

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

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

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Inventors: Sergio A. Guiste, Steven Parker, Terrell J. Green

Title: SMOOTH AND LOW DENSITY PAPERBOARD STRUCTURES AND
METHODS FOR MANUFACTURING THE SAME

DECLARATION OF CARL ZOTTERMAN

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I. INTRODUCTION AND QUALIFICATION

I, Carl Zotterman, declare as follows:

1. I have prepared this report as an expert witness retained by Billerud Aktiebolag (Publ), which I understand is challenging the validity of claims 1, 2, and 4-23 of U.S. Patent No. 11,293,142 (“the ‘142 Patent). In this report I have my opinions as to whether claims 1, 2, and 4-23 of the ‘142 Patent are unpatentable. I provide technical bases for these opinions as appropriate.
2. This report 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, if called upon to testify, would testify competently to the matters contained herein.
3. As I explain more fully below, it is my opinion that the prior art references cited herein, when combined, teach each and every feature of claims 1, 2, and 4-23 of the ‘143 Patent. Also, it is my opinion that claims 1, 2, and 4-23 of the ‘143 Patent would have been obvious to those of ordinary skill in the art at the time of the alleged invention in view of certain combinations of the *Fugitt*, *Papermaking*, *Gratton*, and *Papermaking II* references discussed

herein. I understand that the *Papermaking*, *Gratton*, and *Papermaking II* were not provided to or considered by the US Patent and Trademark office during examination of the '142 Patent.

A. Background

4. This section contains a summary of my educational background, career history, publications, and other relevant qualifications. My curriculum vitae is attached as Appendix 1 to this declaration.
5. I am at present an independent consultant at my own consulting company. I have more than 40 years of experience in manufacturing processes related to paperboard and paper.
6. In 1975, I was awarded a Master of Science at University of Linköping, Applied Physics and Electrical Engineering (Linköping, Sweden). A summary of my relevant employment history is as follows:
 - 1975 – 1979, Research Engineer, Forming and Wet Pressing, AB Karlstad Mekaniska Werkstad, Karlstad, Sweden.
 - 1980 – 1981, Visiting Assistant Professor, The Institute of Paper Chemistry, Appleton, WI, USA.
 - 1982– 1983, Application Engineer, AB Karlstad Mekaniska Werkstad, Karlstad, Sweden.
 - 1983 – 1985, Paperboard Research Manager, Billerud AB Research Centre, Säffle, Sweden.
 - 1985 – 1987, Board Machine #7 Superintendent, Stora-Billerud AB, Skoghall, Sweden.

- 1987 – 1995, Research Manager and Vice President, Board Machine Research, Valmet-KMW AB, Karlstad, Sweden.
- 1995 – 1997, Production Manager, Stora Skoghall Board Mill, Skoghall, Sweden. Installation and start-up of new KM8 paperboard machine.
- 1997 – 2004, Vice President, Global Board Machine Technology, Metso Paper Corporation.
- 2004 – 2008, President, The Packaging Greenhouse AB (Paperboard product development and training of board mill personnel).
- 2008 – present, Senior Consultant and Owner, Papercom in Sweden AB, active in technical training of paper and paperboard mill personnel, including personnel of various coated paperboard mills.
- 2010 – 2015 Karlstad University, Sweden: Paper Surface Centre, Project Leader, innovation and research in coatings and finishing of coated paperboard (Participants: Karlstad University, Stora Enso, Billerud, Iggesund, Kemira, UMV-Coating, Synthomer, MWV).
- 2015 – 2021 Paper Province, Sweden, Innovation Adviser, mainly technical support in various paperboard barrier coating projects.

7. I have extensive experience regarding paperboard materials and manufacturing paperboard, including calendering.

B. Compensation

8. For my efforts in connection with the preparation of this declaration I have been compensated at my standard consulting rate of 2000 SEK/hour. My

compensation is in no way contingent on the results of these or any other proceedings relating to the above-captioned patent.

II. DOCUMENTS AND OTHER MATERIAL CONSIDERED

9. 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 2 (Materials Considered in the Preparation of This Declaration) in forming my opinions.
10. In forming my opinions, I have also relied on my experience and education.

III. UNDERSTANDINGS OF THE LAW

11. I am not an attorney. In forming my opinions in this Declaration. I offer no opinions on the law. But counsel has informed me of legal standards that apply to the issue of patent validity. I have applied these standards in arriving at my conclusions.
12. I understand that in an *inter partes* review the petitioner has the burden of proving a proposition of unpatentability by a preponderance of the evidence. 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 invalidity by clear and convincing evidence.
13. I understand that a patent may not be valid even though the invention is not identically disclosed or described in the prior art if the differences between the

subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious to a person having ordinary skill in the art in the relevant subject matter at the time the invention was made.

14. To determine if a claim is obvious, the following factors should be considered: (1) the level of ordinary skill in the art at the time the invention was made; (2) the scope and content of the prior art; (3) the differences between the claimed invention and the prior art; and (4) secondary considerations, including evidence of commercial success, long-felt but unsolved need, unsuccessful attempts by others, copying of the claimed invention, unexpected and superior results, acceptance and praise by others, independent invention by others, and the like.
15. For example, I understand that the combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results. I also understand that an obviousness analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim because a court can take account of the inferences and/or creative steps that a person of ordinary skill in the art would employ.
16. I understand that the obviousness determination of an invention turns on whether a hypothetical person with ordinary skill and full knowledge of all

the pertinent prior art, when faced with the problem to which the claimed invention is addressed, would be led naturally to the solution adopted in the claimed invention or would naturally view that solution as an available alternative. Facts to be evaluated in this analysis include:

- The scope and contents of the prior art;
- Differences between the prior art and the claims at issue;
- The level of ordinary skill in the pertinent art; and
- Evidence of objective factors suggesting or negating obviousness.
- I understand that the following rationales may be used to determine whether a piece of prior art can be combined with other prior art or with other information within the knowledge of one of ordinary skill in the art:
 - o Combining prior art elements according to known methods to yield predictable results;
 - o Simple substitution of one known element for another to obtain predictable results;
 - o Use of known techniques to improve similar devices (methods, or products) in the same way;
 - o Applying a known technique to a known device (method, or product) ready for improvement to yield predictable results;
 - o “Obvious to try” - choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success;
 - o 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 would have been predictable to one of ordinary skill in the art; or
 - o Some teaching, suggestion, or motivation in the prior art that would have lead one of ordinary skill to modify the

prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

17. I understand that when a work is available in one field of endeavor, design incentives, and/or other market forces, for example, can prompt variations of it, either in the same field or a different one. Moreover, if a person of ordinary skill can implement a predictable variation, I understand that likely bars its patentability.
18. I understand that obviousness must be tested as of the time the invention was made. I understand that the test for obviousness is what the combined teachings of the prior art references would have suggested, disclosed, or taught to one of ordinary skill in the art. Specifically, it is my understanding that a patent claim is invalid based upon obviousness if it does nothing more than combine familiar elements from one or more prior art references or products according to known methods to yield predictable results. For example, I understand that where a technique has been used to improve one device, and a person of ordinary skill in the art would have recognized that it would improve similar devices in the same way, using that technique is obvious. I understand that obviousness can be proved by showing that a combination of elements was obvious to try (*i.e.*, that it does no more than yield predictable results; implements a predictable variation; is no more than the predictable use of prior art elements according to their established

functions; or when there is design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions). I have been further informed that when a patent claim simply arranges old elements with each element performing the same function it had been known to perform and yields results no more than one would expect from such an arrangement, the combination is obvious.

19. I understand that another factor to be considered is common sense. For example, I understand that common sense teaches that familiar items may have obvious uses beyond their primary purposes, and in many cases, a person of ordinary skill in the art will be able to fit the teachings of multiple references together like pieces of a puzzle.
20. I understand that the Supreme Court articulated additional guidance for obviousness in its *KSR* decision. My understanding is that the Supreme Court said that technical people of ordinary skill look for guidance in other solutions to problems of a similar nature, and that the obviousness inquiry must track reality, and not legal fictions. I have relied on these understandings in expressing the opinions set forth below.

IV. RESERVATION OF RIGHTS

21. My opinions are based upon the information that I have considered to date. I am unaware of any evidence of secondary considerations with respect to the

'142 Patent that would render any of the challenged claims non-obvious. I reserve the right, however, to supplement my opinions in the future to respond to any arguments raised by the owner of the '142 Patent and to take into account new information that becomes available to me.

22. I declare that all statements made herein of my knowledge are true, and that all statements made on information and belief are believed to be true, and that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

V. PERSON OF ORDINARY SKILL IN THE ART

23. In determining the characteristics of a hypothetical person of ordinary skill in the art of the '142 Patent at the time of the claimed invention, I considered several things, including various prior art techniques relating to the field of the development and production of paperboard. I also considered the sophistication of the technologies involved, and the educational background and experience of those actively working in the field at the time. I also considered the level of education that would be necessary to understand the '142 Patent. Finally, I placed myself back in the relevant time period and considered the engineers, and researchers that I have worked with in the field of the development and production of coated paperboard.

24. I came to the conclusion that a person of ordinary skill in the field of art of the '142 Patent would have been a person with a bachelor's degree in paper science and engineering, chemical engineering, process engineering, mechanical engineering, or a related degree with at least three to five years of experience in paperboard manufacturing, or a person with a master's degree in paper science and engineering, chemical engineering, process engineering, or mechanical engineering, or a similar field with a specialization in paperboard manufacturing. A person with less or a different education but more relevant practical experience may also meet this standard.
25. In view of the types of problems encountered in the art and prior art solutions to those problems, including the widespread use of heated rolls in calendering machines, a person of ordinary skill in the art in or around 2019 with the level of skill described above would have had the knowledge and skills necessary to: optimize paperboard properties and paperboard machine production output, including adjusting calender roll materials, roll temperatures, nip load, and other characteristics of calendering machines to achieve optimal results related to smoothness and density of paperboard substrates.

VI. BACKGROUND OF PAPERBOARD CALENDERING

26. As I discuss in detail throughout this declaration, hot-hard calendering of paperboard substrates was well-known in the art by May 2019, the filing date of the '142 Patent priority document, and there was nothing innovative about the methods of manufacturing smooth and low-density paperboard of the '142 Patent.

VII. THE '142 PATENT

27. In this section, I summarize the disclosure in the '142 Patent, followed by a summary of the examination of the '142 Patent at the USPTO.

A. Summary

28. The application for the '142 patent was filed May 7, 2020, and assigned application number 16/869,156. The '142 patent issued on April 5, 2022.
29. The '142 patent is directed to “smooth, low-density paperboard and to methods for manufacturing the same.” (Ex. 1001, at 1:15–17).
30. In the "Background of the Invention" section of the '142 Patent, the Patent Owner states 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 Patent Owner stated that while wet stack calendering smooths paperboard by compressing the fiber network through a nip load,

the density of paperboard is increased. (Ex. 1001, col. 1: 28–39). It is understood in the art that increased density is not a desired characteristic for most paperboard structures.

