Papermaking* does not teach a hot-hard calender wherein only the contact surface of the thermo-roller is heated to an elevated temperature and the counter roller is not heated to the elevated temperature as recited in Substitute Claim 24. Therefore, it is my opinion that Substitute Claim 24 is not obvious over *Fugitt*, *Papermaking*, and *Gratton*.

d. Substitute Claim 25

108. Ground 2 challenges Claim 2 based on *Fugitt*, *Papermaking*, and *Gratton*. I have explained above that *Fugitt* and *Papermaking* do not disclose the nip load range recited in substitute Claim 25. In Ground 2, Petitioner relies upon *Gratton* for the teaching of the nip load range in Claim 2. (Pet., pp. 63-64). In contrast to *Fugitt*, *Papermaking*, and *Gratton*, Substitute Claim 25 recites a nip load ranging from about 20 pli to about 90 pli. The nip loads disclosed in *Gratton* are 114.2, 228.4, 342.6, 456.8, and 571.0 pli, which define a range from 114.2 to 571.0 pli using the highest and lowest values disclosed in *Gratton* to define limits of a range. (Pet. pp. 63-34). There is no overlap between the range disclosed in *Gratton*, and the range recited in Substitute Claim 25. Since *Gratton*, *Papermaking*, and *Fugitt* do not disclose the nip load range recited in Substitute Claim 25, it is my opinion that Substitute Claim 25 is not obvious over *Gratton*, *Papermaking*, and *Fugitt*.

e. Substitute Claim 26

109. Ground 2 did not challenge Claim 6. Substitute Claim 26 adds to the language of Claim 6 that the elevated temperature is at least about 480° F. In challenging the underlying Claim 1 in Ground 2, Petitioner cited *Gratton* for disclosure of elevated temperatures of 405° F, 408° F, and 411° F. (Pet.

p. 58). I note that Gratton also discloses in Figure 1 roller temperatures of 210° C, which converts to 410° F. (Ex. 1006, p. 81).

110. In his deposition, Zotterman appears to claim that *Gratton* teaches a possible roller surface temperature of 250° C (482° F). (Ex. 2005, p. 102-103). Zotterman derives that temperature from Figure 1 in *Gratton*, which shows a graph of the temperature profile as a function of position in the web and within each of the rollers. (*Id.*). The highest temperature in this graph is less than 250° C and is at a position fairly deep of the roller surfaces. It is not a surface temperature. *Gratton* gives the roller surface temperature in the circles to the left of the graph in Figure 1, *i.e.*, 210° C. (*Id.*) The surface temperature of the rollers is relevant, since that is the temperature controlled for calendering the web. Zotterman was incorrect to assert that *Gratton* discloses roller surface temperatures of 250° C (482° F). I also note that the highest roller surface temperature disclosed in Gratton is in Table II and has a value of 211° C (412° F), well below the 250° C (482° F) values Zotterman attempted to read into *Gratton*. (Ex. 1006, p. 84).
111. In contrast to *Fugitt*, *Papermaking*, and *Gratton*, Substitute Claim 26 recites that the elevated temperature is at least about 480° F, which is well above any of the roller surface temperatures from *Papermaking* cited in Ground 1, and well above any of the roller surface temperatures from *Gratton*

temperatures cited in Ground 2. Since *Fugitt*, *Papermaking*, and *Gratton* do not disclose the elevated temperature as recited in Substitute Claim 26, Substitute Claim 26 is patentable over *Fugitt*, *Papermaking*, and *Gratton*.

f. Substitute Claim 27

112. Ground 2 did not challenge Claim 7. But Substitute Claim 27 recites that the counter roller is not heated, and the elevated temperature is at least 400° F. Ground 2 combines *Gratton* with *Papermaking* and *Fugitt*. I have already pointed out above in Ground 1 that the combination of *Fugitt* and *Papermaking* would not make the temperature recited in Claim 27 obvious. In *Gratton*, both rollers in the nip of the calender are heated. (Ex. 1006, Fig. 1; p. 86).
113. Where Claim 1 and *Fugitt* both outclass *Gratton* on every metric, it would not be obvious to modify *Fugitt* with *Gratton* in the manner suggested by Petitioner, because the extra heat would downgrade the paperboard structure of *Fugitt* Example 3 out of the Y₂ area of Claim 1. (Ex. 2003, ¶137). This would all be in a hindsight driven attempt to arrive at a product in league with *Fugitt* and the equation in Claim 1. (*Id.*)
114. It is also my opinion that there is a teaching against the combination of *Gratton* and *Papermaking*. *Gratton* is a research paper typical of the research work referred to in *Papermaking*, “[h]eating up both nip rolls,

however, is complicated because the other roll is a deflection-compensated roll. Because of the benefits of soft-calender technology, this kind of calendering has remained very rare in spite of the amount of research work done.” (See Ex. 1005, p. 40). Given the level of one of ordinary skill in the art, it is my opinion that it would not have been obvious to use the two-heated rollers of *Gratton* in any practical setting, let alone in combination with *Papermaking* and *Fugitt*. (Ex. 2003, ¶139). This is especially true since *Papermaking* teaches away from that combination by associating the very rare two-heated-rolls technique of *Gratton* with complications and research work. (*Id.*). Instead, *Papermaking* teaches toward using soft calendering. (*Id.*) One of ordinary skill in the art possessing copies of *Fugitt*, *Papermaking*, and *Gratton* would ignore the teachings of *Gratton* and follow the suggestion in *Papermaking* to use a soft calendering technique, which is not relevant to Claim 1. (*Id.*).

115. In view of the foregoing, it is my opinion that *Fugitt*, *Papermaking*, and *Gratton* do not constitute an obvious combination with respect to Substitute Claim 27. As such, Substitute Claim 27 is patentable over *Fugitt*, *Papermaking*, and *Gratton*.

