

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

Issued: April 5, 2022

Filed: May 7, 2020

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

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

PETITION FOR *INTER PARTES* REVIEW OF

U.S. PATENT NO. 11,293,142 B2

TABLE OF CONTENTS

	Page
I. INTRODUCTION	1
II. MANDATORY NOTICES UNDER 37 C.F.R. § 42.8(a)(1)	2
A. Real Party-In-Interest Under 37 C.F.R. § 42.8(b)(1).....	2
B. Related Matters Under 37 C.F.R. § 42.8(b)(2)	2
C. Lead and Back-Up Counsel Under 37 C.F.R. § 42.8(b)(3)	3
D. Service Information Under 37 C.F.R. § 42.8(b)(4)	3
III. PAYMENT OF FEES UNDER 37 C.F.R. § 42.203	3
IV. REQUIREMENTS FOR INTER PARTES REVIEW UNDER 37 C.F.R. § 42.104.....	4
A. Grounds for Standing Under 37 C.F.R. § 42.104(a).....	4
B. Identification of Challenge Under 37 C.F.R. § 42.104(b) and Relief Requested.....	4
1. Claims for which <i>inter partes</i> review is requested under 37 C.F.R. § 42.104(b)(1)	4
2. The specific art and statutory grounds on which the challenge is based under 37 C.F.R. § 42.104(b)(2)	5
3. How the challenged claim(s) are to be construed under 37 C.F.R. § 42.104(b)(3)	6
4. How the construed claims are unpatentable under 37 C.F.R. § 42.104(b)(4)	12
5. Supporting evidence under 37 C.F.R. § 42.104(b)(5).....	13
C. 325(d) Discretion Does Not Apply	13
V. SUMMARY OF THE ‘142 PATENT	17
A. Effective Filing Date of the ‘142 Patent	17
B. Person of Ordinary Skill in the Art	17
C. The ‘142 Patent’s Specification	18
D. The ‘142 Patent’s Prosecution History	20
VI. DETAILED EXPLANATION UNDER 37 C.F.R. § 42.104(b)	24

TABLE OF CONTENTS
(continued)

	Page
A. Ground 1: Claims 1, 2, and 4-24 are Obvious Under 35 U.S.C. § 103 over <i>Fugitt</i> in view of <i>Papermaking</i>	24
1. Overview of <i>Fugitt</i>	24
2. Overview of <i>Papermaking</i>	26
3. Claims 1, 2, and 5-23 are Obvious Under 35 U.S.C. § 103 over <i>Fugitt</i> in view of <i>Papermaking</i>	28
a. Claim 1 is Unpatentable Under 35 U.S.C. § 103.....	28
b. Claim 2 is Unpatentable Under 35 U.S.C. § 103	39
c. Claim 5 is Unpatentable Under 35 U.S.C. § 103.....	40
d. Claim 6 is Unpatentable Under 35 U.S.C. § 103	41
e. Claim 7 is Unpatentable Under 35 U.S.C. § 103.....	42
f. Claim 8 is Unpatentable Under 35 U.S.C. § 103	43
g. Claim 9 is Unpatentable Under 35 U.S.C. § 103	43
h. Claim 10 is Unpatentable Under 35 U.S.C. § 103	44
i. Claim 11 is Unpatentable Under 35 U.S.C. § 103	45
j. Claim 12 is Unpatentable Under 35 U.S.C. § 103	45
k. Claim 13 is Unpatentable Under 35 U.S.C. § 103	46
l. Claim 14 is Unpatentable Under 35 U.S.C. § 103	47
m. Claim 15 is Unpatentable Under 35 U.S.C. § 103	47
n. Claim 16 is Unpatentable Under 35 U.S.C. § 103	48
o. Claim 17 is Unpatentable Under 35 U.S.C. § 103	49
p. Claim 18 is Unpatentable Under 35 U.S.C. § 103	49
q. Claim 19 is Unpatentable Under 35 U.S.C. § 103	50
r. Claim 20 is Unpatentable Under 35 U.S.C. § 103.....	51
s. Claim 21 is Unpatentable Under 35 U.S.C. § 103.....	51
t. Claim 22 is Unpatentable Under 35 U.S.C. § 103	52
u. Claim 23 is Unpatentable Under 35 U.S.C. § 103	53

TABLE OF CONTENTS
(continued)

	Page
B. Ground 2: Claims 1, 2, and 4 are Obvious Under 35 U.S.C. § 103 over <i>Fugitt</i> in view of <i>Papermaking</i> and <i>Gratton</i>	54
1. Overview of <i>Fugitt</i>	54
2. Overview of <i>Papermaking</i>	54
3. Overview of <i>Gratton</i>	55
4. Claim-by-claim analysis of claims 1, 2, and 4 in view of <i>Fugitt</i> in view of <i>Papermaking</i> and <i>Gratton</i>	56
a. Claim 1 is Unpatentable Under 35 U.S.C. § 103	56
b. Claim 2 is Unpatentable Under 35 U.S.C. § 103	63
c. Claim 4 is Unpatentable Under 35 U.S.C. § 103	64
C. Ground 3: Claim 4 is Obvious Under 35 U.S.C. § 103 over <i>Fugitt</i> in view of <i>Papermaking</i> and <i>Papermaking II</i>	65
1. Overview of <i>Fugitt</i>	65
2. Overview of <i>Papermaking</i>	65
3. Overview of <i>Papermaking II</i>	65
4. Claim-by-claim analysis of claim 4 in view of <i>Fugitt</i> in view of <i>Papermaking</i> and <i>Papermaking II</i>	66
a. Claim 4 is Unpatentable Under 35 U.S.C. § 103	66
VII. CONCLUSION	67
ATTACHMENT A: PROOF OF SERVICE OF THE PETITION	69
ATTACHMENT B: LIST OF EVIDENCE AND EXHIBITS RELIED UPON IN PETITION	70

PETITION FOR *INTER PARTES* REVIEW OF
U.S. PATENT NO. 11,293,142 B2

I. INTRODUCTION

Pursuant to 35 U.S.C. § 311 and 37 C.F.R. § 42.100, Billerud Aktiebolag (publ) (“Petitioner”) requests *inter partes* review of claims 1, 2, and 4-23 of U.S. Patent No. 11,293,142 B2 (“the ‘142 Patent,” Ex. 1001) assigned on its face to WestRock MWV, LLC (“Patent Owner”).

On May 7, 2020, the Patent Owner applied for the ‘142 Patent, via US Patent Application 16/869,156 (the ‘156 Application), which is directed to a method for manufacturing a paperboard structure. The ‘156 application touted a method that prepared paperboard that resulted in a smooth surface, and had low density. Part of the reason the paperboard was smooth and had a low density was the elevated temperature of a hot-hard calander.

During prosecution of the ‘156 Application, a rejection was made over Patent Owner’s own prior art that disclosed “the rolls of the calender may be steam heated.” To overcome this rejection during prosecution, the Patent Owner added a claim limitation that the thermo-roller is “heated to an elevated temperature of at least 250°F,” and argued that while “[t]raditional calenders may employ rollers that are heated to temperatures that are greater than ambient temperature... the claimed

method requires a temperature that is significantly hotter than traditional temperatures...”

This Petition demonstrates that the temperature limitation added by amendment is in fact not only not new but also conventional and does not distinguish the ‘142 Patent from what was well known in the field at the time.

This Petition also demonstrates that there is a reasonable likelihood that Petitioner will prevail on the challenged claims, and a trial for *inter partes* review must therefore be instituted. Evidence in this Petition establishes that claims 1, 2, and 4-23 are unpatentable under 35 U.S.C. § 103. Petitioner respectfully requests that claims 1, 2, and 4-23 be judged unpatentable and canceled.

II. MANDATORY NOTICES UNDER 37 C.F.R. § 42.8(A)(1)

As set forth below and pursuant to 37 C.F.R. § 42.8(a)(1), the following mandatory notices are provided as part of this Petition.