31. Accordingly, the '142 Patent aimed to improve upon the prior art by preparing a smooth paperboard without substantially increasing paperboard density. (*Id.* at 1:35–38). The “Summary of the Invention” section further provides that the process employed by the '142 Patent “includes passing a paperboard substrate through a hot-hard calender, the hot-hard calender including a nip defined by a thermo-roller and a counter roller, wherein a contact surface of the thermo-roller is heated to an elevated temperature.” (*Id.* at 1:45–51).
32. Figure 2 illustrates a schematic representation of an example of the method disclosed in the '142 Patent attempts to manufacture a smooth, lower density paperboard structure. It is reproduced below:

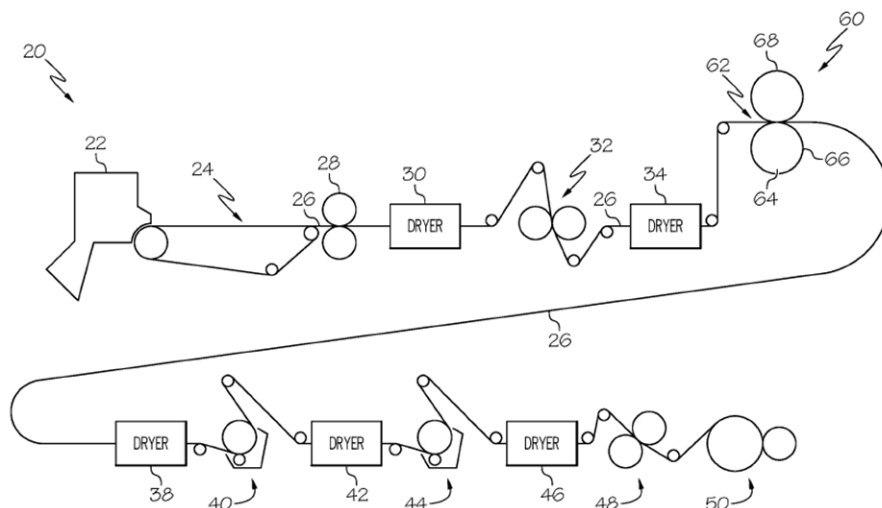


FIG. 2

33. The “Detailed Description” section of the patent describes the process of manufacturing a paperboard substrate as depicted in Figure 2. See below (col. 5, lines 27-47):

Referring to FIG. 2, an example method **20** for manufacturing a paperboard structure **10** is illustrated. The method **20** may begin at the head box **22** which may discharge a fiber slurry onto a Fourdrinier **24** to form a paperboard substrate **26**. The paperboard substrate **26** may pass through one or more wet presses **28** and, optionally through one or more dryers **30**. A size press **32** may be used and may slightly reduce the caliper thickness of the paperboard substrate **26** and an optional dryer **34** may additionally dry the paperboard substrate **26**.

The paperboard substrate **26** then passes through a hot-hard calender **60** to yield a calendered paperboard substrate. The hot-hard calender **60** includes a nip **62** wherein a nip load may be applied to the paperboard substrate **26**. Further, the nip **62** is defined by a counter roller **68** and a thermo-roller **64**. The counter roller **68** and/or the thermo-roller **64** may be made from a metallic material, such as steel or iron, or other suitably hard materials, such as a heat-resistant resin

composite. The thermo-roller 64 includes at least one contact surface 66 (for contacting the paperboard substrate 26) that is heated to an elevated temperature.

34. This is known in the art as “pre-calendering,” since this hot-hard calender (60) is prior to the first and second coaters (40, 44 in Fig. 2). This is further supported by *Papermaking* (Ex. 1005, section 4.4.2, page 81: “Precalendering is used before the coater to reduce roughness...”).
35. Following precalendering, the substrate 26 passes through a dryer 38 before being applied a basecoat by a coater 40, then subsequently dried again 42 before passing through a second coater 44 to apply a topcoat. Finally, after being dried 46 after the second coater 44, the paperboard substrate 26 may pass through a gloss calender 48 and be wound on a reel 50. (*Id.* at 6:5–22).
36. Since the gloss calender is positioned downstream of the first and second coaters, it would be understood in the art as “final calendering”. (See *Papermaking* section 4.4.3, page 82: Final calendering of a *coated* carton board...).
37. Looking to Example 1 as a representative example (*Id.* at col. 6), an uncoated solid bleached sulfate (SBS) paperboard substrate was prepared “using a full-scale production process.” This production process appears to be the same one that is depicted in Fig. 2.

38. This example states that starch was applied to the surface of the SBS board during production. (*Id.* at col. 6:43-44). This would have occurred at the size press 32 prior to precalendering. The paperboard substrate was then precalendered by “Valmet Technologies Oy of Järvenpää, Finland, using a hot-hard calender having a two roll (e.g., one nip) design. The hot-hard calender included one thermo-roller and one counter roller.”
39. I am familiar with Valmet Technologies Oy. The Valmet pilot facility in Järvenpää is set up to demonstrate a wide range of calendering technologies, including hot hard pre-calendering and to test and verify the performance of different machine settings in the development and optimization of coated board properties. The facility is frequently used by Valmet existing and potential new customers.
40. Following precalendering, a basecoat was applied by a coater (See 40 in Fig. 2) and following a drying step the topcoat was applied by a coater (see 44 in Fig 2). In Fig. 2, both of these coaters are depicted as being on one side of the substrate (26 in Fig 2). Indeed, this example indicates that the “calendered paperboard substrate was then coated on one side (C1S) with the basecoat and then the topcoat”. Like other aspects of the process disclosed in this example, the basecoat and the topcoat compositions,

applications, and amounts are state of the art (*i.e.*, not in and of themselves novel).

41. The coated paperboard structure was then final calendered using a gloss-type calender (48 in Fig. 2).
42. A preliminary amendment was filed with the application that included 24 claims. For example, original claim 1 read as follows:

B. Examination at the Patent Office

43. Original claim 1 read as follows:

1. (Original) A method for manufacturing a paperboard structure comprising:
passing a paperboard substrate through a hot-hard calender to yield a calendered paperboard substrate, said hot-hard calender comprising a nip defined by a thermo-roller and a counter roller, wherein a contact surface of said thermo-roller is heated to an elevated temperature;
applying a basecoat to said calendered paperboard substrate to yield a basecoated paperboard substrate, said basecoat comprising a basecoat binder and a basecoat pigment; and
applying a topcoat to said basecoated paperboard substrate,
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_2 pounds per 3000 ft², wherein Y_2 is a function of said caliper thickness (X) in points and is calculated as follows:

$$Y_2 = 3.71 + 13.14X - 0.1602X^2.$$

44. On August 20, 2021, the examiner rejected all the claims as anticipated by, or in the alternative, as obvious over *Fugitt*. (Ex. 1002 at page 74).

45. The Patent Owner then amended independent claim 1 to further require that “a contact surface of said thermo-roller is heated to an elevated temperature of at least 250 °F...” (*Id.* at page 83). The Patent Owner then argued that the steam heated rolls disclosed by *Fugitt* did not render obvious this so-called elevated temperature limitation because “[t]he claimed method requires a temperature that is significantly hotter than traditional temperatures.” Also as part of the amendment and response to office action, the Patent Owner added new dependent claims 67–86 drawn to the method for manufacturing a paperboard structure and dependent claim 87 drawn to a paperboard structure manufactured by the claimed method. This was the only point of argument from the Patent Owner that *Fugitt* was different from their claimed invention. (*Id.* at pages 83-84).
46. The Patent Owner acknowledged that “Traditional calenders may employ rollers that are heated to temperatures that are greater than ambient temperature,” and stated that their claims are distinguished from *Fugitt* because they “[require] a temperature that is significantly hotter than traditional temperatures – specifically, an elevated temperature of at least 250°F – which is not disclosed or suggested by *Fugitt*.” (*Id.* at page 88).
47. This argument by the Patent Owner appeared to convince the Examiner that their claims were now patentable.

48. Then on November 30, 2021, the Examiner allowed the application. In the notice of allowability, the examiner stated that “The primary reason for allowance is that the cited prior art does not disclose a method for manufacturing a paperboard structure per steps claimed, the method including passing a paperboard substrate through a nip of a hot-hard calender, wherein the nip is defined by a thermo-roller and a counter roller, and wherein the contact surface of the thermo-roller is heated to an elevated temperature of at least 250 °F (claim 1).” (*Id.* at page 103).

VIII. CLAIM CONSTRUCTION

49. In this section, I am asked to provide my opinion on how certain claim terms of the ‘142 Patent should be interpreted. I understand that in the proceeding, the claim terms must be construed in accordance with their ordinary and customary meaning as understood by one of ordinary skill in the art, the specification and the prosecution history.
50. It is my understanding that the “plain and ordinary meaning” has traditionally been applied in district court litigation and is now applied in post-grant proceedings at the U.S. Patent and Trademark Office, where a claim term is given its plain and ordinary meaning in view of the specification from the view point of a person of ordinary skill in the art. I

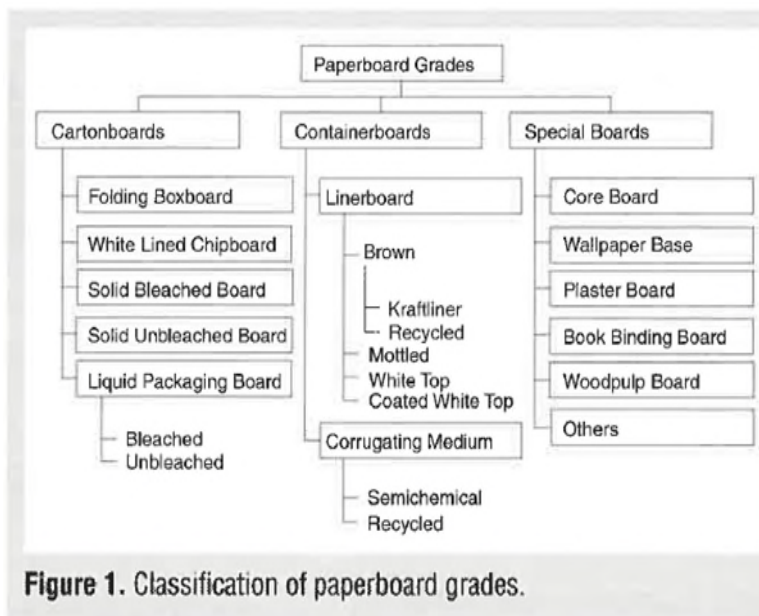
understand that this is referred to as the *Phillips* standard. I have applied the *Phillips* standard in my analysis.

51. Unless otherwise stated, I have applied the plain and ordinary meaning to claim terms.
52. I have not formed and do not offer an opinion on the indefiniteness of the claims. While there may be issues that prevent a person of ordinary skill in the art from determining the scope of the claims with reasonable certainty, my opinions here rely on prior art that falls squarely within the scope of the challenged claims of the '142 patent, and nowhere near the boundaries of the claims. Therefore, it is not necessary for determining the invalidity of the challenged claims to resolve whether the '142 patent informs a person of ordinary skill in the art of the scope and boundaries of its claims with reasonable certainty. Thus, I have not offered an opinion regarding the indefiniteness of the claims.
53. It is my opinion that the terms identified below should be construed in the manner outlined below. In general, the terms below are well understood in the paperboard industry, and sufficiently generic to warrant a broad interpretation.

