

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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NEW NGC, INC. dba NATIONAL GYPSUM COMPANY,

Petitioner

v.

UNITED STATES GYPSUM COMPANY,

Patent Owner

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Case No. IPR2017-01352

Patent No. 8,142,914

**PETITION FOR *INTER PARTES* REVIEW OF  
UNITED STATES PATENT NO. 8,142,914  
PURSUANT TO 35 U.S.C. §§ 311–319, 37 C.F.R. § 42**

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## EXHIBITS

NGC914-1001	Expert Declaration of Gerry Harlos
NGC914-1002	U.S. Patent No. 6,632,550 (“the ’550 patent”)
NGC914-1003	U.S. Patent No. 6,342,284 (“the ’284 patent”)
NGC914-1004	Selections from the Prosecution History of the ’284 Patent
NGC914-1005	Selections from the Prosecution History of the ’550 Patent
NGC914-1006	U.S. Patent No. 5,932,001 (“Graux”)
NGC914-1007	U.S. Patent No. 3,234,037 (“Satterthwaite”)
NGC914-1008	U.S. Patent No. 5,980,628 (“Hjelmeland”)
NGC914-1009	ASTM C473-95
NGC914-1010	U.S. Patent No. 2,884,413 (“Kerr”)
NGC914-1011	U.S. Patent No. 3,770,468 (“Knauf”)
NGC914-1012	Thomas Koslowski & Udo Ludwig, <i>The Chemistry and Technology of Gypsum</i> , ASTM STP 861, 103 (R. A. Kuntze, ed., 1984)
NGC914-1013	Lydia M. Luckevick & Richard A. Kuntze, <i>The Relationship Between Water Demand and Particle Size Distribution of Stucco</i> , in <i>The Chemistry and Technology of Gypsum</i> , ASTM STP 861, 84-85 (R.A. Kuntze, ed., 1984)

NGC914-1014	ASTM C472-93
NGC914-1015	Robert F. Acker, Physical Testing of Gypsum Board Per ASTM C 473, 3-7 (R.A. Kuntze, ed., 1984)
NGC914-1016	L. Amathieu, <i>Improvement of Mechanical Properties of Set Plasters</i> , 79 J. of Crystal Growth 169, 176 (1986)
NGC914-1017	U.S. Patent No. 2,985,219
NGC914-1018	U.S. Patent No. 3,179,529
NGC914-1019	U.S. Patent No. 2,090,625
NGC914-1020	U.S. Patent No. 3,190,787
NGC914-1021	U.S. Patent No. 2,346,999
NGC914-1022	U.S. Patent No. 3,573,947
NGC914-1023	U.S. Patent No. 4,009,062
NGC914-1024	U.S. Patent No. 5,320,677
NGC914-1025	U.S. Patent No. 5,534,059
NGC914-1026	U.S. Patent No. 5,395,438
NGC914-1027	U.S. Patent No. 3,246,063

NGC914-1028	Redacted Complaint
NGC914-1029	[RESERVED]
NGC914-1030	[RESERVED]
NGC914-1031	ASTM C473-81
NGC914-1032	U.S. Patent No. 5,085,929
NGC914-1033	[RESERVED]
NGC914-1034	[RESERVED]
NGC914-1035	[RESERVED]
NGC914-1036	U.S. Patent No. 5,643,510
NGC914-1037	[RESERVED]
NGC914-1038	U.S. Patent No. 8,142,914
NGC914-1039	[RESERVED]

**I. MANDATORY NOTICES UNDER 37 C.F.R § 42.8**

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

The real party in interest for Petitioner is New NGC, Inc. dba National Gypsum Company.

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

U.S. Patent No. 8,142,914 is at issue in a district court case styled United States Gypsum Company v. New NGC, Inc., Case No. 1:17-cv-00130 (D. Del. Feb. 6, 2017). Petitioner filed Petitions for IPR challenging the claims of related U.S. Patent Nos. 6,632,550 (the “550 patent”), 7,425,236 (the “236 patent”), and 7,964,034 (the “034 patent”) in petitions styled IPR2017-01011, IPR2017-01086, and IPR2017-01088. Petitioner is concurrently filing Petitions for IPR challenging the claims of related U.S. Patent Nos. 6,342,284 (the “284 patent”), 7,758,980 (the “980 patent”), and 8,500,904 (the “904 patent”).