A. Real Party-In-Interest Under 37 C.F.R. § 42.8(b)(1)

Billerud Aktiebolag (publ) is the real party-in-interest for Petitioner.

B. Related Matters Under 37 C.F.R. § 42.8(b)(2)

Petitioner is not aware of any related matter under 37 C.F.R. § 42.8(b)(2).

C. Lead and Back-Up Counsel Under 37 C.F.R. § 42.8(b)(3)

Pursuant to 37 C.F.R. § 42.8(b)(3), Petitioner provides the following designation of counsel:

Lead Counsel	Backup Lead Counsel
Richard S. Myers, Jr. (Reg. No. 42,022) richard.myers@stites.com Stites & Harbison, PLLC 401 Commerce Street Suite 800 Nashville, Tennessee 37219 615-782-2333	Terry Wright (Reg. No. 57,992) twright@stites.com Stites & Harbison, PLLC 400 West Market Street Suite 1800 Louisville, Kentucky 40202-3352 502-779-5829

D. Service Information Under 37 C.F.R. § 42.8(b)(4)

Service on Petitioner may be made by mail or hand delivery to: Stites & Harbison, PLLC, 401 Commerce Street, Suite 800, Nashville, Tennessee 37219. Petitioner also consents to electronic service by email at richard.myers@stites.com.

III. PAYMENT OF FEES UNDER 37 C.F.R. § 42.203

The required fees are submitted herewith in accordance with 37 C.F.R. §§ 42.203(a) and 42.15(b)].

IV. REQUIREMENTS FOR *INTER PARTES* REVIEW UNDER 37 C.F.R.

§ 42.104

A. Grounds for Standing Under 37 C.F.R. § 42.104(a)

Petitioner hereby certifies that the ‘142 Patent is available for *inter partes* review and that the Petitioner is not barred or estopped from requesting *inter partes* review challenging the claims of the ‘142 Patent on the grounds identified herein. Neither Petitioner, nor any party in privity with Petitioner: (i) has filed a civil action challenging the validity of claims 1, 2, and 4-23 of the ‘142 Patent; (ii) has been served a complaint alleging infringement of the ‘142 Patent more than one year prior to the present date; or (iii) is estopped from challenging the claims on the grounds identified in the Petition.

Claims 1, 2, and 4-23 of the ‘142 Patent also have not been the subject of a prior *inter partes* review or a finally concluded district court litigation.

B. Identification of Challenge Under 37 C.F.R. § 42.104(b) and Relief Requested

1. Claims for which *inter partes* review is requested under 37 C.F.R. § 42.104(b)(1)

Petitioner requests *inter partes* review of claims 1, 2, and 4-23 of the ‘142 Patent.

2. The specific art and statutory grounds on which the challenge is based under 37 C.F.R. § 42.104(b)(2)

Inter partes review of the ‘142 Patent is requested in view of the following references, all of which qualify as prior art to the ‘142 Patent under 35 U.S.C. § 102(b):

Fugitt et al. U.S. Pat. Appl. Pub. No. 2009/0236062 A1 (“*Fugitt*”). (Ex. 1004).

Rautiainen, P. (2009). *Papermaking Science and Technology Book 10: Papermaking Part 3, Finishing* (2nd ed., pp. 35-42, 79-99). Paper Engineers’ Association (*Papermaking*). (Ex. 1005).

Gratton, et al., Temperature-gradient calendering of foodboard, TAPPI JOURNAL January 1988 (*Gratton*). (Ex. 1006).

Lehtinen, E. (2000). *Papermaking Science and Technology Book 11: Pigment Coating and Surface Sizing of Paper* (pp. 581-583). Paper Engineers’ Association (*Papermaking II*). (Ex. 1007).

Inter partes review of the ‘142 Patent is requested in view of the following statutory grounds:

Ground 1: Claims 1, and 5-24 are unpatentable as obvious under U.S.C. § 103 based on Fugitt et al. U.S. Pat. Appl. Pub. No. 2009/0236062 A1 (“*Fugitt*”) in view of Rautiainen, P. (2009). *Papermaking Part 3, Finishing* (2nd ed., pp. 35-42, 79-99). Paper Science and Technology, Book 10 (“*Papermaking*”).

Ground 2: Claims 1, 2, and 4 are unpatentable Under 35 U.S.C. § 103 over *Fugitt* in view of *Papermaking* and M.F. Gratton et al., “Temperature-gradient calendering of foodboard,” Tappi Journal, Jan. 1988, pp. 81-86 (“*Gratton*”).

Ground 3: Claim 4 is unpatentable Under 35 U.S.C. § 103 over *Fugitt* in view of *Papermaking* and Esa Lehtinen (2000). *Pigment Coating and Surface Sizing of Paper* (pp. 581-583) Paper Science and Technology, Book 11 (“*Papermaking II*”).

Petitioner’s proposed construction of the claims, the evidence relied upon, and the precise reasons why the claims are unpatentable are set forth in the Sections that follow.

3. How the challenged claim(s) are to be construed under 37 C.F.R. § 42.104(b)(3)

In this 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 and the prosecution history. 37 C.F.R. 42.100(b).

Petitioner submits that the following terms should be construed in the following manner:

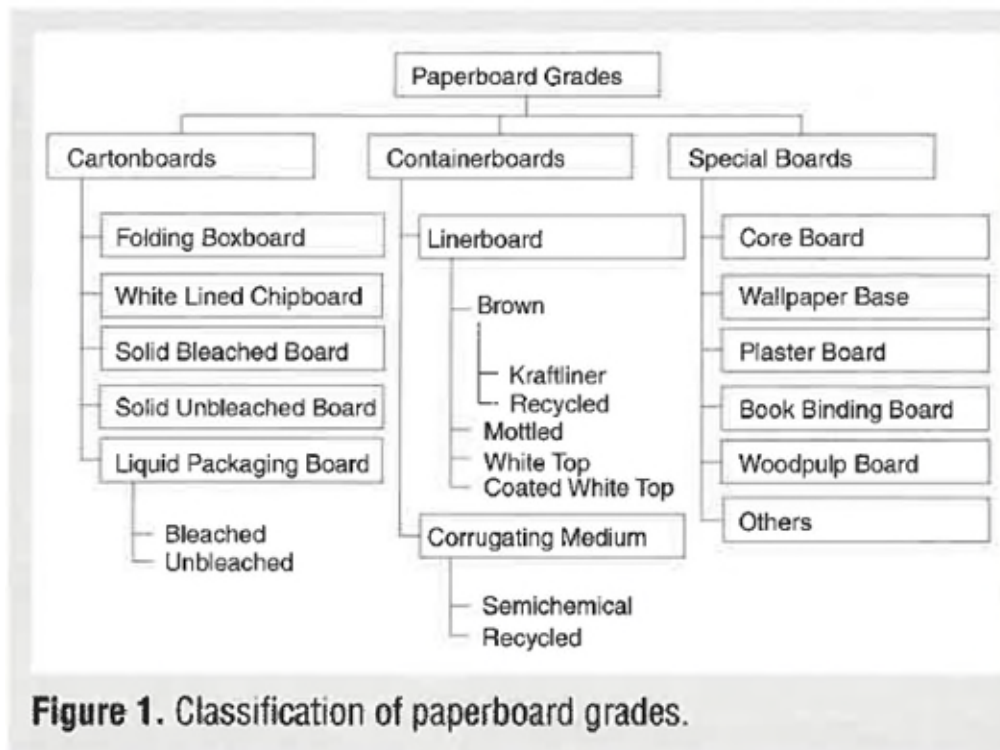
“paperboard substrate”

Claims 1, 2, 4, 5, 7, 8, and 19 of the ‘142 Patent recite the term “paperboard substrate.” “Paperboard substrate” should be broadly construed, and means “a material that can be used to create paperboard structure.” (Ex. 1003 at ¶ 54). 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).