A. “Paperboard Substrate.”

54. Claims 1, 2, 4, 5, 7, 8, and 19 of the ‘142 Patent recite the term “paperboard substrate.” “Paperboard substrate” would be broadly construed by one of ordinary skill in the art. It means “a material that can be used to create paperboard structure.” The ‘142 patent states that “[t]he paperboard substrate 12 may be any paperboard material that is capable of being coated, such as with the disclosed basecoat 14. The paperboard substrate 12 may be bleached, and may be a single-ply substrate or a multi-ply substrate” (Ex. 1001 at col. 2:63-67 (emphasis added)). The paperboard may also be unbleached. (*Id.* at col. 2:67-col. 3:1).
55. “Paperboard material” is a broadly construed term that indicates a material that can be “used in various packaging applications. For example, aseptic liquid packing paperboard is used for packaging beverage cartons, boxes, and the like.” (*Id.* col. 1: 20-23).
56. For the purpose of claim construction, one of ordinary skill in the art would understand the term paperboard includes cartonboard (or carton board). One type of cartonboard is solid bleached board (also referred to as solid bleached sulphate, “SBS”). Another type of cartonboard is boxboard, or folding boxboard. Paperboard also includes containerboard.

57. This is shown in the following table, which summarizes various paperboard grades, that are all made from paperboard material and paperboard substrates:



See Paulapuro, Hannu (2000). *Papermaking Science and Technology Book 18: Paperboard and Grades* (p. 55). Paper Engineers' Association.

58. One of ordinary skill in the art at the time of the '142 Patent's filing would have considered each of the above materials to be considered a variation of paperboard.

B. "Hot-Hard Calender."

59. Claims 1, 2, 4 and 5 recite the term "hot-hard calender." "Hot-hard calender" should be construed to mean "a calender defined by at least two rollers of suitable hardness (e.g., metallic material or heat-resistant resin composite) wherein at least one roller is heated to a temperature above ambient temperature." The term "hot-hard calender" also includes what is known as a

heated “hard-nip calender.” *Papermaking* describes a hard-nip calender as simply “two or more hard rolls.” See page 35. The calender may be two-roll hard-nip calenders and multi-roll hard-nip calenders. *Id.* The multi-roll hard-nip calender may be a stack calender.

60. Claim 1 of the ’142 patent provides that the hot-hard calender “compris[es] a nip defined by a thermo-roller and a counter roller.” See col. 12:37–40. Figure 2 of the ’142 patent shows two rollers (64, 68) and the nip (62) formed by the heated roller (64) and the counter roller (68).
61. The Specification of the ’142 Patent further supports this construction through its discussion of exemplary materials and temperatures applied through the hot-hard calender. Regarding the hardness of rollers within the hot-hard calender, the Specification discloses that the counter roller and/or the thermo-roller “may be made from a metallic material, such as steel or iron, or other suitably hard materials, such as a heat-resistant resin composite.” *Id.* at 5:42–45.
62. Regarding the temperature of the hot-hard calender, the Specification of the ’142 Patent discloses that the thermo-roller of the hot-hard calender “includes at least one contact surface (for contacting the paperboard substrate) that is heated to an elevated temperature.” *Id.* at 5:45–47.

63. The Specification also provides a direct comparison between a hot-hard calender and what it calls a traditional calender in its discussion of comparative examples for examples 1–6. *Id.* at 10:5–30. In particular, the Specification contrasts hot-hard calendering at nip loads ranging from 90 pli to 140 pli and roller surface temperatures from 480–500 °F with what it calls traditional calendering at nip loads of 350 pli and roller surface temperatures of 200 °F. Although the Specification appears to contrast hot-hard calenders with traditional calenders at 200 °F, the prosecution history discussed below evidences a broader interpretation of hot-hard calenders.
64. In the USPTO office action, the examiner rejected claim 1 over *Fugitt*, where the pending claim 1 recited substantially the same hot-hard calender as recited in the '142 patent except for the specific temperature of the thermo-roller contact surface. (Ex. 1002 at page 74). In particular, the examiner found that *Fugitt* provided such a calender by disclosing a calender with “[a]t least some of the rolls in nips with counter rolls in the calender are steam heated to an elevated temperature.” (*Id.* at 74, citing Ex. 1004, ¶26).
65. A “hot-hard calender” may be a calender used for any calendering for the paperboard process including precalendering. A “precalender” is a calender that is used prior to coating.

C. “Nip.”

66. Claims 1, 2, and 5 recite the term “nip.” This term should be defined as the space where a paperboard is pressed between two rolls. The ‘142 Patent identified a “nip” as being “defined by a thermo-roller and a counter roller.” See col 2, lines 2-3.

D. “Thermo-roller.”

67. Claims 1, 5, and 6 recite the term “thermo-roller.” A “thermo-roller” is a roller that has a contact surface that is heated to an elevated temperature. (Ex. 1002 at col. 5:45-47).

E. “Counter-roller.”

68. Claims 1, 5, and 6 recite the term “counter roller.” A “counter roller” is a roller that forms a nip with a thermo-roller. See the ‘142 Patent at col. 1, lines 49-50: “the hot-hard calender including a nip defined by a thermo-roller and a counter roller.” Also see Fig. 3 (counter roller 86 and thermo-roller 64).
69. One type of counter roller is known as a “deflection-compensated roll.” (Ex. 1005 at pages 38 and 39). “Most commonly, a two-roll hard-nip calender is composed of a heated cast-iron roll and a deflection-compensated roll (Figure 22).” (*Id.*).

70. Thus, a “counter roller” is a roller that is opposite of a thermo-roller. *Gratton* further demonstrates this. (Ex. 1006 at Figure 1, p. 81). Most printing papers are expected to be symmetrical – both sides having similar properties. However also some paperboard grades, used for graphical purposes would benefit from hot calendering on both surfaces.

F. “Basecoat.”

71. Claims 1, 7-11, 15, and 19 recite the term “basecoat.” “Basecoat” should also be broadly construed, and means a first coating applied to the paperboard after the hot-hard calender. (Ex. 1001 at col. 3:31-34). The ‘142 Patent states: “The basecoat 14 is applied first, directly to the paperboard substrate 12, and may be followed by various intermediate coating layers 16. The topcoat 18 is applied last to form the outermost layer (e.g., the basecoat is positioned between the topcoat and the paperboard substrate).” (*Id.*).

G. “Topcoat”

72. Claims 1, 8, and 16-19 recite the term “topcoat.” “Topcoat” should also be broadly construed, and means a coating that is applied to the paperboard *after* the basecoat. The ‘142 Patent states: “The topcoat 18 may be applied to the paperboard substrate 12 after a basecoat 14 has been applied. (Ex. 1001 at col. 4: 58-59).

IX. SUMMARY OF THE PRIOR ART

73. As discussed above, there are a number of patents and publications that constitute prior art to the '722 patent. I have reviewed and considered the prior art discussed in this section, along with the materials listed in Appendix 2.

A. *Fugitt* (Exhibit 1004)

74. *Fugitt* is directed to a method for coating a paperboard, and in particular, to methods for coating paperboard that ultimately results in smooth paperboard structures. (Ex. 1004 at ¶2). *Fugitt* explains that paper or paperboard substrates used for printing and packaging are generally required to have good optical properties, excellent smoothness and excellent printability. *Fugitt* states that:

“[S]trength and stiffness are required such that the substrates can pass smoothly through high-speed printing and converting machines without breaking or jamming. High stiffness is necessary for maintaining the structural integrity of paperboard products during filling and in subsequent use... Stiffness has a close relationship to the basis weight and density of the substrate... The general trend is that stiffness increases as basis weight increases. However, if one increases basis weight to improve stiffness, more fiber must be utilized, adding to cost and weight... In addition to the mechanical properties of stiffness and strength, paper or paperboard substrates

that will be printed must have a required level of gloss and smoothness.” (*Id.* at ¶3-5).

75. *Fugitt* also explains the general relationship among physical characteristics of paperboard substrates by noting that the stiffness of paperboard is closely tied to the basis weight and density of a particular substrate, and further, that mechanical properties like stiffness and strength must be balanced with levels of gloss and smoothness required for printing. (*Id.* at ¶ 4–5). *Fugitt* notes that calendering is the primary means for obtaining smoothness and that doing so reduces the stiffness of paperboard. In addition, wet stack calendering, which utilizes rewetting of the substrate prior to calendering to optimize smoothness, greatly increases the density of the calendered paperboard. (*Id.* at ¶ 5). Due to the generally inverse relationship between stiffness and smoothness of paperboard, *Fugitt* recognizes the need to produce smooth paperboard without densification, thus, maintaining thickness without excessive material cost. (*Id.* at ¶ 6).
76. Like the ‘142 Patent, *Fugitt* discloses a size press upstream of calendering. (*Id.* at ¶26).
77. *Fugitt* states that “[i]t will be desirable to be able to produce a finished paper or board having a smooth surface that was developed without the need for

densification, thereby maintaining thickness with the minimum cellulose fiber usage. (*Id.* at ¶6).

78. Like the ‘142 Patent, *Fugitt* is looking for a process to increase stiffness and smoothness while using less material. This process includes a process where “the rolls of the calender may be steam heated.” (*Id.* at ¶26).

B. *Papermaking*

79. *Papermaking* is the tenth book in the Papermaking Science and Technology book series, a seminal work featuring 20 volumes that cover the entire paper manufacturing process from wood raw material to final product. The complete title is “Book 10: Papermaking Part 3, Finishing, Second Edition,” Pentti Rautiainen, Ed, © 2009 Paper Engineers’ Association, ISBN 978-9525216363.
80. The Papermaking Science and Technology book series is widely known as a foremost reference guide for covering the latest technology and trends of papermaking. Of course, this includes paperboard and manufacturing paperboard. This book series was assembled and edited by Finnish Paper Engineers’ Association, TAPPI (Technical Association of the Paper & Pulp Industry), and Fapet Oy (Helsinki, Finland), and published by Paper Engineers’ Association (Helsinki, Finland). It is universally considered the largest and most comprehensive book series in the field of papermaking

since the first edition was published in 1988-2000. (Second editions of several of the volumes have since been released). The books are used globally as course material on B.Sc. and M.Sc. levels, in further professional training, and as trusted handbooks for professionals in both industry and research.