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

Lead counsel is Ross R. Barton (Reg. No. 51,438) and backup counsel are S. Benjamin Pleune (Reg. No. 52,421), Lauren E. Burrow (Reg. No. 70,447), Tasneem D. Delphry (Reg. No. 72,506), Stephen R. Lareau (Reg. No. 63,273), and Adam Doane (Reg. No. 73,568) all of Alston & Bird LLP, 101 S. Tryon St., Ste. 4000, Charlotte, NC 28280, 704-444-1000. Pursuant to 37 C.F.R § 42.10(b), Powers of Attorney are being submitted with this Petition.

#### **D. Service Information**

Petitioner consents to electronic service directed to ross.barton@alston.com, ben.pleune@alston.com, lauren.burrow@alston.com, stephen.lareau@alston.com, tasneem.delphry@alston.com, and adam.doane@alston.com.

#### **II. GROUNDS FOR STANDING UNDER 37 C.F.R. § 42.104(a)**

Petitioner certifies that the '914 patent is available for IPR and, Petitioner is not barred or estopped from requesting an IPR challenging Claims 1-4, 6, 8 and 10 of the '914 patent on the grounds identified herein.

#### **III. PAYMENT OF FEES**

Petitioner authorizes Deposit Account No. 16-0605 to be charged for the payment of any fees.

#### **IV. OVERVIEW OF CHALLENGES AND RELIEF REQUESTS**

Pursuant to Rules 42.22(a)(1) and 42.104(b)(1)–(2), Petitioner requests cancellation of claims 1-4, 6, 8 and 10 of the '914 patent on the following grounds:

**Count 1:** claims 1-4, 6, 8 and 10 of the '914 patent are unpatentable under at least 35 U.S.C. § 103(a) over Graux, ASTM C473-95, Hjelmeland, Sucech, and Summerfield.

**Count 2:** claims 1-4, 6, 8 and 10 of the '914 patent are unpatentable under at least 35 U.S.C. § 103(a) over Satterthwaite, ASTM C473-95, Hjelmeland, Sucech, and Summerfield.

## V. INTRODUCTION

The '914 patent claims commonplace ingredients in identified combinations to yield known results. NGC914-1001, ¶¶ 32-40, 48, 62. The '914 patent is broadly directed to gypsum-containing building products, including “gypsum boards, reinforced gypsum composite boards, plasters, machinable materials, joint treatment materials, and acoustical tiles.” NGC914-1038, 1:25-30; NGC914-1001, ¶¶ 57-59. Claim 1 of the '914 patent is representative and can be summarized as follows:

A gypsum board comprising a core of material sandwiched between cover sheets, wherein the core comprises an interlocking matrix of set gypsum, and the board has been prepared by a method comprising:

(1) forming or depositing a mixture between the cover sheets, wherein the mixture comprises

(1)(a) calcined gypsum

(1)(b) water

(1)(c) an accelerator

(1)(d) sodium trimetaphosphate, tetrapotassium pyrophosphate, tetrasodium pyrophosphate, aluminum trimetaphosphate, sodium acid

pyrophosphate, ammonium polyphosphate having 1000-3000 repeating phosphate units, and acids, salts, or the anionic portions thereof

(2) maintaining the mixture to allow it to set

(3) including enough of the chosen enhancing material(s) from the list provided in the mixture so that the resulting product has greater resistance to permanent deformation to provide a sag resistance of less than about 0.1 per two foot of gypsum board cast from the gypsum containing product; and

(4) including enough accelerator that the product has improved strength.

Every single one of these ingredients was known in the prior art. In fact, the specification reveals that the inventors only considered one step – the addition of certain “enhancing materials” – to be new, admitting that the mixture of water, calcined gypsum, and accelerators was “employed in the prior art” using “conventional additives...in customary amounts.” NGC914-1038, 9:6-27; NGC914-1001, ¶ 60. The use of “enhancing materials” to improve sag resistance, however, was also widely known in the prior art. NGC914-1001, ¶¶ 58-64. In particular, the use of “enhancing materials,” including sodium trimetaphosphate, had been used in the prior art specifically to provide improved sag resistance. *Id.* When

the claims are viewed against this backdrop, there is nothing nonobvious or inventive about the claims of the '914 patent, and the claims are not patentable.