Thus, “paperboard material” should be construed to include 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.” (Ex. 1001 at col. 1:20-23 and 1003 at ¶¶ 55, 56).

For the purpose of claim construction, 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. (Ex. 1003 at ¶ 53).

The following table summarizes various paperboard grades. All are made from paperboard material and paperboard substrates:



(Exhibit 9, page 55; Ex. 1003 at ¶¶ 57-58).

“hot-hard calender”

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.” (Ex. 1003 at ¶ 59). 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.” (Ex. 1005, page 35 and 1003 at ¶ 59). 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. (Ex. 1005 at page 36 and 1003 at ¶ 59).

A limitation of claim 1 of the ‘142 Patent is that the hot-hard calender “compris[es] a nip defined by a thermo-roller and a counter roller.” (Ex. 1001 at 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) (*Id.* at Fig. 2, 5:37-47).

The Specification of the ‘142 Patent is consistent with, and further supports this proposed 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 ‘142 Patent 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; 5:63-6:4).

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 and Ex. 1003 at ¶ 62).

The Specification of the ‘142 Patent also provides a direct comparison between a hot-hard calender and 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 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.

For example, during the prosecution of the ‘156 Application, 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 explicitly identifying 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 45 (citing Ex. 1004, ¶ 26)).

Accordingly, 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. (Ex. 1003 at ¶ 65).

“nip”

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.” For example, the ‘142 Patent identified a “nip” as being “defined by a thermo-roller and a counter roller.” (Ex. 1004 at 2: 2-3 and 1003 at § 66).

“thermo-roller”

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. 1004 at 5: 45-47 and 1003 at § 24).

“counter roller”

Claims 1, 5, and 6 recite the term “counter roller.” A “counter roller” is a roller that forms a nip with a thermo-roller. (Ex. 1004 at 1: 49-50: “the hot-hard calender including a nip defined by a thermo-roller and a counter roller.”) (Ex. 1004 at Fig. 3 and 5:40-43 (counter roller 68 and thermo-roller 64)).

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).”) (Ex. 1003 at ¶ 69).

Accordingly, a “counter roller” should be interpreted as a roller that is opposite of a thermo-roller. (Ex. 1006 at Figure 1, p. 81 and 1003 at ¶ 70).

“basecoat”

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. 1003 at ¶ 69). 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).” (Ex. 1001 at col. 3:31-34).

“topcoat”

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. (Ex. 1003 at ¶ 72). “The topcoat 18 may be applied to the paperboard substrate 12 after a basecoat 14 has been applied.” (Ex. 1001 at 4:58-59).

4. How the construed claims are unpatentable under 37 C.F.R. § 42.104(b)(4)

An explanation of how the construed claims of the ‘142 Patent are unpatentable under the statutory grounds identified above is provided in Section VI, below, in the form of claim charts and further explanation.

5. Supporting evidence under 37 C.F.R. § 42.104(b)(5)

The exhibit numbers of the supporting evidence relied upon to support the challenge and the relevance of the evidence to the challenge raised, including identifying specific portions of the evidence that support the challenge, are provided in Section VI, below, in the form of claim charts and comments related to the claim charts. An Appendix of Exhibits identifying the exhibits is also attached.

C. 325(d) Discretion Does Not Apply

Petitioner respectfully submits that Board discretion to deny institution under 35 U.S.C. § 325(d) does not apply to the instant Petition.

The Board's analysis under 325(d) presents a two-part inquiry determining (1) whether the same or substantially the same art or arguments were previously presented to the Office; and (2) if either the same or substantially same art or arguments were presented to the Office, whether the Petitioner has demonstrated that the Office erred in a manner material to the patentability of the challenged claims. *Advanced Bionics*, IPR2019-01469, Paper 6 (P.T.A.B. Feb. 13, 2020) p. 9.

In the first prong of this analysis, the Board considers several of the *Becton, Dickinson* factors, including (a) the similarities and material differences between the asserted art and the prior art involved during examination, (b) the cumulative nature of the asserted art and the prior art evaluated during examination, and (c) the extent of the overlap between the arguments made during examination and the

manner in which Petitioner relies on the prior art. See *Becton, Dickinson & Co. v. B. Braun Melsungen AG*, IPR2017-01586 (PTAB Dec. 15, 2017).

In the second prong of this analysis, the Board considers further *Becton, Dickinson* factors, including (d) the extent to which the asserted art was evaluated during examination, including whether the prior art was the basis for rejection, (d) whether Petitioner has pointed out sufficiently how the Examiner erred in his evaluation of the asserted prior art, and (e) the extent to which additional evidence and facts presented in the Petition warrant reconsideration of the prior art or arguments.

Regarding the first prong of the *Advanced Bionics* framework, Petitioners acknowledge that *Fugitt* was previously considered by the Office. However, it was considered on its own, and not in combination with any other reference. The additional references of *Papermaking*, *Gratton*, and *Papermaking II* are “new,” as they were not considered by the Office. As will be seen below, the *Papermaking*, *Papermaking II*, and *Gratton* references all relate to a material point of patentability. It is clear from the prosecution history of the ‘142 Patent, discussed below, that the limitation alleged by the Patent Owner to impart patentability to the issued claims is the elevated roller surface temperature of “at least 250°F.” In the prosecution history of the ‘142 Patent, the Patent Owner alleged a shortcoming regarding the required temperature teaching of *Fugitt*. (Ex. 1002 at page 88).

However, the combined teaching of *Fugitt* and *Papermaking or Gratton* directly addresses those shortcomings. Consideration of this new prior art, especially as it pertains to the temperature limitation, is especially relevant to the unpatentability of the challenged claims of the ‘142 Patent.

Thus, there are material differences between the combination of prior art references asserted here and the single reference prior art rejection over *Fugitt* made during examination. Specifically, the temperature of the thermo-roller was not considered in reviewing the prior art reference cited during prosecution. Because the roller temperature was not considered during examination, the *combination* of prior art references cited here is not cumulative. Likewise, there is no overlap between the arguments made during examination and the manner in which Petitioner relies on the new prior art, because the *Fugitt* reference fails to specifically address a claim limitation (roller temperature) that the Examiner deemed critical to patentability. That limitation, however, is clearly disclosed in the new prior art raised for the first time in this Petition.

Accordingly, the prior art combinations asserted in this Petition should not be viewed as presenting the same or substantially the same arguments as presented to the Office.

Looking at the second prong of the *Advanced Bionics* analysis, *even* if the combination of references asserted against the ‘142 Patent is determined to be

substantially the same prior art previously considered by the Office, there is clear material error by the Office in how it evaluated the prior art. Regarding the extent to which the prior art was considered during examination, *Fugitt* did form the basis for a § 102/§ 103 rejection of the claims of the ‘156 Application. However, *Fugitt* was asserted in a single-reference prior art rejection, and not in the combinations as presented herein. The Examiner noted that paragraph 26 of *Fugitt* discloses that the “rolls of the calender may be steam heated.” When the claims were amended with the 250°F limitation, and the Patent Owner argued that the limitation imparted patentability, the Examiner erred in not performing a supplemental search of the prior art focused on temperature. Such a supplemental search would have revealed that the temperature floor in the claims is disclosed in the prior art. The Examiner essentially took the Patent Owner’s argument at face value that the claimed temperature was “significantly hotter,” than what was disclosed in the prior art, and allowed the claims. Had the Examiner even cursorily further investigated “steam heating” as disclosed in *Fugitt*, he would have discovered that it was known steam heating temperatures can reach up to 170°C [*i.e.*, 338°F]. (Ex. 1005, p. 98). This reads on the amended limitation of “an elevated temperature of at least 250°F,” that resulted in the allowance and issue of the ‘142 Patent.

In summary, the Petitioner respectfully submits that 325(d) discretion does not apply here because the prior art and arguments presented herein have not been

before the Examiner before. Additionally, the Office erred in a manner material to the patentability of the challenged claims.