81. This opinion is based in part on Chapter 3, titled “Calender types.” Section 3.1 states that “Hard-nip calenders are used for a variety of paper and board grades. In this calendering process, the web is pressed between two or more hard rolls.” See page 35. Section 3.1.1 states that “Traditionally, hard-nip calenders have had heated systems that were unable to influence the surface temperature of the rolls and the process. In today’s two-nip hard calenders with heated rolls that are able to operate at elevated temperatures, the temperature has become an active parameter.”
82. This opinion is also based in part on Chapter 1, titled “Calendering.” Section 4 of Chapter 1 is titled “Calendering process application areas.” (Ex. 1005, pages 67-84). One of these application areas is Cartonboards. See Section 4.4. This section explains that calendering can be carried out before coating (“Precalendering”) or after coating (“Final calendering”). Section 4.4.2 relates to Precalendering and states that it “is used before the coater to reduce roughness and porosity to coater-specified target levels. CD

caliper control is also important.” Since the dry stack calender 36 in *Fugitt* is arranged before the coaters 40, 44, it is a precalender.

83. *Papermaking* further explains that “[a] modern cartonboard line as a rule has one hard-nip precalender before the coating section, especially in Asia. High thermo roll temperatures (in some cases over 200°C [392°F]) result in bulk savings because of the temperature gradient.” (Ex. 1005, page 82) This clearly shows that it was known to produce the paperboard of the ‘142 Patent using a heated hard nip calender as claimed, and heating the thermo-roll to a temperature of at least 250°F.
84. Chapter 1, Section 5 is titled “Calender construction.” Section 5.1.3 concerns heated rolls and the section “Heating mediums,” being a subsection to Section 5.1.3 states that “Water, steam and thermal oil are the three main heating media used in thermo rolls.” Specifically, “steam can be used up to 170 °C [338 °F] surface temperature. The hottest rolls surface temperatures are reached with hot oil, which can reach over 220 °C [428 °F].” (Ex. 1005 at page 98).
85. As discussed further below, this contradicts statements that the Patent Owner made to the Patent Office when amending the claims. The Patent Owner acknowledged that the rolls of *Fugitt* may be steam heated. *Papermaking* discloses that it is known that the temperature of steam heated rolls can

reach 338°F, easily within the “at least 250°F” limitation added by their amendment.

86. “Roll materials,” being a sub-section to section 5.1.3 states that “The dominant material [in a thermo roll] is chilled cast iron.”

C. Gratton

87. *Gratton*, (Ex. 1006), is an article disclosing that Temperature-gradient (TG) calendering is a technique that can improve paper surface finish with less bulk reduction than with conventional calendering. TG calendering is a technique that has previously been shown to work well for newsprint. Regarding the TG calendering technique, *Gratton* also makes reference to *Crotogino* (Ex. 1008), wherein the technique was evaluated on newsprint. (Crotogino, R.H., (1982) Tappi J. 65(10):98). (Ex. 1008). As shown by *Gratton* (Ex. 1006, page 81) and Crotogino (1982) (cited in the Gratton abstract), the TG calendering technique comprises calendering in a nip formed by hot (210 °C, i.e., 410 °F) iron rolls.
88. The objective of *Gratton* was to determine whether there are any benefits in applying TG-calendering technique to food boards and other heavy paper products, i.e. not only to newsprint (as in *Crotogino*) (*Id.*).

89. *Gratton* calendered boards with a heated hard nip calender heated to 210°C [410°F] and with nip loads of 20, 40, 60, 80, and 100 kN/m (*Id.* at page 86 “Experimental – TG calendering”).
90. The effect of calendering technique on Parker Print-Surf (S10) roughness is shown in Fig. 4, wherein it is shown that when calendered to the same bulk, the TG-calendered board showed much higher Hunter gloss and a lower Parker Print-Surf roughness than the conventionally calendered board. It was concluded that conventionally calendered boards were found to be substantially rougher than TG-calendered boards having the same bulk and that this effect is far more pronounced on board than it was for newsprint (see page 82 right column 1st paragraph).
91. *Gratton* reinforces the advantages of using the higher temperatures disclosed in Papermaking.

D. Papermaking II

92. *Papermaking II* (Ex. 1007) is Papermaking Science and Technology Book 11, entitled “Book 11: Pigment Coating and Surface Sizing of Paper.” Esa Lehtinen, Ed., © 2000 Fapet Oy, ISBN 978-9525216110. Along with *Papermaking*, is part of the same a book series described above. Again, it is widely known regarded as the foremost reference guide for covering the

latest technology and trends of papermaking, which includes paperboard and manufacturing paperboard.

93. *Papermaking II* discloses that it is conventional to use starch in a size press. (Ex. 1007, page 583). *Papermaking II* describes board coating. (*Id.* at page 581, section 2 titled “2 Introduction to board coating”). *Papermaking II* discloses that “In many cases, there is a size press before coating. Low-consistency starch is applied on the board surface. The main purpose of the size press treatment is to improve stiffness and surface strength of the board before coating. Surface sizing also seals the board surface and evens out the sizing variations of the baseboard for the constant coating color pickup.” (*Id.* at page 583, section 2.1, entitled “2.1 Surface sizing”).
94. *Papermaking II*, thus, discloses that it is general knowledge that if a size press is positioned before coating, as the size press 32 in Fugitt, low consistency starch is applied on the board surface.

X. OBVIOUSNESS GROUNDS

95. Based on my review and analysis of the materials cited herein, my opinions regarding the understanding of a person of ordinary skill in the art (“POSITA”) in the 2019 timeframe, and my training and experience, it is my opinion that the challenged claims of the ’142 Patent are invalid based on the following grounds:

Grounds	Challenged Claims	Basis	Prior Art
1	1, 2, and 5-23	35 U.S.C. §103	<i>Fugitt and Papermaking</i>
2	1, 2, and 4	35 U.S.C. §103	<i>Fugitt and Papermaking and Gratton</i>
3	4	35 U.S.C. §103	<i>Fugitt and Papermaking and Papermaking II</i>

XI. OBVIOUSNESS

96. In this section, I compare the claims of the ‘142 Patent to the disclosure of the materials cited herein and present my invalidity analysis. 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 a person of ordinary skill in the art would have found claims 1, 2, and 4-23 of the ’142 Patent obvious. The reasons for my conclusions are explained fully below.

A. Claims 1, 2, and 5-23 are Obvious Under 35 U.S.C. § 103 over *Fugitt* in view of *Papermaking*

97. In my opinion, *Fugitt* and *Papermaking* describe each and every feature recited in claims 1, 2, and 5-23 of the ‘142 Patent, and it would be obvious to one of ordinary skill in the art to combine those features as claimed.

1. Claim-by-claim analysis

98. Below, I present my feature-by-feature analysis of each claim, and an opinion regarding motivation to combine the prior art teachings where applicable.

a. Claim 1

[1.pre] “A method for manufacturing a paperboard structures comprising . . .”

99. *Fugitt* discloses a method for coating a paperboard that includes the steps of preparing a web of cellulosic fibers (*i.e.*, web) (“paperboard substrate”), calendering that web to form a paperboard substrate (“calendered paperboard substrate”), and then coating that paperboard substrate to form a coated paperboard structure (“paperboard structure”). (Ex. 1004 at ¶ 7 (describing that as a component of the disclosed method for coating paperboard, the method includes calendering a fiber web at least once to form a paperboard substrate), and Figs. 11–12 (depicting forming a paperboard substrate as an aspect of the process for coating paperboard)).

[1.a] “passing a paperboard substrate through a hot-hard calender to yield a calendered paperboard substrate”

100. *Fugitt* discloses initially forming a web (*i.e.*, the claimed “paperboard substrate”) of cellulosic fibers that are passed through a calender to form a

paperboard substrate (i.e., the claimed “calendered paperboard substrate”). (Ex. 1004 at ¶¶ 7, 9, 26 (describing a web 26 of cellulosic fibers passed through a calender to form a paperboard substrate), 26 (noting that the rolls of the calender may be steam heated); *see also* Ex. 1004 at 2:63–3:24 (disclosing the broad category of starting materials to be calendered).

101. *Fugitt* states that “the web 26 may pass through a dry stack calender 36 to form the final paperboard substrate 37”. The rolls of the calender may be steam heated and hence are “hot”. (*Id.* at ¶26).
102. *Papermaking* also teaches passing a paperboard substrate through a hot-hard calender to yield a calendered paperboard substrate. (Ex. 1005 at Chapter 1, Section 4.4, entitled “Cartonboards,” at pages 80-81. That is, *Papermaking* discusses precalendering, which “is used before the coater to reduce roughness...” (*Id.* at 81. This claim step, [1.a], is a precalendering step because it occurs before the coating steps discussed below. *Papermaking* states that “[p]recalendering is usually carried out with one hard-nip calender before the coating section... A modern cartonboard line as a rule has one hard-nip precalender before the coating section, especially in Asia. High thermo roll temperatures (in some cases over 200°C [392°]) result in bulk savings because of the temperature gradient.” (*Id.* at pages 81 and 82).

**[1.a.i] “said hot-hard calender comprising a nip defined by a
thermo-roller and a counter roller”**

103. Fugitt discloses a (steam-heated) thermo-roller. Further the roller arranged opposite the thermo-roller in Fugitt’s dry stack calender acts as a counter roller.
104. *Papermaking* also teaches a nip defined by a thermo-roller and a counter roller. See the section entitled “Two-roll hard-nip calenders” on pages 38-40. “Most commonly, a two-roll hard-nip calender is composed of a heated cast-iron roll and a deflection-compensated roll.” (page 38).
105. *Papermaking* also discloses that different variations of hard-nip calenders can be used, including a multi-roll hard-nip calender. See Section 3.1.2 “Hard-nip calender concepts.” This section includes a sub-section entitled “Two-roll hard-nip calenders” and a subsection entitled “Multi-roll hard-nip calender.” In the later subsection, *Papermaking* states that “Research has shown that surface properties of the web develop according to the total pressure pulse applied. For example, if multiple nips are used, the surface quality is the same as if only one nip of the same total applied pressure were used.” One of ordinary skill in the art would understand that *Papermaking* renders obvious the interchangeability of hard-nip calenders. The ‘142 Patent discloses a two roll hot-hard calender. *Papermaking* teaches the

interchangeability of two roll hard-nip calenders and multi-roll hard-nip calenders like the stack calender in *Fugitt*.

[1.a.ii] “Wherein a contact surface of said thermo-roller is heated to an elevated temperature of at least 250°F”

106. *Fugitt* is silent with respect to a particular temperature of the roller. However, *Fugitt* specifically states that “[t]he rolls of the calender may be steam heated.” (Ex. 1004 at ¶ 25). It would have been obvious to one of ordinary skill in the art to increase the temperature of the heated rolls of *Fugitt* to at least 250°F as demonstrated in *Papermaking*.
107. Chapter 1 of *Papermaking* is entitled “Calendering.” In Section 3.1.2, “Hard-nip calender concepts,” *Papermaking* states that “[m]ost commonly, a two-roll hard-nip calender is composed of a heated cast-iron roll and a deflection-compensated roll (Figure 22).” (Ex. 1005 at page 38). A deflection-compensated roll is a counter roll as described by *Fugitt*.
108. Section 4.4, entitled “Cartonboards,” states that precalendering is used before the coater to reduce roughness and porosity to coater-specific target levels. See page 81. A heated hard-nip is specifically disclosed as a type of precalender that is used. *Id.* A modern cartonboard line as a rule has one hot hard-nip precalender before the coating section, especially in Asia. High

thermo roll temperatures (in some cases over 200°C [392°F]) result in bulk savings because of the temperature gradients.” (*Id.* at page 82).