## **VI. TECHNICAL BACKGROUND OF THE '914 PATENT**

### **A. Basics of Gypsum Products**

Gypsum-containing products, such as boards, plasters, and acoustical tiles, have been used in modern building applications for more than a century, and the basic recipe for the manufacture of gypsum-containing products has been known for nearly as long. *See, e.g.*, NGC914-1017, 1:13-35; NGC914-1001, ¶ 33. Gypsum is a naturally occurring mineral that, when found in nature in its “raw” or rock form, has the chemical name “calcium sulfate dihydrate” and the chemical formula  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ . NGC914-1001, ¶¶ 32-34.

When raw gypsum is heated, much of the water is driven out from the material, resulting in a different form of gypsum called calcined gypsum or stucco. NGC914-1038, 2:9-22, 23:3-15; NGC914-1001, ¶ 34. Calcined gypsum contains the hemihydrate form of gypsum and, when subsequently mixed with water, spontaneously reacts to return to its original crystalline composition: calcium sulfate dihydrate. *Id.* The resulting product is commonly known as “set gypsum.” NGC914-1013, 84-85; NGC914-1038, 4:27-42; NGC914-1001, ¶ 34.

### **B. The '914 Patent**



As noted in the '914 patent, the claimed “composition[s]” can take many different forms, such as gypsum boards, plasters, joint compound, and acoustical tiles. NGC914-1038, 1:26-30; NGC914-1001, ¶ 33. In gypsum boards, the prior art method of manufacturing a board included mixing water, calcined gypsum, and one or more additional additives such as enhancing materials, accelerators, foams, retarders, or starches, both pregelatinized and non-pregelatinized, and depositing the mixture between two layers of paper and allowing it to harden. NGC914-1001, ¶¶ 102-103. The '914 patent acknowledges that the use of these materials in the manufacture of set gypsum-containing products was well-known in the prior art. NGC914-1038, 7:50-62; *id.* at 9:14-37, 11:4-11, 11:23-30, 12:11-16, 17:30-40, 20:49-58, 21:25-38; NGC914-1001, ¶ 60. According to the '914 patent, however, what the inventors (incorrectly) believed to be missing in the prior art was the use of certain “enhancing materials” that, when added in sufficient amounts, would yield a product that had increased resistance to sag. *Id.* The use of these “enhancing materials” was, in fact, known in the prior art. Enhancing Materials

The '914 patent describes enhancing materials as additives that improve one or more of the following attributes: strength, sag resistance, or maintenance of original dimensions (*i.e.* resistance to shrinkage when drying). *See* NGC914-1001, ¶¶ 41-44. The challenged claims require that the enhancing materials be “sodium trimetaphosphate, tetrapotassium pyrophosphate, tetrasodium pyrophosphate,

aluminum trimetaphosphate, sodium acid pyrophosphate, ammonium polyphosphate having 1000-3000 repeating phosphate units, and acids, salts, or the anionic portions thereof.” NGC914-1038, Claim 1. According to the specification, the preferred “enhancing material” was a condensed phosphate called sodium trimetaphosphate (“STMP”). *Id.* at 8:3 (“Sodium trimetaphosphate is preferred.”), 9:22-33.

Since the 1930s, the use of “enhancing materials” to improve these attributes has been known in the art. NGC914-1001, ¶ 45. U.S. Patent No. 2,090,625, which was filed in 1936, discloses treating gypsum with additives such as orthophosphoric acid, monosodium orthophosphate or sodium metaphosphate, and silica. NGC914-1019, 5:45-52; NGC914-1001, ¶ 45. The resulting set gypsum-containing product showed increased strength when these additives were introduced into the manufacturing process. *See* NGC914-1019, 6:30-35, 6:65-75, 8:55-65; NGC914-1001, ¶ 45. Graux, which is also discussed below in detail, discloses the manufacture of set-gypsum containing products using STMP as an additive to enhance the finished product. NGC914-1006, 9:29-30; NGC914-1001, ¶ 49. Quite simply, the use of enhancing materials, including but not limited to STMP, to improve resistance to sag had been known in the industry for more than 30 years before the earliest priority date of the ’914 patent. NGC914-1001, ¶ 45-48, 50-51, 69. Satterthwaite, which is discussed below in detail, discloses the use of STMP – which the ’914

patent identifies as the “preferred” enhancing material claimed in the patents – to improve gypsum-containing products by “increas[ing] wet strength, increas[ing] density and increas[ing] resistance to warp or sag.” NGC914-1007, 1:60-63; NGC914-1001, ¶ 45.