V. SUMMARY OF THE ‘142 PATENT

The ‘142 Patent issued on April 5, 2022 and is titled “Smooth and Low Density Paperboard Structures and Methods for Manufacturing the Same.” It names Sergio A. Guiste, Steven Parker, and Terrell J. Green as the inventors and is attached hereto as Exhibit 1001. Its relevant file wrapper history is attached hereto as Exhibit 1002.

A. Effective Filing Date of the ‘142 Patent

The ‘142 Patent issued from U.S. Patent Application No. 16/869,156 (“the ‘156 Application”), filed May 7, 2020. The ‘156 Application claims benefit of Provisional Application No. 62/846,278, filed May 10, 2019. Only for the purposes of this proceeding, Petitioner has assumed that the earliest effective filing date of the ‘142 Patent is not earlier than May 10, 2019.

B. Person of Ordinary Skill in the Art

Petitioner submits the declaration of Carl Zotterman (Ex. 1003), who opines as to what a person having ordinary skill in the art would have understood at the effective filing date of the ‘142 Patent.

The declaration states:

“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.” (Ex. 1003 at ¶ 25).

C. The ‘142 Patent’s Specification

The ‘142 Patent discloses methods of manufacturing smooth and low density paperboard structures. The “Background of the Invention” section of the ‘142 Patent provides that conventional paperboard manufacturing techniques achieve 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. Because 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). The ‘142 Patent aims to improve upon the prior art by preparing a smooth paperboard without substantially increasing the density of the paperboard. (*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). Figure 2 of the ‘142 Patent illustrates a schematic representation of an example of the method for manufacturing a smooth, low density paperboard structure and is depicted below.

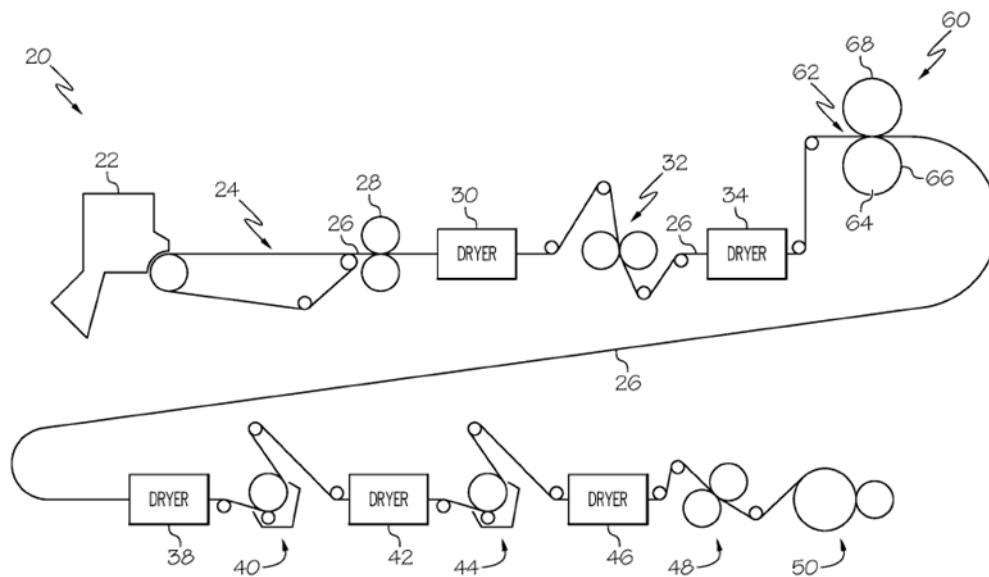


FIG. 2

The “Detailed Description” section of the patent goes on to describe the process of manufacturing a paperboard substrate as depicted in Figure 2. In particular, the method begins at a head box 22, which discharges a fiber slurry onto a Fourdrinier 24 to form a paperboard substrate 26. (*Id.* at 5:27–31). This paperboard substrate 26 passes through a wet press 28, a dryer 30, and a size press 32 followed by another dryer 34 before passing through a hot-hard calender 60.

(*Id.* at 5:31–36). As described above, the hot-hard calender 60 forms a nip 62 defined by a counter roller 68 and a thermo-roller 64, where the contact surface 66 of the thermo-roller is heated to an elevated temperature. (*Id.* at 5:37–47).

Because this calendering process is prior to the first and second coaters (40, 44 in Fig. 2), it would be referred to as “pre-calendering.” (Ex. 1005 at 4.4.2, page 81: “Precalendering is used before the coater to reduce roughness...”; Ex. 1003 at ¶ 34).

After the substrate 26 is precalendered, it may pass through a dryer 38. A basecoat is then applied by a coater 40. The coated substrate 26 is then dried again at dryer 42. A topcoat is then applied by a second coater 44, and then the web is passed through another dryer 46. The paperboard substrate 26 may then pass through a gloss calender 48 and be wound on a reel 50. (Ex. 1001 at 6:5–22).

Because the gloss calender is positioned downstream of the first and second coaters (40, 44 in Fig. 2), it would be referred to as “final calendering”. (Ex. 1005 at 4.4.3, page 82: Final calendering of a *coated* carton board...; 1003 at ¶ 36).

D. The ‘142 Patent’s Prosecution History

The Patent Owner filed the ‘156 Application on May 7, 2020. After a Restriction Requirement entered by the Examiner, the ‘156 Application included, as elected claims, independent claim 1, and dependent claims 2–3, drawn to a

method for manufacturing a paperboard structure. (Ex. 1002 at pages 63-65, 68-69). The Examiner rejected claims 1–3 as anticipated by, or in the alternative, as obvious over *Fugitt*. (*Id.* at 72-74). On their faces, the *Fugitt* published patent application and the ‘142 Patent are co-owned by the same entity, WestRock MVW, LLC.¹

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,” and argued that the steam heated rolls disclosed by *Fugitt* did not render obvious this elevated temperature limitation because “[t]he claimed method requires a temperature that is significantly hotter than traditional temperatures.” The Patent Owner also 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.² (*Id.* at 83-86). The

¹ Notably, there were several commonly owned patents and published patent applications that the Patent Owner divulged to the USPTO in an Information Disclosure Statement, including four patents that listed *Fugitt* as an inventor. However, US 2009/0236062, the “*Fugitt*” reference cited herein, which the Office cited in support of § 102 and § 103 rejections of the claims, was **not** included in the IDS filed by the Patent Owner. (Ex. 1002 at § 55-57).

² New claims 67-87 correspond to issued claims 4-24.

Patent Owner did not argue that any other limitation in the claims was distinguished from *Fugitt*.

Accordingly, the only distinguishing feature of the ‘142 Patent that the Patent Owner discussed vis-à-vis *Fugitt* was “heating a thermo-roller to an elevated temperature of at least 250°F.” (*Id.* at 88). The Patent Owner acknowledged that “Traditional calenders may employ rollers that are heated to temperatures that are greater than ambient temperature,” and stated that “comparative” calenders in the specification used a roller with a surface temperature of 200°F. Patent Owner described the ‘142 Patent claims as “requiring 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.*)

The Examiner did not specifically address Patent Owner’s amendment in the following paper, aside from acknowledging the amendment and entering the new claims for consideration. The Examiner issued a second restriction requirement and did not further reject the pending claims over prior art. (*Id.* at 91-94). Thus, the prosecution history of the ‘156 Application shows that Applicant’s arguments with respect to the elevated temperature were found persuasive enough by the Examiner to remove the rejection over *Fugitt*.

Applicant elected pending claims 1–3 and 67–86 drawn to the method for manufacturing a paperboard structure in a Response After Final Action. (*Id.* at p. 97). The persuasiveness of Applicant’s arguments related to the elevated temperature were confirmed in the Notice of Allowability. (*Id.* at p. 102-103). In particular, the Examiner’s statement of reasons for allowance is as follows:

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 103).