109. Section 5.1.3 in *Papermaking*, entitled “Heated Rolls,” states that “Steam can be used up to 170°C [338°F] surface temperature. The hottest roll surface temperatures are reached with hot oil, which can reach over 220°C [428°F].” (*Id.* at page 98).
110. Accordingly, there is no question that it is known to heat a thermo-roller to a temperature that reads on this claim limitation. In fact, one of ordinary skill in the art would understand that even the steam heating of *Fugitt* should be able to be used up to 338°F.
111. Additionally, in my professional opinion, it is routine optimization in the art to explore the temperature of thermo-rollers as a result-effective variable. That is, it is unquestionably known from *Fugitt* that a steam-heated roller can be heated up to 338°F. Armed with that knowledge, it would be a routine exercise (i.e., routine optimization) to explore the effects of different temperatures of the roller upon the web being passed over it – from ambient temperature to the highest operational temperature that can be achieved by the roller – which according to *Fugitt* is made by steam heating, that is 338°F, as known from *Papermaking*. Thus, there is nothing inventive in heating the contact surface of the thermo-roller to “a temperature of at least

250°F” as recited in claim 1. This is nothing more than routine optimization of an exceedingly well known, result-effective variable – namely roller temperature.

112. This claim step is considered to be a precalender step because it occurs before coating.

[1.b] “applying a basecoat to said calendered paperboard substrate to yield a basecoated paperboard substrate”

113. *Fugitt* discloses applying a basecoat to at least one surface of the paperboard substrate to form a coated paperboard structure. (Ex. 1004 at ¶¶ 7–9, 54).

[1.b.i] “said basecoat comprising a basecoat binder and a basecoat pigment; and”

114. *Fugitt* discloses that the basecoat includes at least one pigment and a binder. (Ex. 1004 at ¶¶ 28–29 (discussing that the basecoat may include a pigment blend and that additional components, such as binders, may be combined with the pigment blend to form a final basecoat)).

[1.c] “applying a topcoat to said basecoated paperboard substrate,”

115. *Fugitt* discloses applying a topcoat over the basecoat to improve the surface smoothness. (Ex. 1004 at ¶¶ 41, 55–56).

[1.d] “wherein said paperboard structure has a basis weight, a caliper thickness and a Parker Print Surf (PPS 10A) smoothness,”

116. See *Fugitt*, (Ex. 1004 at ¶¶ 4, (generally discussing the relationship among caliper thickness, stiffness, basis weight, and density of a substrate), ¶¶ 7–9 (describing the basis weight of the paper web), and ¶¶ 57 (describing a total basis weight, caliper thickness, and Parker Print Surf (PPS 10S) smoothness of the resulting coated paperboard structure). Basis weight, caliper thickness, and PPS smoothness are all prior art, conventional paper metrics, well known to those skilled in the art.

[1.d.i] “said Parker Print Surf (PPS 10S) smoothness being at most 3 microns,”

117. See *Fugitt*, (Ex. 1004 at ¶ 57 (discussing the Parker Print Surf (PPS 10S) smoothness of the paperboard structure being “about 1.5 microns.”) This falls within the limitation of “at most 3 microns.”

[1.d.ii] “said basis weight being at most Y_2 pounds per 3000 ft², wherein Y_2 is a function of said caliper thickness (X) in points and is calculated as follows: $Y_2 = 3.71 + 13.14X - 0.1602X^2$ ”

118. *Fugitt*, ¶ 57 lays out a total basis weight of 130.0 lbs/3000 ft², a caliper of 0.012 inches (12 points) and a Parker Print Surf (PPS 10S) smoothness of

about 1.5 microns. The basis weight of 130 falls below Y_2 as shown in the table below.

	X, i.e., actual caliper (points)	Basis weight (lbs/3000 ft²)	$Y_2=3.71 + 13.14X - 0.1602X^2$
<i>Fugittt</i>	12.0	130.0	138.3212

b. Claim 2:

The method of claim 1 wherein said passing said paperboard substrate through said hot-hard calender comprises applying a nip load to said paperboard substrate ranging from about 20 pli to about 500 pli.

119. As stated above, it would be obvious to combine *Fugitt* and *Papermaking* to arrive at claim 1 of the '142 Patent. Claim 2 is dependent on claim 1. *Papermaking* states that with precalendering, the calendering step prior to coating, the linear load varies usually from 10 to 40 kN/m (kilonewton/meter) [3.5 to 88 pli (pound/inch)]. (Ex. 1005 at page 72). With respect to cartonboard specifically, “[t]he linear load may even exceed 100 kN/m [571 pli].” (*Id.* at page 82). Accordingly, the nip/linear load is often below 100 kN/m. In my experience 10-90 kN/m is common.
120. In my opinion, it would be obvious to one of ordinary skill in the art to combine *Fugitt* with *Papermaking* to arrive at claim 2 because a nip load range that “may even exceed” 571 pli reads on about 20 to about 500 pli, especially considering that both ranges are open ranges. Additionally, the

usual linear load of precalendering described in *Papermaking* falls within the claimed range. In my opinion, claim 2 is obvious over *Fugitt* in view of *Papermaking*.

c. Claim 5

The method of claim 1 wherein said hot-hard calender further comprises a second nip defined by said thermo-roller and a second counter roller, and wherein said passing said paperboard substrate comprises passing said paperboard substrate through said nip and said second nip.

121. As stated above, it would be to combine *Fugitt* and *Papermaking* to arrive at claim 1 of the '142 Patent. Claim 5 is dependent on claim 1.
122. *Fugitt* discloses a second nip defined by the thermo-roller of claim 1, and a second counter roller. (Ex. 1004 at Figure 11). "Finally, the web 26 may pass through a dry stack calender 36 to form the final paperboard substrate 37. The rolls of the calender may be steam heated." (*Id.* at ¶26). Figure 11 shows 6 rolls. , but "the number of nips of the calender may be substantially reduced to minimize or avoid reduction in caliper thickness" (*Id.*).
123. *Papermaking* also discloses this embodiment. See page 35: "Hard-nip calenders of two main categories are used: - two-roll hard-nip calenders – multi-roll calenders." Also see the section entitled "Multi-roll hard-nip

calender,” on pages 40-42. Section 3.4 “Multi-roll calender stacks were and are still used. They comprise more than three rolls, most commonly four to six rolls.” See page 41. In my opinion, claim 5 is therefore obvious over *Fugitt* in view of *Papermaking*.

d. Claim 6

Claim 6: The method of claim 1 wherein at least one of said thermo-roller and said counter roller comprises a metallic material.

124. *Papermaking* teaches that the thermo-roller and the counter roller may comprise a metallic material. *Papermaking* states that “[m]ost commonly, a two roll hard-nip calender is composed of a heat cast-iron roll and a deflection-compensated roll (Figure 22).” (Ex. 1005 at ¶38).
125. Further, *Papermaking* states that for thermo rolls “the dominant material is chilled cast iron. In this material, the surface layer is chilled iron and the inner part (core) of the shell is either gray iron or nodular iron.” (*Id.* at ¶98).
126. Deflection compensation rolls (a type of counter rolls), are also known from *Papermaking* to be metallic. “Theoretically, solid chilled cast-iron rolls could be used, but these rolls should be crowned to compensate for the deflection.” (Ex. 1005 at page 39). In my opinion, claim 6 is obvious over *Fugitt* in view of *Papermaking*.

e. Claim 7

The method of claim 1 wherein said basecoat is applied to only one side of said calendered paperboard substrate.

127. *Fugitt* discloses embodiments where the basecoat is applied to only one side of the calendered paperboard substrate. (Ex. 1004 at ¶41): “Then, the dry stack paperboard substrate 37 may begin ant an optional dryer 38. Then, the dry stack paperboard substrate 37 may pass to a first coater 40. The first coater 40 may be a blade coater or the like and may apply the disclosed basecoat onto the dry stack paperboard substrate 37. An optional dryer 42 may dry, at least partially, the basecoat prior to application of the optional topcoat at the second coater 44.” The base coater, 40 is shown in Fig. 12 to be on only one side.
128. Also, in Example 3, (Ex. 1004 at ¶53, 56-57) the uncoated board has a basis weight of about 120 lbs/3000 ft². The basecoat was applied at a coat weight of about 6 lbs/3000 ft² and the topcoat at a coat weight of about 5.4 lbs/3000 ft². The resulting coated structure had a total basis weight of about 130 lbs/3000 ft². This shows that the basecoat and the topcoat were applied to one side. The coatings were applied using a blade applicator. A blade applicator is known to apply a single-sided coating so the coatings must have been applied only on one side as the total coat weight does not exceed

the coat weight applied in the basecoat + topcoat. In my opinion, claim 7 is obvious over *Fugitt* in view of *Papermaking*.

f. Claim 8

Claim 8: The method of claim 1 further comprising applying an intermediate coating layer to said basecoated paperboard substrate prior to said applying said topcoat.

129. *Fugitt* discloses comprising applying an intermediate coating layer to said basecoated paperboard substrate prior to said applying said topcoat. See (Ex. 1004 at ¶23). “The coating may include a basecoat and, optionally, one or more intermediate coatings and one or more top coats.” It is my opinion that claim 8 is obvious over *Fugitt* in view of *Papermaking*.

g. Claim 9

The method of claim 1 wherein said basecoat binder comprises latex.

130. *Fugitt* discloses that the additional components of the basecoat include binders, which include exemplary latex and combination latex and starch binders. (Ex. 1004 at ¶ 50, 52, 54). In my opinion, claim 9 is obvious over *Fugitt* in view of *Papermaking*.

h. Claim 10

The method of claim 1 wherein said basecoat pigment comprises at least one of clay and calcium carbonate. *Fugitt* discloses that the

basecoat pigment may comprise at least one of clay and calcium carbonate.

131. *Fugitt* states that: “In one particular aspect, the disclosed basecoat may include a pigment blend of high aspect ratio clay and calcium carbonate.” (Ex. 1004 at ¶29).
132. Also see Example 3: “A high-bulk, carbonate/clay basecoat was prepared having the following composition: (1) 50 parts high aspect ratio clay from Imerys Pigments, Inc., (2) 50 parts PG-3 from Omya. (an extra coarse ground calcium carbonate)...” (Ex. 1004 at ¶54). In my opinion, claim 10 is obvious over *Fugitt* in view of *Papermaking*.

i. Claim 11

The method of claim 1 wherein said basecoat pigment comprises clay and calcium carbonate.