### **C. Accelerators**

The claims of the ’914 patent also recite the use of “accelerators” in the manufacturing method to improve the strength of the set gypsum-containing product. Accelerators have been known since at least the late 1960s to “shorten[] the setting time of plaster by providing seed crystals.” NGC914-1022, 2:14-16; NGC914-1001, ¶¶ 52-54. The use of an accelerator in manufacturing provides the additional advantage of increasing the strength of the resulting product. NGC914-1001, ¶ 53. The ’914 patent confirms that accelerators and other additives were known in the prior art, noting that “[o]ther *conventional additives* can be employed in the practice of the invention in *customary amounts* to impart desirable properties and to facilitate manufacturing, such as, for example, aqueous foam, set accelerators....” NGC914-1038, 9:6-27 (emphasis added); NGC914-1003, 9:18-25; NGC914-1001, ¶ 60. As with the claimed “enhancing materials,” the use of accelerators to improve the strength of set gypsum-containing products was well known for decades before the earliest priority date of the ’914 patent. NGC914-1001, ¶¶ 54-56, 69.

## VII. PROSECUTION HISTORY OF THE '914 PATENT

The relevant prosecution history is contained in U.S. Application Nos. 09/138,355 (that ultimately issued as the '284 patent) and 09/249,814 (that ultimately issued as the '550 patent) were rejected as obvious over U.S. Patent Nos. 3,770,468 to Knauf and 4,126,599 to Sugahara. NGC914-1004; NGC914-1005; NGC914-1001, ¶ 65. During prosecution, the applicant made similar arguments and amendments to distinguish its alleged invention, including the factually incorrect argument that the cited references do not disclose “condensed phosphoric acids, and/or the condensed phosphates as described and claimed by applicants,” despite the fact that the prior art references specifically disclose STMP, which is indisputably a condensed phosphate. NGC914-1004, 9; NGC914-1005, 7; NGC914-1001, ¶¶ 65-66. The examiner appears to have been misled by applicant’s arguments, and allowed the claims to issue. *Id.*

In any event, none of Graux, Satterthwaite, and ASTM C473-95 were considered by the examiner during the examination of the application that issued as the '904 patent or its priority application. NGC914-1001, ¶ 67, 69. Although Hjelmeland, Sucech, and Summerfield were disclosed to the PTO during the prosecution of the '914 patent, Sucech, and Summerfield were cited in the '914 patent, and even though Summerfield was incorporated by reference in the '914 patent, Hjelmeland, Sucech, and Summerfield were not cited in an Office Action or

referred to during prosecution, and that a reference was disclosed to the PTO is not a bar to institution. *See Praxair Distribution, Inc. v. Ino Therapeutics, LLC*, IPR2015-00893 (Institution Decision, Paper 14) at pp. 7-8 (Sept. 22, 2015); *Praxair Distribution, Inc. v. Ino Therapeutics, LLC*, IPR2015-00889 (Institution Decision, Paper 14) at pp. 9-10 (Sept. 22, 2015); *Microsoft Corp. v. Parallel Networks Licensing, LLC*, IPR2015-00483 (Institution Decision, Paper 10) at p. 15 (July 15, 2015); *Microsoft Corp. v. Parallel Networks Licensing, LLC*, IPR2015-00486 (Institution Decision, Paper 10) at p. 15 (July 15, 2015); *Int'l Business Machines Corp. v. Intellectual Ventures I LLC*, IPR2015-00302 (Institution Decision, Paper 8) at pp. 14-15 (June 2, 2015); *Cisco Sys., Inc., et al. v. Crossroads Sys., Inc.*, IPR2014-01544 (Institution Decision, Paper 9) at pp. 13-14 (April 3, 2015).