Based on the Patent Owner’s explanation to the Examiner that the claimed thermo-roller temperature of 250°F was “significantly hotter” than the temperature of *Fugitt* and the comparative temperature of 200°F set forth in the specification, the claims were allowed.

VI. DETAILED EXPLANATION UNDER 37 C.F.R. § 42.104(B)

A. Ground 1: Claims 1, 2, and 4-24 are Obvious Under 35 U.S.C. § 103 over *Fugitt* in view of *Papermaking*.

1. Overview of *Fugitt*

Fugitt, Exhibit 1004, discloses a method for coating a paperboard. More specifically, *Fugitt* discloses a method for coating paperboard that ultimately results in smooth paperboard structures. (Ex. 1004, ¶ 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).

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 calendering reduces the stiffness of the 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).

Like the ‘142 Patent, *Fugitt* discloses a size press upstream of calendering. (*Id.* at ¶ 26).

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).

Like the ‘142 Patent, a stated goal in *Fugitt* is a process to increase stiffness and smoothness of the final product while using less material. The process disclosed in *Fugitt* includes a process wherein “the rolls of the calender may be steam heated.” (*Id.* at ¶ 26).

2. Overview of *Papermaking*

Papermaking, Exhibit 1005, 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 finished product.

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. (Ex. 1003, ¶ 80).

Chapter 1 is titled "Calendering." Section 3 of Chapter 1 is 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." (ex. 1005, 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.” (*Id.* at page 36).

Section 4 of Chapter 1 is titled “Calendering process application areas.” One of these application areas is Cartonboards. (*Id.* at Section 4.4, page 80-84). 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.” (*Id.* at page 81). Because the dry stack calender 36 in Fugitt is arranged before the coaters 40, 44, it is a precalender.

Papermaking further explains:

“[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.” (*Id.* at page 82).

This clearly shows that it was known in the prior art 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.” (Ex. 1003, ¶ 83).

Section 5 of Chapter 1 is titled “Calender construction” Section 5.1.3 concerns heated rolls, and includes a sub-section entitled “Heating mediums.” Here, *Papermaking* discloses 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].” (*Id.* at 98.)

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. (Ex. 1002, p. 88; Ex. 1003, ¶ 85). *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.

“Roll materials,” a sub-section to Section 5.1.3 states that “The dominant material [in a thermo roll] is chilled cast iron.” (*Id.*)

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

a. Claim 1 is Unpatentable Under 35 U.S.C. § 103

The limitations of claim 1 are shown in the chart below, and the discussion that follows.

Claim 1:

[1.pre]	A method for manufacturing a paperboard structure comprising...
[1.a]	passing a paperboard substrate through a hot-hard calender to yield a calendered paperboard substrate
[1.a.i]	said hot-hard calender comprising a nip defined by a thermo-roller and a counter roller
[1.a.ii]	wherein a contact surface of said thermo-roller is heated to an elevated temperature of at least 250° F.
[1.b]	applying a basecoat to said calendered paperboard substrate to yield a basecoated paperboard substrate
[1.b.i.]	said basecoat comprising a basecoat binder and a basecoat pigment; and
[1.c]	applying a topcoat to said basecoated paperboard substrate,
[1.d]	wherein said paperboard structure has a basis weight, a caliper thickness and a Parker Print Surf (PPS 10S) smoothness
[1.d.i]	said Parker Print Surf (PPS 10S) smoothness being at most 3 microns,
[1.d.ii]	said basis weight being at most Y_2 pounds per 3000 ft ² , wherein Y_2 is a function of said caliper thickness (X) in points and is calculated as follows: $Y_2=3.71+13.14X-0.1602X^2$.

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

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, ¶ 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 at 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”

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. 1001, 2:63–3:24) (disclosing the broad category of starting materials to be calendered).

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 “hot”.” (*Id.* at ¶26). This is hot-hard calendering. (Ex. 1003, ¶ 101).

Papermaking also teaches passing a paperboard substrate through a hot-hard calender to yield a calendered paperboard substrate. (Ex. 1005, at pages 80-81). That is, *Papermaking* discusses precalendering, which “is used before the coater to reduce roughness...” (*Id.* at page 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 81-82.)

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

Fugitt discloses a (steam-heated) thermo-roller. (Ex. 1004, ¶ 25). The roller arranged opposite the thermo-roller in *Fugitt*’s dry stack calender acts as a counter roller. (Ex. 1003, ¶ 103).

Papermaking also teaches a nip defined by a thermo-roller and a counter roller. (Ex. 1005, Section 3.1.2, entitled “Two-roll hard-nip calenders,” pages 38-

40). “Most commonly, a two-roll hard-nip calender is composed of a heated cast-iron roll and a deflection-compensated roll.” (*Id.*, at page 38).

Papermaking also discloses that different variations of hard-nip calenders can be used, including a multi-roll hard-nip calender. (*Id.*, at section 3.1.2, entitled “Hard-nip calender concepts,” pages 38-42). 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.” (*Id.* at page 40.)

One of ordinary skill in the art would understand that *Papermaking* renders obvious interchangeability of hard-nip calenders. (Ex. 1003, ¶ 105). 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”

Fugitt is silent with respect to a particular temperature of the roller. (Ex. 1003, ¶ 106). However, *Fugitt* specifically states that “[t]he rolls of the

calender may be steam heated.” (Ex. 1004, ¶ 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*.

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, page 38.) A deflection-compensated roll is a counter roll as described by *Fugitt*. (Ex. 1003, ¶ 105).

Section 4.4, entitled “Cartonboards,” states that precalendering is used before the coater to reduce roughness and porosity to coater-specific target levels. (*Id.* at 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.)

Section 5.1.3 of *Papermaking*, which is titled “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.)

Accordingly, one of ordinary skill in the art would view the prior art as disclosing heating a thermo-roller to a temperature that reads on this 250°F claim limitation. Thus, one of ordinary skill in the art would understand that even the steam heating disclosed by *Fugitt* is known to reach temperatures of up to 338°F. (Ex. 1003, ¶ 110).

This claim step is considered to be a precalender step because it occurs before coating. (Ex. 1003, ¶ 112).

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

Fugitt discloses applying a basecoat to at least one surface of the paperboard substrate to form a coated paperboard structure. (Ex. 1004, ¶¶ 7–9, 54; Ex. 1003, ¶113).

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

Fugitt discloses that the basecoat includes at least one pigment and a binder. (Ex. 1004, ¶¶ 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).) (Ex. 1003, ¶ 114).

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

Fugitt discloses applying a topcoat over the basecoat to improve the surface smoothness. (Ex. 1004, ¶¶ 41, 55–56; Ex. 1003, ¶ 115).

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

See *Fugitt*, (Ex. 1004, ¶ 4) (generally discussing the relationship among caliper thickness, stiffness, basis weight, and density of a substrate), (*Id.* at ¶¶ 7–9) (describing the basis weight of the paper web), (*Id.* at ¶ 57) (describing a total basis weight, caliper thickness, and Parker Print Surf (PPS 10S) smoothness of the resulting coated paperboard structure).

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

Fugitt discusses the Parker Print Surf (PPS 10S) smoothness of the paperboard structure being “about 1.5 microns.”) (Ex. 1004 at ¶ 57)

[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: $Y_2 = 3.71 + 13.14X - 0.1602X^2$ ”

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 Y_2 as shown in the table below. (Ex. 1003, ¶118).

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

One of ordinary skill in the art would be motivated to combine *Fugitt* and *Papermaking* to arrive at claim 1 of the ‘142 Patent.

As indicated by the Examiner, *Fugitt* discloses 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.” (Ex. 1003, ¶ 158). 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. (*Id.*)

With respect to claim 1, both *Fugitt* and *Papermaking* disclose a method of manufacturing a paperboard structure. 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 over *Fugitt* alone

and amending the claims, it would be obvious to heat the thermo-roller of *Fugitt* to at least 250°F. (Ex. 1003, ¶ 159).