133. *Fugitt* discloses that the basecoat pigment may comprise clay *and* calcium carbonate: “In one particular aspect, the disclosed basecoat may include a pigment blend of high aspect ratio clay and calcium carbonate.” (Ex. 1004 at ¶ 29).
134. Also see Example 3: “A high-bulk, carbonate/clay basecoat was prepared having the following composition: (1) 50 parts high aspect ratio clay from Imerys Pigments, Inc., (2) 50 parts PG-3 from Omya. (an extra coarse

ground calcium carbonate)...” (Ex. 1004 at ¶54). In my opinion, claim 11 is obvious over *Fugitt* in view of *Papermaking*.

j. Claim 12

The method of claim 1 wherein said clay has an average aspect ratio of at least about 40:1.

135. Fugitt discloses that the clay has an average aspect ratio of at least about 40:1.
136. See Fugitt ¶30 “The clay component of the pigment blend of the disposed basecoat may be any platy clay having relatively high aspect ratio or shape factor (i.e. hyperplaty clay)...The terms “hyperplaty”, “high aspect ratio” and “relatively high aspect ratio” refer to aspect ratios generally in excess of 40:1, such as 50:1 or more, particularly 70:1 or more, and preferably 90:1 or more.”
137. Also see Example 3: “A high-bulk, carbonate/clay basecoat was prepared having the following composition: (1) 50 parts high aspect ratio clay from Imerys Pigments, Inc” *high-aspect* is the same as hyperplaty clay (see above). (Ex. 1004 at ¶54). In my opinion, claim 12 is obvious over *Fugitt* in view of *Papermaking*.

k. Claim 13

The method of claim 11 wherein said calcium carbonate is ground calcium carbonate.

138. *Fugitt* discloses that the calcium carbonate may be ground calcium carbonate.
139. *Fugitt* states : “In one aspect, the calcium carbonate component may include a fine ground calcium carbonate. An example of such a fine ground calcium carbonate is CARBITAL® 95...” (Ex. 1004 at ¶33).
140. Also see Example 3: “A high-bulk, carbonate/clay basecoat was prepared having the following composition... (2) 50 parts PG-3 from Omya. (an extra coarse ground calcium carbonate)...” (Ex. 1004 at ¶54). In my opinion, claim 13 is obvious over *Fugitt* in view of *Papermaking*.

l. Claim 14

The method of claim 13 wherein at most about 60 percent by weight of said ground calcium carbonate has a particle size smaller than 2 microns.

141. *Fugitt* discloses examples wherein at most about 60 percent by weight of said ground calcium carbonate has a particle size smaller than 2 microns. *Fugitt* states: “An example of such an extra coarse ground calcium carbonate is CARBITAL® 35, also available from Imerys Pigments, Inc., wherein

only about 35 percent of the calcium carbonate particles are less than about 2 microns in diameter.” (Ex. 1004 at ¶33). In my opinion, claim 14 is obvious over *Fugitt* in view of *Papermaking*.

m. Claim 15

The method of claim 13 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.

142. *Fugitt* discloses where ground calcium carbonate may comprise at least about 10 percent by weight of said basecoat pigment and at most about 60 percent by weight of said basecoat pigment, including several examples where the blend is 50 percent calcium carbonate. *Fugitt* states: “...a basecoat including a 50:50 pigment blend of CARBITAL® 35 (extra coarse calcium carbonate) and XP-6100 (high aspect ratio and high average particle size clay) yielded a topcoated PPS smoothness value below about 3 microns, specifically about 2 microns, at a relatively low basecoat weight of 6 pounds per ream.” (Ex. 1004 at ¶44). In my opinion, claim 15 is obvious over *Fugitt* in view of *Papermaking*.

n. Claim 16

The method of claim 1 wherein said topcoat comprises a topcoat binder and a topcoat pigment blend.

143. *Fugitt* discloses a topcoat that has a topcoat binder and a topcoat pigment blend. See Example 3: “A topcoat was prepared having the following composition: 50 parts fine carbonate; 50 parts fine clay; 17 parts polyvinyl acetate [binder]; and minor amounts of coating lubricant, plastic pigment, protein, dispersant, synthetic viscosity modifier, defoamer and dye.” (Ex. 1004 at ¶55). *Fugitt* also explains that polyvinyl acetate latex is a binder. In my opinion, claim 16 is obvious over *Fugitt* in view of *Papermaking*. (*Id.* at ¶54). In my opinion, claim 16 is obvious over *Fugitt* in view of *Papermaking*.

o. Claim 17

The method of claim 16 wherein said topcoat binder comprises latex.

144. *Fugitt* discloses a topcoat binder that comprises latex. (Ex. 1004 at ¶55). *Fugitt* states: “A topcoat was prepared having the following composition: 50 parts fine carbonate; 50 parts fine clay; 17 parts polyvinyl acetate; and minor amounts of coating lubricant, plastic pigment, protein, dispersant, synthetic viscosity modifier, defoamer and dye. (Ex. 1004 at ¶55). *Fugitt* also explains

that polyvinyl acetate latex is a binder. In my opinion, claim 16 is obvious over *Fugitt* in view of *Papermaking*.

p. Claim 18

The method of claim 16 wherein said topcoat pigment blend comprises calcium carbonate and clay.

145. *Fugitt* discloses a topcoat pigment blend comprising calcium carbonate and clay. See *Fugitt* at Example 3: a topcoat was prepared having the following composition: 50 parts fine carbonate, 50 parts fine clay, 17 parts fine polyvinyl acetate. (Ex. 1004 at ¶55). In my opinion, claim 18 is obvious over *Fugitt* in view of *Papermaking*.

q. Claim 19

The method of claim 1 wherein said applying said basecoat and said applying said topcoat yields a coating structure on said paperboard substrate, said coating structure having a total coat weight, on a dry basis, ranging from about 8 lbs/3000 ft² to about 18 lbs/3000 ft².

146. See *Fugitt* at Example 3: “The basecoat was applied at a coat weight of about 6 lbs/3000 ft². The topcoat at a coat weight of about 5.4 lbs/3000 ft².” (Ex. 1004 at ¶¶56-57). Hence a coating structure having a total coat weight of 11.4 lbs/3000 ft². In my opinion, claim 19 is obvious over *Fugitt* in view of *Papermaking*.

r. Claim 20

The method of claim 1 wherein said Parker Print Surf (PPS 10S) smoothness is at most 2.5 microns. *Fugitt* discloses a Parker Print Surf (PPS 10S) smoothness being less than 2.5 microns.

147. See *Fugitt* at Example 3: “The resulting coated structure had ... a Parker Print Surf (PPS 10s) smoothness of about 1.5 microns. (Ex. 1004 at ¶57). In my opinion, claim 20 is therefore obvious over *Fugitt* in view of *Papermaking*.

s. Claim 21

The method of claim 1 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_2' pounds per 3000 ft², wherein Y_2' is a function of said caliper thickness (X) in points and is calculated as follows: $Y_2' = 35.55 + 8.173X - 0.01602X^2$.

148. *Fugitt* lays out a total basis weight of 130.0 lbs/3000 ft², a caliper of 0.012 inches (12 points) and a Parker Print Surf (PPS 10S) smoothness of about 1.5 microns. The basis weight of 130 falls below Y_2' as shown in the table below. (Ex. 1004 at ¶57).

	X, i.e. actual caliper (points)	Basis weight (lbs/3000 ft²)	$Y_2' = 35.55 + 8.173X$ $— 0.01602X^2$
Fugitt	12.0	130.0	131.31912

In my opinion, claim 21 is obvious over *Fugitt* in view of *Papermaking*.

t. Claim 22

The method of claim 1 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 follows: $Y_3 = 3.63 + 12.85X - 0.1566X^2$.

149. *Fugitt* lays out a total basis weight of 130.0 lbs/3000 ft², a caliper of 0.012 inches (12 points) and a Parker Print Surf (PPS 10S) smoothness of about 1.5 microns. (Ex. 1004 at ¶57). The basis weight of 130 falls below curve of Y_3 as shown in the table below.

	X, i.e. actual caliper (points)	Basis weight (lbs/3000 ft²)	$Y_3 = 3.63 +$ $12.85X —$ $0.1566X^2$
Fugitt	12.0	130.0	135.2796

In my opinion, claim 22 is obvious over *Fugitt* in view of *Papermaking*.

u. Claim 23

The method of claim 1 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 $Y3'$ pounds per 3000 ft², wherein $Y3'$ is a function of said caliper thickness (X) in points and is calculated as follows: $Y3'=34.83+8.010X-0.01570X^2$.

150. *Papermaking* states that “[a] modern cartonboard line as a rule has one hardnip precalender before the coating section, especially in Asia. High thermo roll temperatures (in some cases over 200°C) result in bulk savings because of the temperature gradient.” (Ex. 1005 at page 82.
151. Bulk savings, i.e. a higher caliper thickness at the same grammage, is, thus, obtained when the Person of Ordinary Skill in the Art applies the general knowledge from *Papermaking* to *Fugitt*. A caliper thickness being 12.2 instead of 12.0, i.e. only 1.6% higher, is sufficient for providing a paperboard having a basis weight being below the function $Y3'$.
152. It is obvious that the bulk savings will provide a paperboard having a caliper thickness of at least 12.2 at maintained basis weight of 130.0 lbs/3000 ft²

from Fugitt in view of Papermaking. Hence, it is obvious that such paperboard has a basis weight below the function Y3’.

153. Moreover, in Papermaking, in figure 62, page 80 (ex. 1005 at page 80): “Typical bulk and PPS s10 roughness values for coated board grades” are presented.
154. The figure shows that it is expected with state-of-the-art equipment to produce a Folding Boxboard (FBB), that is a coated paperboard structure (c.f. paragraphs 56-57 above), with a bulk as high as 1.7 cm³/g (corresponding to a basis weight of 130 lbs/3000ft² and caliper of 14.2) with a smoothness of 2.0 PPS s10.

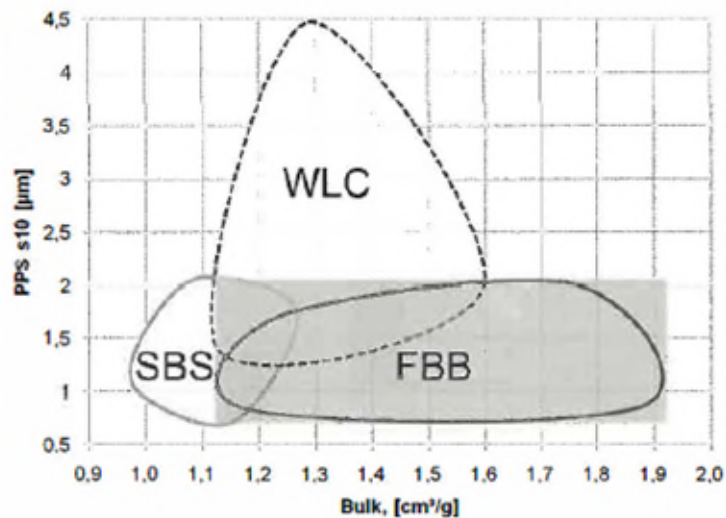


Figure 62. Typical bulk and PPS s10 roughness values for coated board grades. Copyright of Metso.