## **VIII. CLAIM CONSTRUCTION**

The '914 patent will expire no later than August 21, 2017. Thus, because the '914 patent will be expired at institution, Petitioner addresses the meaning of the claim terms under the *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005)

standard. *Cisco Sys., Inc. v. AIP Acquisition, LLC*, IPR2014-00247 at \*7-\*8 (Final Decision, May 20, 2015); NGC914-1001, ¶ 70.

Claim 1 of the '914 patent, which is representative for purposes of claim construction, is reproduced below:

1. A gypsum board comprising a core of material sandwiched between cover sheets, wherein the core comprises an interlocking matrix of set gypsum, and the board has been prepared by a method comprising:

forming or depositing a mixture between the cover sheets, wherein the mixture comprises a calcined gypsum, water, an accelerator, and one or more enhancing materials selected from the group consisting of: sodium trimetaphosphate, tetrapotassium pyrophosphate, tetrasodium pyrophosphate, aluminum trimetaphosphate, sodium acid pyrophosphate, ammonium polyphosphate having 1000-3000 repeating phosphate units, and acids, salts, or the anionic portions thereof, and maintaining the mixture under conditions sufficient for the calcined gypsum to form the interlocking matrix of set gypsum, the enhancing material or materials having been included in the mixture in an amount such that the gypsum board has greater sag resistance than it

would have if the enhancing material had not been included in the mixture

said board having a sag resistance as determined according to ASTM C473-95 of less than about 0.1 inch per two foot length of said board, the accelerator having been included in an amount such that the gypsum board has greater strength than it would have if the accelerator had not been included in the mixture.

**A. Enhancing Material(s)**

The term “enhancing materials” appears throughout the claims of the ’914 patent and its related family of patents. Although the challenged claims of the ’914 patent further limit “enhancing materials” to a specific Markush group of chemicals, this Markush group is not a limitation on the *meaning of the term* “enhancing materials” to a PHOSITA. This is evidenced by claim 2 of related U.S. Patent No. 7,425,236 (the subject of previously filed petition number IPR2017-1088), which includes the term “enhancing materials” not accompanied by a Markush group.

Although the Markush group in the challenged claims of the ’914 patent requires the presence of certain specific chemicals listed in the group, all of these chemicals are disclosed in the prior art, the Board need not address the proper construction of this term to find the challenged claims unpatentable. In IPR2017-1088, however, the challenged claim of the ‘236 patent does not contain a Markush

group limiting the term “enhancing materials.” Thus, resolution of the proper construction of “enhancing materials” is required to resolve at least one of the Counts for the ’236 patent. Thus, Petitioner identifies this term for construction here for purposes of consistency, as the term should be construed consistently across the family of these patents. *NTP, Inc. v. Research in Motion, Ltd.*, 418 F.3d 1282, 1293 (Fed. Cir. 2005); *Microsoft Corp. v. Multi-Tech Sys., Inc.*, 357 F.3d 1340, 1349–50 (Fed. Cir. 2004).

The ’914 patent is clear that an “enhancing material” improves at least one of three properties in a set gypsum-containing product: strength, resistance to permanent deformation (e.g., sag resistance), and dimensional stability (e.g., non-shrinkage during drying of set gypsum). NGC914-1038, 1:42-47; NGC914-1001, ¶ 71. The specification is explicit, however, that an “enhancing material” does not have to improve all three properties. NGC914-1038, 27:39-47; NGC914-1001, ¶ 71.

In addition, the specification suggests that there was a need in the art for gypsum-containing products to have greater dimensional stability, resistance to sag, and strength and that “[e]ach embodiment of the invention meets *one or more of these needs*.” NGC914-1003, 3:30-64 (emphasis added); NGC914-1001, ¶¶ 72-74. Thus, the proper construction for the term “enhancing material” is, under the *Phillips* standard, an “additive that improves at least one of resistance to permanent



deformation, strength, and dimensional stability in set gypsum-containing products.” NGC914-1001, ¶¶ 75-76. *Microsoft Corp. v. Proxyconn, Inc.*, 789 F.3d 1292, 1298 (Fed. Cir. 2015) (observing that claim constructions during IPR must not be “*unreasonable* under general claim construction principles” and “must be consistent with the one that those skilled in the art would reach”) (emphasis in original). For those reasons, Petitioner’s proposed claim construction for this term should be adopted.