Additionally, *Papermaking* discloses that a heated hard nip calender can be used to produce paperboard (Ex. 1005, at 83; Ex. 1003, ¶ 160), and that hard-nip calenders can be two-roll hard nip calenders or multi-roll calenders (*Id.* at 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.” (*Id.* at page 82; Ex. 1003, ¶ 160).

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. (Ex. 1003, ¶ 161). 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. (*Id.*).

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. (Ex. 1003,

¶ 161). *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.” (*Id.* at page 36). However, “[h]igh temperature produces better web surface quality, uniformity and smoothness (Figure 23), and preserves bulk and strength properties. (*Id.* at page 40.)

Papermaking even states that cartonboard lines, as a rule, use one hot hard-nip calender in the pre-calendering position, *i.e.*, the position of the dry stack calender 36 in *Fugitt* with thermos-roll temperatures that are in some cases over 392°F. (*Id.* at page 82; Ex. 1003, ¶ 160).

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.” (*Id.*) Smoothness in combination with low density is a characteristic desired by the ‘142 Patent. (Ex. 1003, ¶ 162).

As stated above, *Fugitt* was asserted by the Examiner as teaching each limitation of claim 1 except for the “elevated temperature of at least 250°F” (Ex. 1004 ¶¶ 7-9, 26, 28, 29, 41, 54-57, and Figs. 11-12) (Ex. 1002, p. 74).

Papermaking, however, teaches that it is advantageous to calender paperboard at temperatures including (and well above) the temperatures recited in the claims of the ‘142 Patent. (Ex. 1003, ¶ 165).

In view of the above, claim 1 is obvious over *Fugitt* in view of *Papermaking*.

b. Claim 2 is Unpatentable Under 35 U.S.C. § 103

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.

As shown above, it is 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/linear inch)]. (Ex. 1005, page 72). With respect to cartonboard specifically, “[t]he linear load may even exceed 100 kN/m [571 pli].” (*Id.* at page 82.)

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. (Ex. 1003, ¶ 120).

In view of the above, claim 2 is obvious over *Fugitt* in view of *Papermaking*.

c. Claim 5 is Unpatentable Under 35 U.S.C. § 103

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.

As shown above, it is obvious to combine *Fugitt* and *Papermaking* to arrive at claim 1 of the ‘142 Patent. Claim 5 is dependent on claim 1.

Fugitt discloses this limitation. In *Fugitt*, 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 ¶ 25). Figure 11 shows 6 rolls.

Papermaking also discloses this embodiment.(Ex. 1005 at page 35): “Hard-nip calenders of two main categories are used: - two-roll hard-nip calenders – multi-roll calenders.” Also see the sub-section entitled “Multi-roll hard-nip

calender,” (*Id.* at pages 40-42). Further, Section 3.4, titled “Multi-nip calender” states: “Multi-roll calender stacks were and are still used. They comprise more than three rolls, most commonly four to six rolls.” (*Id.* at page 41.)

In view of the above, claim 5 is obvious over *Fugitt* in view of *Papermaking*. (Ex. 1003, ¶123).

d. Claim 6 is Unpatentable Under 35 U.S.C. § 103

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

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 page 38.)

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 page 98).

Deflection compensation rolls, i.e., counter rolls, are also known to be metallic. “Theoretically, solid chilled cast-iron rolls could be used, but these rolls should be crowned to compensate for the deflection.” (*Id.* at page 39; Ex. 1003, ¶ 126).

In view of the above, claim 6 is obvious over *Fugitt* in view of *Papermaking*. (Ex. 1003, ¶ 126).

e. Claim 7 is Unpatentable Under 35 U.S.C. § 103

Claim 7: The method of claim 1 wherein said basecoat is applied to only one side of said calendered paperboard substrate.

Fugitt discloses this embodiment, where the basecoat is applied to only one side of the calendered paperboard substrate.

Fugitt states:

“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 2 ay 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.” (Ex. 1004, at ¶ 1).

Also, see *Fugitt* at Example 3, where 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. (Ex. 1003, ¶ 120). The resulting coated structure had a total basis weight of about 130 lbs/3000 ft². This shows that the basecoat and the top coat 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. (*Id.* at ¶¶ 53, 56-57; Ex. 1003, ¶ 128).

In view of the above, claim 7 is obvious over *Fugitt* in view of *Papermaking*.

f. Claim 8 is Unpatentable Under 35 U.S.C. § 103

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.

Fugitt discloses comprising applying an intermediate coating layer to said basecoated paperboard substrate prior to said applying said topcoat. “The coating may include a basecoat and, optionally, one or more intermediate coatings and one or more top coats.” (Ex. 1004 at ¶ 23).

In view of the above, claim 8 is obvious over *Fugitt* in view of *Papermaking*. (Ex. 1003, ¶ 129).

g. Claim 9 is Unpatentable Under 35 U.S.C. § 103

Claim 9: The method of claim 1 wherein said basecoat binder comprises latex.

Fugitt discloses that the additional components of the basecoat include binders, which include exemplary latex and combination latex and starch binders. (Ex. 1004, ¶ 50, 52, 54.)

In view of the above, claim 9 is obvious over *Fugitt* in view of *Papermaking*. (Ex. 1003, ¶ 130).

h. Claim 10 is Unpatentable Under 35 U.S.C. § 103

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.

“In one particular aspect, the disclosed basecoat may include a pigment blend of high aspect ratio clay and calcium carbonate.” (Ex. 1004 at ¶ 29)

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)...” (*Id.*, at ¶54).

In view of the above, claim 10 is obvious over *Fugitt* in view of *Papermaking*. (Ex. 1003, ¶ 131).

i. Claim 11 is Unpatentable Under 35 U.S.C. § 103

Claim 11. The method of claim 1 wherein said basecoat pigment comprises clay and calcium carbonate.

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).

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)...” (*Id.* at ¶54).

In view of the above, claim 11 is obvious over *Fugitt* in view of *Papermaking*. (Ex. 1003, ¶ 134).

j. Claim 12 is Unpatentable Under 35 U.S.C. § 103

Claim 12. The method of claim 1 wherein said clay has an average aspect ratio of at least about 40:1.

Fugitt discloses that the clay has an average aspect ratio of at least about 40:1.

Fugitt states:

“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.” (Ex. 1004, at ¶ 40).

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” (*Id.* at ¶ 54). *High-aspect* ratio clay is synonymous with hyperplaty clay (see above).

In view of the above, claim 12 is obvious over *Fugitt* in view of *Papermaking*. (Ex. 1003, ¶ 137).

k. Claim 13 is Unpatentable Under 35 U.S.C. § 103

Claim 13. The method of claim 11 wherein said calcium carbonate is ground calcium carbonate.

Fugitt discloses that the calcium carbonate may be ground calcium carbonate.

“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).

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)...” (*Id.* at ¶ 54).

In view of the above, claim 13 is obvious over *Fugitt* in view of *Papermaking*. (Ex. 1003, ¶ 140).

l. Claim 14 is Unpatentable Under 35 U.S.C. § 103

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.

Fugitt discloses examples wherein at most about 60 percent by weight of said ground calcium carbonate has a particle size smaller than 2 microns.

“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 view of the above, claim 14 is obvious over *Fugitt* in view of *Papermaking*. (Ex. 1003, ¶ 141).

m. Claim 15 is Unpatentable Under 35 U.S.C. § 103

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.

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.

“...[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 view of the above, claim 15 is obvious over *Fugitt* in view of *Papermaking*. (Ex. 1003, ¶ 142).

n. Claim 16 is Unpatentable Under 35 U.S.C. § 103

Claim 16. The method of claim 1 wherein said topcoat comprises a topcoat binder and a topcoat pigment blend.

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. (*Id.* at ¶ 54).