155. A basis weight of 130 falls below curve of Y3' as shown in the table below.

	X, i.e. actual caliper (points)	Basis weight (lbs/3000 ft²)	Y₃'= 34.83 + 8.010X — 0.01570X²
FBB with a bulk of 1.7 cm ³ /g from Papermaking	14.2	130.0	145.405252

In my opinion, claim 23 is obvious over *Fugitt* in view of *Papermaking*.

2. Obviousness of Combining the Known Features

156. As I explained above, I am not an attorney, and I offer no opinions on the law. But counsel has informed me of legal standards that apply to the issue of obviousness, which I recounted above in detail. Based on this understanding, it is my opinion that it would have been obvious to one of ordinary skill in the art would be motivated to combine *Fugitt* and *Papermaking* to arrive at claims 1, 2, and 5-23 of the '142 Patent.

157. As an initial matter, it would have been obvious to one of ordinary skill in the art that the disclosures of the *Fugitt* reference and the *Papermaking* reference may be considered together. As stated above, the Papermaking Science and Technology book series is widely known as a foremost reference guide for covering the latest technology and trends of papermaking. It is considered the largest and most comprehensive book

series in the field since its publishing in 2000 (First edition) & 2009 (Second edition) . The books are used globally as course material on B.Sc. and M.Sc. levels, in further professional training, and as trusted handbooks for professionals in industry and research levels. It is a resource that would be considered by one of ordinary skill in the art in conjunction with *Fugitt*.

158. As shown above, and alleged by the examiner during examination, *Fugitt* discloses or suggests each limitation of claim 1 with the exception of specifically disclosing limitation [1.a.ii] “Wherein a contact surface of said thermo-roller is heated to an elevated temperature of at least 250°F.” However, the elevated temperature is taught by *Papermaking*. It would be commonplace, even routine, to look at *Papermaking* to supplement the process of *Fugitt*. Accordingly, it would be obvious to one of ordinary skill in the art to combine *Fugitt* and *Papermaking* to arrive at claim 1.
159. With respect to claim 1, both *Fugitt* and *Papermaking* disclose method of manufacturing a paperboard structure. (*Papermaking* p. 80). Both *Fugitt* and *Papermaking* disclose hot calendering. While *Fugitt* teaches that a hot calender may be steam heated, *Papermaking* clarifies that one of ordinary skill in the art would understand that steam heated thermo-rollers may reach up to 338°F. Accordingly, contrary to the statements of the Patent Owner

when responding to the rejection and amending the claims, it would be obvious to heat the thermo-roller of *Fugitt* to at least 250°F.

160. Additionally, *Papermaking* discloses that a heated hard nip calender can be used to produce paperboard (page 83), and that hard-nip calenders can be two-roll hard nip calenders or multi-roll calenders (page 35). The two roll hard-nip calender may be composed of a heated cast-iron roll and a deflection-compensated roll. Like the '142 Patent, *Papermaking* discloses that "A modern cartonboard line as a rule has one hot hard-nip precalender before the coating section... [and] thermo roll temperatures (in some cases over 200°C [392°F]) result in bulk savings because of the temperature gradient.
161. Thus, it would clearly be obvious to and even expected by one of ordinary skill in the art that the steam heated rollers of *Fugitt* would operate at a temperature within the range of claim 1. It would also be obvious to use the heated hard nip calenders disclosed in *Papermaking* in the process of *Fugitt*, including the two-roll hard-nip calender that has a thermo-roller and a counter roller. *Papermaking* discloses that rollers can be heated using steam up to 338°F, and may be heated using oil, which can reach over 428°F.
162. It would also be obvious to combine *Fugitt* and *Papermaking* to arrive at claim 1 of the '142 Patent because of the known advantages of heated

rollers. *Papermaking* states that “traditionally, hard-nip calenders have had heating systems that were unable to influence the surface temperature of the rolls and the process.” *Papermaking* page 36. However, “[h]igh temperature produces better web surface quality, uniformity and smoothness (Figure 23), and preserves bulk and strength properties. (Ex. 1005 at page 40).

163. *Papermaking* even states that cartonboard lines, as a rule, use one hot hard-nip calender in the pre-calendering position as *Fugitt* with thermo roll temperatures that are in some cases over 392°F. *Papermaking* at page 82.
164. One of ordinary skill in the art would be motivated to use the elevated temperature taught by *Papermaking* because “Precalendering is used before the coater to reduce roughness and porosity” and “high thermo roll temperatures (in some cases over 200° C [392°F]) result in bulk savings because of the temperature gradient.” See page 82. Smoothness in combination with low density is a characteristic desired by the ‘142 Patent.
165. As stated above, *Fugitt* was asserted as teaching each limitation of claim 1 except for the “elevated temperature of at least 250°F,” but *Papermaking* teaches that paperboard known to be calendered at temperature including and well above the temperatures claimed by the ‘142 Patent that resulted in its allowance. In my opinion, claim 1 is obvious over *Fugitt* in view of *Papermaking*.

166. To the extent that both *Fugitt* and *Papermaking* to arrive at the dependent claims (claims 2, 5, 6, and 23, for example) where both references were relied on for disclosing the claim limitations, the same reasons apply.

B. Ground 2: Claims 1, 2, and 4 are Obvious Under 35 U.S.C. § 103 over *Fugitt* in view of *Papermaking* and *Gratton*.

1. Claim-by-claim analysis

167. Below, I present my feature-by-feature analysis of each claim in this ground, and an opinion regarding motivation to combine the prior art teachings where applicable.

168. *Fugitt* in view of *Papermaking* and *Gratton* describe each and every feature recited in claims 1, 2, and 4 of the ‘142 Patent, and it would be obvious to one of ordinary skill in the art to combine those features as claimed.

a. Claim 1

[1.pre] “A method for manufacturing a paperboard structures comprising . . .”

169. This limitation is taught by *Fugitt* and *Papermaking* for the reasons set forth in connection with Ground 1.

[1.a] “passing a paperboard substrate through a hot-hard calender to yield a calendered paperboard substrate”

170. This limitation is taught by *Fugitt* and *Papermaking* for the reasons set forth above in connection with Ground 1.

[1.a.i] “said hot-hard calender comprising a nip defined by a thermo-roller and a counter roller”

171. This limitation is taught by *Fugitt* and *Papermaking* for the reasons set forth above in connection with Ground 1.

[1.a.ii] “wherein a contact surface of said thermo-roller is heated to an elevated temperature of at least 250°F”

172. This limitation is taught by *Fugitt* and *Papermaking* for the reasons set forth above in connection with Ground 1.

173. *Gratton* discloses “temperature-gradient (TG) calendering is a technique that can improve paper surface properties with less bulk reduction than with conventional calendering.” (Ex. 1006 at page 81). Roll temperatures were 211°C [411°F], 209°C [408°F], and 207°C [405°F]. See Table II and “Experimental” 210°C [410 °F]. *Gratton* showed that “when calendered to the same bulk, the TG-calendered board showed a much higher Hunter Gloss and a lower Parker Print-Surf roughness than the conventionally calendered board.” See page 85.

174. Accordingly, there is no question that it was known to heat a thermo-roller to a temperature that reads on this claim limitation. In fact, one of ordinary

skill in the art would understand that even the steam heating of *Fugitt* will heat a roller up to 338°F.

[1.b] “applying a basecoat to said calendered paperboard substrate to yield a basecoated paperboard substrate”

175. This limitation is taught by *Fugitt* and *Papermaking* for the reasons set forth above in connection with Ground 1

[1.b.i] “said basecoat comprising a basecoat binder and a basecoat pigment; and”

176. This limitation is taught by *Fugitt* and *Papermaking* for the reasons set forth above in connection with Ground 1.

[1.c] “applying a topcoat to said basecoated paperboard substrate,”

177. This limitation is taught by *Fugitt* and *Papermaking* for the reasons set forth above in connection with Ground 1.

[1.d] “wherein said paperboard structure has a basis weight, a caliper thickness and a Perker Print Surf (PPS 10A) smoothness,”

178. This limitation is taught by *Fugitt* and *Papermaking* for the reasons set forth above in connection with Ground 1.

[1.d.i] “said Parker Print Surf (PPS 10S) smoothness being at most 3 microns,”

179. This limitation is taught by *Fugitt* and *Papermaking* for the reasons set forth above in connection with Ground 1

[1.d.ii] “said basis weight being at most Y_2 pounds per 3000 ft², wherein Y_2 is a function of said caliper thickness (X) in points and is calculated as follows: $Y_2 = 3.71 + 13.14X - 0.1602X^2$ ”

180. This limitation is taught by *Fugitt* and *Papermaking* for the reasons set forth above in connection with Ground 1.

181. In my opinion, claim 1 is obvious over *Fugitt* in view of *Papermaking* and *Gratton*.

b. Claim 2

The method of claim 1 wherein said passing said paperboard substrate through said hot-hard calender comprises applying a nip load to said paperboard substrate ranging from about 20 pli to about 500 pli.

182. In *Gratton*, temperature-gradient (TG) calendering was conducted using nip loads of 20, 40, 60, 80 and 100 kN/m. (Ex. 1006 at page 86). The following table shows the conversion of kilonewton meter (kN/m) to pound-force inch (PLI):

Nip load (kN/m)	Nip load (PLI)
20	114.2
40	228.4
60	342.6
80	456.8
100	571.0

183. In view of the above, my opinion is that claim 2 is obvious over *Fugitt* in view of *Papermaking* and *Gratton*.

c. Claim 4

The method of claim 1 further comprising applying starch to said paperboard substrate prior to said passing said paperboard substrate through said hot-hard calender.

184. As stated above, it is obvious to combine *Fugitt*, *Papermaking*, and *Gratton* to arrive at claim 1. Claim 4 is also obvious because it is also obvious to one of ordinary skill in the art to combine *Fugitt* with *Gratton* to arrive at claim 4 because in *Gratton* sized boards were calendered. The coating, a pigmented starch consisting of two parts pigment to one part starch, was applied in a size press. (Ex. 1006 at page 86 “Experimental”).

185. Also, the size press in *Fugitt* is 32 in Figure 11. It is in the same position (32) in the ‘142 Patent. *Papermaking* and *Gratton* show that it is obvious and even conventional to apply starch in the size press. The size press is prior to the hot-hard calender in the ‘142 Patent just like it is prior to the pre-

calendering press in *Fugitt* and *Gratton*. Claim 4 is obvious over *Fugitt*, *Papermaking*, and *Gratton* because is conventional to apply starch in a size press prior to the pre-calendering step.

186. In view of the above, it is my opinion that claim 4 is obvious over *Fugitt* in view of *Papermaking* and *Gratton*.