## **B. Accelerator**

The related ’550 patent states that an accelerator can be “[a]ny of the materials known to be useful to accelerate the rate of formation of set gypsum.” NGC914-1002, 35:20-40; NGC914-1001, ¶ 77. The ’914 patent further describes an example in which an accelerator is used in conjunction with an enhancing material to overcome the retardant and weakening effects the enhancing material had on the product. *Id.* Accordingly, a PHOSITA would understand an accelerator to mean any “reagent or combination of reagents known to be useful to influence the rate of formation of set gypsum.” NGC914-1001, ¶ 77.

## **IX. PRIOR ART REFERENCES**

To provide context to the discussion of the prior art, the below table provides the combinations of the various prior art references used in the two Grounds of this petition:

<b>Ground 1</b>		
<b>Claim(s)</b>	<b>Primary Reference</b>	<b>Secondary Reference(s)</b>
1	Graux	Summerfield, ASTM, Hjelmeland
2		Hjelmeland
3, 4, 6		None
8, 10		Sucech

<b>Ground 2</b>		
<b>Claim(s)</b>	<b>Primary Reference</b>	<b>Secondary Reference(s)</b>
1	Satterthwaite	Summerfield, ASTM, Hjelmeland
2		Hjelmeland
3, 4, 6		None
8, 10		Sucech

#### **A. Graux**

U.S. Patent No. 5,932,001 to Graux (“Graux”) was filed on May 9, 1997, and issued on August 3, 1999. NGC914-1001, ¶ 79. As such, Graux is prior art under at least 35 U.S.C. § 102(e) (pre-AIA) to the ’914 patent. 35 U.S.C. § 102(a) (pre-

AIA). Graux was not before the Examiner during prosecution of the '914 patent. NGC914-1001, ¶ 79.

Graux is directed to set gypsum-containing products, including a cationic amylaceous (or starchy) compound, and clearly describes the same set gypsum-containing products disclosed and claimed in the '914 patent. NGC914-1006, 1:4-5, 1:12-19, 3:8-12; NGC914-1001, ¶¶ 78, 80. Graux states that while “[t]he use of cationic amylaceous compounds is not new in itself,” many of the known cationic amylaceous compounds “have only a limited thickening capacity and...are unable to meet the current demands of the art.” NGC914-1006, 3:13-35; NGC914-1001, ¶¶ 80-81. The object of Graux is to provide a set gypsum-containing product having improved thickening capacity, and a process for the preparation of said set gypsum-containing product. NGC914-1006, 3:40-45, 8:15; NGC914-1001, ¶¶ 81-82.

The set gypsum-containing product disclosed by Graux includes “finished articles,” NGC914-1006, 1:35-39, made from a “form of calcium sulphate” including gypsum and “calcined/rehydrated forms.” NGC914-1006, 1:24-30; NGC914-1001, ¶¶ 80-82. The set gypsum-containing product contains calcined gypsum mixed with water and other additives, including “accelerators” and a starch

“crosslinked with sodium trimetaphosphate.” NGC914-1006, 7:32-33, 9:29-30; NGC914-1001, ¶¶ 80-82.

## **B. Satterthwaite**

U.S. Patent No. 3,234,037 to Satterthwaite (“Satterthwaite”) issued on February 8, 1966. NGC914-1001, ¶ 138. As such, Satterthwaite is prior art under 35 U.S.C. § 102(b) (pre-AIA) to the ’914 patent. 35 U.S.C. § 102(b) (pre-AIA). Satterthwaite was not before the Examiner during prosecution of the ’914 patent. NGC914-1001, ¶ 138.