Thus, claim 16 is obvious over *Fugitt* in view of *Papermaking*. (Ex. 1003, ¶ 143).

o. Claim 17 is Unpatentable Under 35 U.S.C. § 103

Claim 17. The method of claim 16 wherein said topcoat binder comprises latex.

Fugitt discloses a topcoat binder that comprises latex.

“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 explains that polyvinyl acetate latex is a binder. (*Id.* at ¶ 54).

Thus, claim 17 is obvious over *Fugitt* in view of *Papermaking*. (Ex. 1003, ¶ 144).

p. Claim 18 is Unpatentable Under 35 U.S.C. §103

Claim 18. The method of claim 16 wherein said topcoat pigment blend comprises calcium carbonate and clay.

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).

Thus, claim 18 is obvious over *Fugitt* in view of *Papermaking*. (Ex. 1003, ¶ 145).

q. Claim 19 is Unpatentable Under 35 U.S.C. § 103

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.

See *Fugitt* at Example 3: (¶¶ 56-57). “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). Thus, *Fugitt* teaches a coated paperboard substrate having a total coat weight of 11.4 lbs/3000 ft² (6 + 5.4 = 11.4)

As a result, claim 19 is obvious over *Fugitt* in view of *Papermaking*. The combined teaching of the two references teaches a substrate having a total coat weight (11.4 lbs/3000 ft²) that falls within the claimed range of from about 8 lbs/3000 ft² to about 18 lbs/3000 ft². (Ex. 1003, ¶ 146).

r. Claim 20 is Unpatentable Under 35 U.S.C. § 103

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.

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 view of the above, claim 20 is obvious over *Fugitt* in view of *Papermaking*. (Ex. 1003, ¶ 147).

s. Claim 21 is Unpatentable Under 35 U.S.C. § 103

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: $Y_2' = 35.55 + 8.173X - 0.01602X^2$.

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; Ex. 1003, ¶ 148). In *Fugitt*'s coated paperboard, the basis weight of 130 falls below Y_2' (131.31912) as shown in the table below.

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

Thus, claim 21 is obvious over *Fugitt* in view of *Papermaking*. (Ex. 1003, ¶ 148).

t. Claim 22 is Unpatentable Under 35 U.S.C. § 103

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: $Y_3 = 3.63 + 12.85X - 0.1566X^2$.

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 ft ²)	$Y_3 = 3.63 + 12.85X - 0.1566X^2$
Fugitt	12.0	130.0	135.2796

Thus, claim 22 is obvious over *Fugitt* in view of *Papermaking*. (Ex. 1003, ¶ 149).

u. Claim 23 is Unpatentable Under 35 U.S.C. § 103

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: $Y3'=34.83+8.010X-0.01570X^2$.

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).

Papermaking states 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) result in bulk savings because of the temperature gradient.” (Ex. 1005, at page 82.)

Papermaking further demonstrates that in a conventional folding boxboard (FBB), the PPS 10S smoothness is at most 2 µm and the bulk ranges up to 1.9 cm³/g. (*Id.* at Fig. 62, page 80. In *Fugitt*, the type of paperboard used was SBS, and it would be obvious to exchanging the SBS in *Fugitt* for FBB to increase bulk, i.e. decrease density at a given caliper.

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*. (Ex. 1003, ¶ 151). A caliper thickness being 12.2 instead of 12.0, i.e. only 1.6 % higher, yields a paperboard having a basis weight (120) that is below the function Y3' (130.21).

$$Y3' = 34.83 + 8.010X - 0.01570X^2$$

$$Y3' = 34.83 + 8.010(12.2) - 0.01570(12.2)^2;$$

$$Y3' = 34.83 + 97.72 - 2.34 = \underline{\underline{130.21}} \text{ (Ex. 1003, ¶155).}$$

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*. (*Id.* at ¶¶ 152-154). As shown by the above calculation, such a paperboard has a basis weight (130) below the function Y3' (130.21).

Thus, claim 23 is obvious over *Fugitt* in view of *Papermaking*. (*Id.* at ¶ 155).

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. Overview of *Fugitt*

See Section VI (A) (1) on page 24 for an overview of *Fugitt*.

2. Overview of *Papermaking*

See Section VI (A) (1) on page 26 for an overview of *Papermaking*.

3. Overview of Gratton

Gratton (Exhibit 1006) states that Temperature-gradient (TG) calendering is a technique that can improve paper surface finish with less bulk reduction than with conventional calendering. (Ex. 1006, page 81).³

Regarding the TG calendering technique, *Gratton* also cites another prior art reference, Crotogino, wherein the technique was evaluated on newsprint. (*Id.* at pages 81 and 82).⁴ As shown by *Gratton* (page 81) and Crotogino (cited in the *Gratton* abstract and on page 82), the TG calendering technique comprises calendering in a nip formed by hot (210 °C, i.e. 410 °F) iron rolls.⁵

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.* at page 81, left column). (Ex. 1003, ¶ 88).

³ This is the same stated advantage as the ‘142 Patent, to produce smooth and low density paperboard structures.

⁴ Crotogino, R.H., (1982) *Tappi J.* 65(10):98.

⁵ Iron rollers equates with “hard calender,” as laid out in the ‘142 Patent: *The counter roller 68 and/or thermo-roller 64 may be made from a metallic material, such as steel or iron* (Ex. 1001, col. 5:42-44).

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”).

The effect of calendering technique on Parker Print-Surf (S10) roughness is shown in Fig. 4 of *Gratton*. *Gratton*’s Fig. 4 shows that when calendered to the same bulk, the TG-calendered board had much higher Hunter gloss and a lower Parker Print-Surf roughness than the conventionally calendered board. *Gratton* 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 (*Id.* at page 82, right column, 1st paragraph).

Gratton reinforces the advantages of using the higher temperatures disclosed in *Papermaking*. (Ex. 1003, ¶ 91).

4. Claim-by-claim analysis of claims 1, 2, and 4 in view of *Fugitt* in view of *Papermaking* and *Gratton*.

a. Claim 1 is Unpatentable Under 35 U.S.C. § 103

The limitations of claim 1 are shown in the claim chart below, and the discussion that follows.

Claim 1:

[1.pre]	A method for manufacturing a paperboard structure comprising...
[1.a]	passing a paperboard substrate through a hot-hard calender to yield a calendered paperboard substrate
[1.a.i]	said hot-hard calender comprising a nip defined by a thermo-roller and a counter roller
[1.a.ii]	wherein a contact surface of said thermo-roller is heated to an elevated temperature of at least 250° F.
[1.b]	applying a basecoat to said calendered paperboard substrate to yield a basecoated paperboard substrate
[1.b.i.]	said basecoat comprising a basecoat binder and a basecoat pigment; and
[1.c]	applying a topcoat to said basecoated paperboard substrate,
[1.d]	wherein said paperboard structure has a basis weight, a caliper thickness and a Parker Print Surf (PPS 10S) smoothness
[1.d.i]	said Parker Print Surf (PPS 10S) smoothness being at most 3 microns,
[1.d.ii]	said basis weight being at most Y_2 pounds per 3000 ft ² , wherein Y_2 is a function of said caliper thickness (X) in points and is calculated as follows: $Y_2 = 3.71 \div 13.14X - 0.1602X^2$.

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

Fugitt discloses a method for coating a paperboard for the reasons explained above. See Section VI(A)(3)(a), page 28-30.

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

Fugitt and *Papermaking* disclose this limitation for the reasons explained above. See Section VI(A)(3)(a), page 30-31.

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

Fugitt and *Papermaking* disclose this limitation for the reasons explained above. See Section VI(A)(3)(a), page 31-32.

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

Fugitt and *Papermaking* disclose this limitation for the reasons explained above. See Section VI(A)(3)(a), page 32-34.

Additionally, *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, page 81). *Gratton* discloses using roll temperatures of 211°C [411°F], 209°C [408°F], and 207°C [405°F]. (*Id.* at Table II, page 84). *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.” (*Id.* at page 85.)