C. Ground 3: Claim 4 is non-obvious under 35 U.S.C. § 103 over *Fugitt* in view of *Papermaking*, *Papermaking II*

116. In my opinion, *Fugitt* combined with *Papermaking* and *Papermaking II* (or *Mohan*) do not describe each and every element recited in Claim 4 of the '142 Patent or Substitute Claim 24 as presented in the MTA, and it would not be obvious to one of ordinary skill in the art to combine *Fugitt*, *Papermaking*, and *Papermaking II* to arrive at the method claimed.

1. Claims analysis

117. In the sections below, I provide my response to the feature-by-feature analysis in the Petition, Zotterman Declaration, and Decision to Institute.

a. Claim 4

118. Claim 4 depends from Claim 1 and therefore the same arguments provided above with respect to Claim 1 also applies to Claim 4. In view of the foregoing, Claim 4 is not obvious over *Fugitt*, *Papermaking*, and *Papermaking II*. Claim 4 is therefore patentable over *Fugitt*, *Papermaking*, and *Papermaking II*.

b. Substitute Claim 24

119. Claim 4 depends from Claim 1. Although Claim 4 is not amended with a substitute claim, Substitute Claim 24 is a contingent replacement for Claim 1, and therefore the same arguments provided above with respect to Substitute Claim 24 also apply to Claim 4 for purposes of this Declaration. Specifically, under Ground 1 above, the deficiencies of the combinations of

Fugitt, and *Papermaking* with respect to Substitute Claim 24 have already been addressed. *Papermaking II* does not even discuss the temperature range in Substitute Claim 24, let alone reach the amended features of Substitute Claim 24, nor has Petitioner alleged anything about *Papermaking II* and temperature. (See Pet., pp. 66-67). Moreover, *Papermaking II* does not disclose the nip load range recited in Substitute Claim 24, which is also missing from *Fugitt* and *Papermaking* as I explained above under Ground 1.

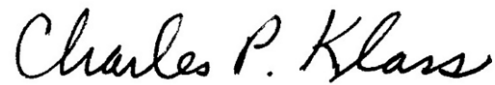
120. *Papermaking II* does not remedy the deficiencies of the combination of *Fugitt* and *Papermaking* with respect to Substitute Claim 24. Therefore, it is my opinion that the combination of *Fugitt*, *Papermaking*, and *Papermaking II* does not render Substitute Claim 24 obvious. For at least the same reasons, dependent Claim 4, should it become dependent on Substitute Claim 24, is not obvious over *Fugitt*, *Papermaking*, and *Papermaking II*, and therefore would be patentable over *Fugitt*, *Papermaking*, and *Papermaking II*.

VIII. CONCLUSION

121. In my opinion, the asserted references failed to disclose or suggest Claims 1, 2, and 4-23 of the '142 Patent, or Substitute Claims 24-27 to a person having ordinary skill in the art. Accordingly, it is my opinion that the challenged claims are patentable over the asserted art for the reasons set forth above.

122. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of U.S. Patent No. 11,293,142.

Dated: June 19, 2024

A handwritten signature in black ink that reads "Charles P. Klass". The signature is written in a cursive style with a horizontal line underneath the name.

Charles P. Klass

APPENDIX 1

MATERIALS CONSIDERED IN DECLARATION

Exhibit No.	Short Name	Description
Paper No. 1	Petition	Petition as filed, IPR2023-01206, Paper 1
1001	The ‘142 Patent	US Patent No. 11,293,142
1002	‘142 Patent File History	The relevant file history for US Patent No. 11,293,142
1003	Zotterman Declaration	Declaration of Carl Zotterman
1004	Fugitt	Fugitt et al., U.S. Pat. Appl. Pub. No. 2009/0236062
1005	Papermaking	Excerpts from Rautiainen, P. (2009). <i>Papermaking Science and Technology Book 10: Papermaking Part 3, Finishing</i> (2nd ed., pp. 35-42, 79-99). Paper Engineers’ Association.
1006	Gratton	Gratton, et al., Temperature-gradient calendering of foodboard, TAPPI JOURNAL January 1988
1007	Papermaking II	Excerpts from Lehtinen, E. (2000). <i>Papermaking Science and Technology Book 11: Pigment Coating and Surface Sizing of Paper</i> (pp. 581-583). Paper Engineers’ Association
1008	Crotogino	Temperature Gradient Calendering (Crotogino, R.H., (1982) Tappi J. 65(10):98).

Exhibit No.	Short Name	Description
1009	Paperboard Examples	Hannu (2000). <i>Papermaking Science and Technology Book 18: Paperboard and Grades</i> (p. 55). Paper Engineer's Association
1010	Remainder of Ex. 1005	Excerpts from Rautiatinen, P. (2009). <i>Papermaking Science and Technology Book 10: Papermaking Part 3, Finishing</i> (2nd ed., pp. 86-173). Paper Engineers' Association.
Paper No. 14	Institution Decision	Institution Decision: DECISION Granting Institution of Inter Partes Review 35 U.S.C. § 314
Ex. 2005	Zotterman Transcript	Transcript of Deposition of Carl Zotterman
Ex. 2006	Equation Y_3'	Note page containing Equation Y_3' , Exhibit 7 to deposition of Carl Zotterman
Ex. 2007	Zakaib	Zakaib et al., Quality Improvements to Publication and Board Grades by Hot Calendering with Induction Heating, Presented at the 1997 TAPPI Newsprint Forum, Birmingham, AL, March 1997
Ex. 2008	Sigma Thermal	PDF printout of webpage: https://www.sigmathermal.com/products/thermal-fluid-systems , last accessed June 14, 2024