Satterthwaite is also directed to set gypsum-containing products, in particular tile products such as acoustical ceiling tiles. NGC914-1007, 1:13-23; NGC914-1001, ¶¶ 137-139. In fact, the ’914 patent specifically indicates that, as early as 1966, it was known in the art that acoustical ceiling tiles could be made using rehydrated calcium sulfate hemihydrate, *i.e.* set gypsum. NGC914-1003, 1:11-16; NGC914-1027; NGC914-1001, ¶ 139. Satterthwaite discloses “the production of a starch binder comprising a thick-boiling starch and a polyhydric alcohol fatty acid ester.” NGC914-1007, 1:11-12; NGC914-1001, ¶ 139. The starch binder disclosed by Satterthwaite includes a starch treated with STMP “for use in the manufacture of acoustical ceiling tile and other tile products made from a mixture of water, gypsum, mineral wool and other ingredients.” NGC914-1007, 2:9-11, 1:15-18; NGC914-1001, ¶ 140. The mixture including the starch binder is “formed into sheets...cut

into sections, dried in an oven, cooled, cut, and processed for sale.” NGC914-1007, 3:41-42; NGC914-1001, ¶ 140.

Satterthwaite states that while thick-boiling starches are “commonly used as binders in the tile making process,” existing methods of making thick-boiling starches are “time-consuming and expensive because of the high percentage of partially dried tile...obtained after the usual drying operation.” NGC914-1007, 1:24-25, 1:40-42; NGC914-1001, ¶ 141. Thus, the stated object of Satterthwaite is to provide a “faster drying rate...[,] elimination of sub-standard tile...[,] increased wet strength, increased density and increased resistance to warp or sag.” NGC914-1007, 1:58-62; NGC914-1001, ¶ 141.

### **C. ASTM**

ASTM C473-95 entitled *Standard Test Methods for Physical Testing of Gypsum Board Products and Gypsum Lath* was the testing standard for gypsum products in 1995, although the same tests as those provided by ASTM C473-95 were used at least as early as 1981, NGC914-1031, and some version of ASTM C473 existed as early as 1961. NGC914-1009, at 1, n.1; NGC914-1001, ¶¶ 83-84, 142-143. As such, ASTM C473-95 is prior art under 35 U.S.C. § 102(b) (pre-AIA) to the '914 patent. 35 U.S.C. § 102(b) (pre-AIA). Moreover, the '914 patent repeatedly identifies ASTM C473-95 as the known testing standard at the time the

'914 patent was filed, thereby making ASTM C473-95 admitted prior art. *See, e.g.*, NGC914-1038, 18:61-67; NGC914-1001, ¶¶ 83-84, 142-143.

ASTM C473-95 provides test methods for measuring various characteristics of gypsum products, including humidified deflection (*i.e.* sag resistance), hardness, and nail pull resistance. NGC914-1009; NGC914-1001, ¶¶ 83-84, 142-143. As previously discussed, the humidified deflection test is used to “evaluat[e] the deflection of gypsum board or gypsum lath when horizontally suspended and subjected to high humidity.” NGC914-1009, ¶ 49; NGC914-1001, ¶¶ 83-84, 142-143. The hardness test is used for “evaluating the relative ability of gypsum board or gypsum lath core, ends, and edges to resist crushing during handling or use of the material.” NGC914-1009, ¶ 9; NGC914-1001, ¶¶ 83-84, 142-143. The nail pull resistance test is used for “evaluating the ability of gypsum board or gypsum lath to resist nail pull-through by determining the load required to force a standard nailhead through the board or lath.” NGC914-1009, ¶ 18; NGC914-1001, ¶¶ 83-84, 142-143.

#### **D. Hjelmeland**

U.S. Patent No. 5,980,628 (“Hjelmeland”) claims priority to PCT Application No. PCT/NO96/00116 filed May 14, 1996 and published December 5, 1996. NGC914-1001, ¶¶ 85, 144. As such, Hjelmeland is prior art under 35 U.S.C. § 102(e) (pre-AIA) to the '914 patent. 35 U.S.C. § 102(e) (pre-AIA). Hjelmeland

was not before the Examiner during prosecution of the '914 patent. NGC914-1001, ¶¶ 85, 144.

Hjelmeland is directed to set gypsum-containing products. NGC914-1008, 1:6-7; NGC914-1001, ¶¶ 86, 145. Hjelmeland states that existing set gypsum-containing products either “creep” after application or harden “in mixer units and pumps and lead to clogging or blocking of the equipment.” NGC914-1008, 1:22-31; NGC914-1001, ¶¶ 86, 145. Thus, the stated object of Hjelmeland is to teach “a curable gypsum-based composition for the production of cured gypsum, enabling an efficient use of gypsum as material in...building constructions.” NGC914-1008, 3:16-19; NGC914-1001, ¶¶ 86-87, 145-146.