2. Obviousness of Combining the Known Features

187. One of ordinary skill in the art would be motivated to combine *Fugitt* with *Papermaking* and *Gratton* to arrive at claims 1, 2, and 4 of the '142 Patent.
188. I agree with the examiner's determination that *Fugitt* discloses or suggests each limitation of claim 1 with the exception of specifically disclosing limitation [1.a.ii] "Wherein a contact surface of said thermo-roller is heated to an elevated temperature of at least 250°F." However, the elevated temperature is taught by *Papermaking*. It would be obvious to one of ordinary skill in the art to combine *Fugitt* and *Papermaking* to arrive at claim 1.
189. With respect to claim 1, each of *Fugitt*, *Papermaking*, and *Gratton* each disclose a method of manufacturing a paperboard structure. All three references disclose hot calendering. While *Fugitt* teaches that a hot calender may be steam heated, *Papermaking* clarifies that one of ordinary skill in the art would understand that steam heated thermo-rollers may reach up to

338°F. Accordingly, contrary to the statements of the Patent Owner when responding to the rejection and amending the claims, it would be obvious to heat the thermo-roller of *Fugitt* to at least 250°F.

190. Additionally, *Papermaking* discloses that a heated hard nip calender can be used to produce paperboard (page 83), and that hard-nip calenders can be two-roll hard nip calenders or multi-roll calenders (page 35). The two roll hard-nip calender may be composed of a heated cast-iron roll and a deflection-compensated roll. Like the '142 Patent, *Papermaking* discloses that "A modern cartonboard line as a rule has one hot hard-nip precalender before the coating section... [and] thermo roll temperatures (in some cases over 200°C [392°F]) result in bulk savings because of the temperature gradient.
191. Thus, it would clearly be obvious and even expected that the steam heated rollers of *Fugitt* would operate at a temperature within the range of claim 1. It would also be obvious to use the heated hard nip calenders discloses in *Papermaking* in the process of *Fugitt*, including the two-roll hard-nip calender that has a thermo-roller and a counter roller. *Papermaking* discloses that rollers can be heated using steam up to 338°F, and may be heated using oil, which can reach over 428°F.

192. It would be obvious to combine *Fugitt* and *Papermaking* to arrive at claim 1 of the '142 Patent because of the known advantages of heated rollers. *Papermaking* states that “traditionally, hard-nip calenders have had heating systems that were unable to influence the surface temperature of the rolls and the process.” *Papermaking* page 36. However, “[h]igh temperature produces better web surface quality, uniformity and smoothness (Figure 23), and preserves bulk and strength properties. See page 40.
193. *Papermaking* even states that cartonboard lines, as a rule, use one hot hard-nip calender in the same manner as *Fugitt* with thermo roll temperatures that are in some cases over 392°F. (Ex. 1005 at page 82).
194. One of ordinary skill in the art would be motivated to use the elevated temperature taught by *Papermaking* because “[t]he higher end of the temperature range significantly increases the smoothness development potential of the calender.” Smoothness is a characteristic desired by the '142 Patent.
195. As stated above, *Fugitt* was asserted as teaching each limitation of claim 1 except for the “elevated temperature of at least 250°F,” but *Papermaking* teaches that paperboard known to be calendered at temperature including and well above the temperatures claimed by the '142 Patent that resulted in its allowance.

196. *Gratton* also discloses roll temperatures within the claimed range to “improve paper surface properties with less bulk reduction than with conventional calendering.”
197. *Fugitt* attempts to produce a paperboard material with increased smoothness and less density. *Papermaking* provides one of ordinary skill in the art direction in doing so (in part by increasing roll temperature to above 250°F). *Gratton* confirms the advantages of increasing the temperature to above 250° for the same reasons.
198. It is my opinion that claim 1 is obvious over *Fugitt* in view of *Papermaking* and *Gratton*.

C. Ground 3: Claim 4 is Obvious Under 35 U.S.C. § 103 over Fugitt in view of Papermaking and Papermaking II.

1. Claim-by-claim analysis

199. Below, I present my feature-by-feature analysis of each claim in this ground, and an opinion regarding motivation to combine the prior art teachings where applicable.
200. *Fugitt* in view of *Papermaking* and *Papermaking II* describe each and every feature recited in claim 4 of the ‘142 Patent, and it would be obvious to one of ordinary skill in the art to combine those features as claimed.

a. Claim 4

The method of claim 1 further comprising applying starch to said paperboard substrate prior to said passing said paperboard substrate through said hot-hard calender.

201. As stated above, it is obvious to combine *Fugitt*, and *Papermaking*, to arrive at claim 1. Claim 4 is also obvious because *Fugitt*, *Papermaking*, and *Papermaking II* disclose each element of claim 4. *Papermaking II* discloses that it is conventional to use starch in a size press. (Ex. 1007 at page 583). *Papermaking II* describes board coating. See page 581 “2 Introduction to board coating”. *Papermaking II* discloses that “In many cases, there is a size press before coating. Low-consistency starch is applied on the board surface. The main purpose of the size press treatment is to improve stiffness and surface strength of the board before coating. Surface sizing also seals the board surface and evens out the sizing variations of the baseboard for the constant coating color pickup.” (*Id.* at page 583: “2.1 Surface sizing”).
202. *Papermaking II*, thus, discloses that it is general knowledge that if a size press is positioned before coating, as the size press 32 in *Fugitt*, low consistency starch is applied on the board surface.
203. *Papermaking II* discloses that “the main purpose of the size press treatment is to improve stiffness and surface strength” and “Surface sizing also seals

the board surface and evens out the sizing variations”, i.e. addition of functional properties as disclosed in *Fugitt* ¶ 26 being the purpose of the size press 32.

2. Obviousness of Combining the Known Features

204. It is my opinion that it would have been obvious to one of ordinary skill in the art to combine the above known features and arrive at the recited limitations of claim 4.

205. As I explained above, it would have been obvious for those of ordinary skill in the art to consider *Fugitt* and *Papermaking* together. For the same reasons, it would be obvious to consider *Fugitt* and *Papermaking* and then look to *Papermaking II* concerning the application of starch. This is especially true given *Papermaking II*'s status in the industry.

206. After such consultation, one would discover that the use of starch in the size press of *Fugitt* is conventional.

XII. CONCLUSION

207. In my opinion claims 1, 2, and 4-23 of the '142 Patent are rendered obvious for the reasons set forth above over *Fugitt* in view of *Papermaking*.

Moreover, claims 1, 2 and 4 of the '142 Patent are in my opinion also rendered obvious for the reasons set forth above over *Fugitt* in view of

Papermaking and *Gratton* Finally, claim 4 of the '142 Patent is also rendered obvious for the reasons set forth above over *Fugitt* in view of *Papermaking* and *Papermaking II*.

Dated: 12 July 2023

A handwritten signature in blue ink, appearing to read 'Carl Zotterman', written over a horizontal line.

Carl Zotterman

APPENDIX 1

Curriculum Vitae

for Carl Zotterman, born April, 13, 1952, in Karlstad, Sweden

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SE-66341 Hammarö
Sweden

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E-mail: carl.zotterman@gmail.com

Summary

Professional with 40+ experience in the Paper and Paperboard industry world-wide. Management positions in development of paperboard production machinery, the process of paperboard manufacturing and mill operations. Training of paperboard machine operators. Active in development of production equipment and new paperboard grades. Trouble shooting in paperboard grade quality issues.

Work Experience

2008 – present, Senior Consultant and owner, Papercom in Sweden AB

- Ongoing training programs for paperboard machine operators, 2022-2023
- Independent Expert for the EU-Commission in the 7th Framework and Horizon 2020 Research Program 2012-2023
- Innovation Advisor for Paper Province 2015-2021
- Training of machine operators for major new coated board machine project, 2017
- Paper Surface Centre, project leader, innovation and research in Coatings of Coated Board (Participants: Stora Enso, Billerud, Iggesund, Kemira, UPM-Coating, Synthomer, MeadWestvaco), 2010-2015
- Trouble shooting PT Surya Pamenang FBB board (BCTMP-related problem)
- FBB/Coated Board Machine seminar for Valmet BCTMP customers
- Development of new starch based "Green" barrier coatings for FBB
- Training of managers and technicians in Stora Enso Tiger China Coated Board Machine Project
- Ongoing paper and board mill engineers, technicians and operators training

2004 – 2008, President, The Packaging Greenhouse AB

- China Board Machine survey for TetraPak
- Laminator development for TetraPak
- MeadWestvaco Trio Project, new FBB/Coated Board Machine in Brazil, consulting
- Paperboard machine crew and technician/engineer training in technology: Iggesund Workington Mill, BillerudKorsnäs Frövi Mill, StoraEnso Skoghall and Fors Mills
- Paperboard product development with pilot plant forming trials
- Ongoing paper and board mill engineers, technicians and operators training

- 1997 – 2004, Vice President, Global Paper Board Machine Technology, Metso Paper Corporation
- Development of Coated Paper Board Machine concepts – Opti Board Machine Concept
 - Technical support in sales projects: BCTMP plant to IP Svetogorsk, IPSUN FBB Board Machine, Sinar Mas Serang Board Machine rebuild, April Project (Kerinci), new Board Machine Rizhao, Ningbo Zhonghua Paper XPM1, new Board Machine, APP Guangxi, New Board Machine
 - Coated Board Technology presentations Metso Paper Technology days, Shanghai, etc.

- 1995 – 1997, Production Manager, StoraEnso Skoghall Board Mill, Skoghall, Sweden
- Installation and start-up new machine
 - Manager Coated Board production
 - Stora Enso FBB productivity development team: Inkeroinen, Imatra, Baienfurt, Arnsberg, Skoghall and Barcelona

- 1987 – 1995, Vice President, Board Machine Research, Valmet, Karlstad, Sweden
- Manager Valmet Board Machine and Packaging Paper Machine research
 - Technical support in Coated Board Machine sales
 - Development and implementation of new technology – SYM-Belt press – first FBB installation in Kyro mill, Finland
 - SE Skoghall #8 Machine project

- 1985 – 1987, Board Machine #7 Superintendent, Stora-Billerud AB, Skoghall, Sweden
- Machine rebuild, new headboxes (concept IV)
 - Manager Paper Board production

- 1983 – 1985, Paperboard Research Manager, Billerud AB Research Centre, Säffle, Sweden
- Board research manager (supporting production Skoghall Mill BM7)

1980 – 1981, Visiting Assistant Professor, The Institute of Paper Chemistry, Appleton, WI, USA

1978 – 1983, Application Engineer Paper Machinery, AB KMW, Karlstad, Sweden

1975 – 1978, Research Engineer, Forming and Wet Pressing, AB KMW, Karlstad, Sweden

Language skills

Swedish native language, English fluent in speaking and writing, German some speaking.

Education

1975, Master of Science at University of Linköping, Applied Physics and Electrical Engineering
2001, Metso, Management Program, IMD, Lausanne

APPENDIX 2

LIST OF EVIDENCE AND EXHIBITS RELIED UPON IN PETITION

Exhibit No.	Short Name	Description
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
1004	Fugitt	Fugitt et al., U.S. Pat. Appl. Pub. No. 2009/0236062
1005	Papermaking	Excerpts from Rautiatinen, 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	Crotogina	Temperature Gradient Calendering (Crotogino, R.H., (1982) Tappi J. 65(10):98).
1009	Paperboard Examples	Hannu (2000). <i>Papermaking Science and Technology Book 18: Paperboard and Grades</i> (p. 55). Paper Engineer's Association