Accordingly, the combination of *Fugitt*, *Papermaking*, and *Gratton* teaches heating a thermo-roller to a temperature that reads on this claim limitation. (Ex. 1003, ¶ 174). In fact, the combination of references clearly evidences that 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 (as taught by *Papermaking*). (*Id.*). Further *Gratton* discloses even higher temperatures to achieve the same smoothness and density advantages touted by the ‘142 Patent.

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

Fugitt discloses a method for coating a paperboard for the reasons explained above. See Section VI(A)(3)(a), page 34.

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

Fugitt discloses a method for coating a paperboard for the reasons explained above. See Section VI(A)(3)(a), page 34.

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

Fugitt discloses a method for coating a paperboard for the reasons explained above. See Section VI(A)(3)(a), page 34-35.

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

Fugitt discloses a method for coating a paperboard for the reasons explained above. See Section VI(A)(3)(a), page 35.

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

Fugitt discloses a method for coating a paperboard for the reasons explained above. See Section VI(A)(3)(a), page 35.

[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: $Y_2 = 3.71 + 13.14X - 0.1602X^2$ ”

Fugitt discloses a method for coating a paperboard for the reasons explained above. See Section VI(A)(3)(a), page 35-36.

One of ordinary skill in the art would be motivated to combine *Fugitt*, *Papermaking*, and *Gratton* to arrive at claim 1 of the ‘142 Patent.

As shown above, *Fugitt* discloses 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.

With respect to claim 1, *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 can 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. (Ex. 1003, ¶ 159).

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). 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. (Ex. 1003, ¶¶ 160, 164).

Thus, it would clearly be obvious and even expected that the steam heated rollers of *Fugitt* could be operated at a temperature within the range of claim 1, and that one of ordinary skill in the art would be motivated to do so. 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. (Ex. 1003, ¶¶ 189, 191).

It would be obvious to combine *Fugitt*, *Papermaking* and *Gratton* 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.” (Ex. 1005, page 36.) However, “[h]igh temperature produces better web surface quality, uniformity and smoothness (Figure 23), and preserves bulk and strength properties. (*Id.* at page 40; Ex. 1003, ¶ 192).

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. (*Id.* at page 82; Ex. 1003, ¶ 193).

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 and

Papermaking clearly teaches that smoothness can be achieved at higher temperatures. (Ex. 1003, ¶ 194).

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 is conventionally calendered at temperatures including and well above the temperatures recited in the claims of the ‘142 Patent.

Gratton also discloses roll temperatures within the claimed range (210°C [410°F]) to “improve paper surface properties with less bulk reduction than with conventional calendering.”

In view of the above, claim 1 is obvious over *Fugitt* in view of *Papermaking* and *Gratton*. (Ex. 1003, ¶¶ 195-198).

b. Claim 2 is Unpatentable Under 35 U.S.C. § 103

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.

As stated above, it is obvious to combine *Fugitt*, *Papermaking*, and *Gratton* to arrive at claim 1. Claim 2 is also obvious because in *Gratton* temperature-gradient (TG) calendering was conducted using nip loads of 20, 40, 60, 80 and 100 kN/m. (Ex. 1006, page 86). The following table shows the conversion of kilonewton meter (kN/m) to pounds per linear inch (PLI):

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

In view of the above, claim 2 is obvious over *Fugitt* in view of *Papermaking* and *Gratton*. (Ex. 1003, ¶¶182-183).

c. Claim 4 is Unpatentable Under 35 U.S.C. § 103

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.

As stated above, it is obvious to combine *Fugitt*, *Papermaking*, and *Gratton* to arrive at claim 1. Claim 4 is also obvious because in the combination of *Fugitt* with *Gratton*, the 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, page 86, “Experimental” as well as Table II sample no. S-6 to S-10.)

Also, the size press in *Fugitt* is 32 in Figure 11. It is in the same position (32) in the ‘142 Patent. (Ex. 1001, figure 2) *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 the combination of references clearly teach that

is conventional to apply starch in a size press prior to the pre-calendering step.
(Ex. 1003, ¶¶ 185-186).

Thus, claim 4 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. Overview of *Fugitt*

See Section VI (A) (1) on page 24 for an overview of *Fugitt*.

2. Overview of *Papermaking*

See Section VI (A) (2) on page 26 for an overview of *Fugitt*.

3. Overview of Papermaking II

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 well known and important book series described above.

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”).

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. (Ex. 1003 at ¶ 94).

4. Claim-by-claim analysis of claim 4 in view of *Fugitt* in view of *Papermaking* and *Papermaking II*.

a. Claim 4 is Unpatentable Under 35 U.S.C. § 103

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.

As stated above, it is obvious to combine *Fugitt* and *Papermaking* to arrive at claim 1. It is also obvious to one of ordinary skill in the art to combine *Fugitt* with *Papermaking* and *Papermaking II* to arrive at claim 4 because *Papermaking II* discloses that it is conventional to use starch in a size press. (Ex. 1007, page 583; Ex. 1003 at ¶ 201).

Papermaking II includes a chapter dedicated to board coating. A section of that chapter is titled “2 Introduction to board coating”. (*Id.* at page 581). A subsection in the introduction is titled “2.1 Surface sizing.” (*Id.* at page 583). It states:

“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.)

Papermaking II also discloses that if a size press is positioned before coating, as is the size press 32 in *Fugitt* (see Ex. 1004 at Fig. 11 and ¶ 26), low consistency starch is applied on the board surface.

One of ordinary skill in the art would view the function properties of the size press discussed in *Papermaking II* (“improve stiffness and surface strength” and “surface sizing”) match up with the “functional properties” and sizing benefits mentioned in *Fugitt* (Ex. 1004 at ¶ 26). (Ex. 1003 at ¶¶ 205-206).

In view of the above, claim 4 is obvious over *Fugitt* in view of *Papermaking* and *Papermaking II*.

VII. CONCLUSION

Claims 1, 2, and 4-23 of the ‘142 Patent are rendered obvious for the reasons set forth above. There is a reasonable likelihood that Petitioner will prevail as to each of these claims. *Inter partes* review of claims 1, 2, and 4-23 is accordingly requested.

Dated: July 14, 2023

Respectfully submitted,
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CERTIFICATION OF COMPLIANCE WITH WORD COUNT

Pursuant to 37 C.F.R. § 42.24(d), I certify that the petition complies with the type-volume limits of 37 C.F.R. § 42.24(a)(1)(i) because it contains less than 14,000 words, according to the word-processing used to prepare this Petition.

/s/ Richard S. Myers, Jr.

Richard S. Myers, Jr.

ATTACHMENT A: PROOF OF SERVICE OF THE PETITION

The undersigned certifies service pursuant to 37 C.F.R. §§ 42.6(e) and 42.105(b) on the Patent Owner by Express Mail of a copy of this Petition for *Inter Partes* Review and supporting materials at the correspondence addresses of record for the '142 Patent:

Scott Wofsy
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UNITED STATES

Dated: July 14, 2023

/s/ Richard S. Myers, Jr.
Richard S. Myers, Jr.
(Reg. No. 42,022)

**ATTACHMENT B: 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
1003	Zotterman Declaration	Declaration of Carl Zotterman
1004	Fugitt	Fugitt et al., U.S. Pat. Appl. Pub. No. 2009/0236062
1005	Papermaking	Excerpts from Rautiainen, P. (2009). <i>Papermaking Science and Technology Book 10: Papermaking Part 3, Finishing</i> (2nd ed., pp. 35-42, 79-99). Paper Engineers' Association.
1006	Gratton	Gratton, et al., Temperature-gradient calendering of foodboard, TAPPI JOURNAL January 1988
1007	Papermaking II	Excerpts from Lehtinen, E. (2000). <i>Papermaking Science and Technology Book 11: Pigment Coating and Surface Sizing of Paper</i> (pp. 581-583). Paper Engineers' Association
1008	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