The set gypsum-containing products disclosed by Hjelmeland include “a set retarding substance comprising (i) an organic acid containing at least two acid groups selected from the group consisting of...phosphate or phosphonate...and/or (ii) inorganic anions selected from the group consisting of polyphosphate....” NGC914-1008, 3:60-4:2; NGC914-1001, ¶¶ 87, 145-146. Hjelmeland further discloses that “the set retarding substance constitutes...0.01-0.2%...by weight of the gross water quantity in the first component.” NGC914-1008, 4:13-15; NGC914-1001, ¶¶ 88, 145-146. Accordingly, a PHOSITA would further understand that Hjelmeland discloses the addition of the “set retarding substance” in the range claimed in the '914 patent. NGC914-1001, ¶¶

88, 147. Further, a PHOSITA would understand that the “set retarding substance” of Hjelmeland includes STMP. NGC914-1001, ¶¶ 88, 147.

#### **E. Sucech**

U.S. Patent No. 5,643,510 (“Sucech”) issued on July 1, 1997. NGC914-1036; NGC914-1001, ¶¶ 89, 148. As such, Sucech is prior art under 35 U.S.C. § 102(b) (pre-AIA) to the ’914 patent. 35 U.S.C. § 102(b) (pre-AIA). Sucech was disclosed to the PTO during the prosecution of the ’914 patent, but was not cited in an Office Action or referred to during prosecution. NGC914-1001, ¶¶ 89, 148. Sucech is directed to a “process and foaming system for producing foamed gypsum board which permits the production and control of large foam voids in the gypsum core by adjusting the ratio of a first foaming agent and a second foaming agent” in order to develop a lighter board. NGC914-1036, Abstract; NGC914-1001, ¶¶ 89, 148. Sucech teaches processes for incorporating foaming agents into the gypsum mixtures. NGC914-1036, 2:26-29; NGC914-1001, ¶¶ 89, 148.

#### **F. Summerfield**

U. S. Patent No. 2,985,219 (“Summerfield”) issued on May 23, 1961. NGC914-1017; NGC914-1001, ¶¶ 90, 149. As such, Summerfield is prior art under 35 U.S.C. § 102(b) (pre-AIA) to the ’914 patent. 35 U.S.C. § 102(b) (pre-AIA). Summerfield states that one object of the invention is to disclose “a process and apparatus for making plasterboard which is readily adaptable to present day



commercial machines and methods.” NGC914-1017, 3:33-37; NGC914-1001, ¶¶ 90, 149. Summerfield further discloses the basic process for making gypsum boards, which include mixing a gypsum-containing slurry, depositing the slurry onto a sheet of paper, covering the slurry with another sheet of paper, allowing the slurry to set, cutting the slurry into the desired size, and drying the slurry in a kiln. NGC914-1017, 1:17-30; NGC914-1001, ¶¶ 90, 149.

**X. THERE IS A REASONABLE LIKELIHOOD THAT AT LEAST ONE CLAIM OF THE '914 PATENT IS UNPATENTABLE**

Each of the arguments below is made from the standpoint of a PHOSITA in the field of the '914 patent as of the August 21, 1997 filing date of the earliest priority application (“priority date”). NGC914-1001, ¶¶ 11-12, 69. Specifically, a PHOSITA would have a bachelor’s degree in chemical engineering or organic or physical chemistry and 3 to 5 years of experience in gypsum board manufacturing or a master’s degree in chemical engineering or organic or physical chemistry and 2 to 3 years of experience. *Id.*

**XI. GROUND 1: OBVIOUSNESS OF CLAIMS 1-4, 6, 8, AND 10 BASED ON GRAUX IN VIEW OF ASTM C473-95, HJELMELAND, SUCECH, AND SUMMERFIELD**

**A. Motivation to Combine Graux, ASTM C473-95, Hjelmeland, Sucech and Summerfield**

The '914 patent essentially emphasizes three points relevant to gypsum

containing products. First, the specification notes there is a “continuing effort” to make set gypsum products lighter, and notes that the natural consequence of that is a need to increase the strength of the product beyond normal levels to increase overall strength. NGC914-1038, 2:27-35; NGC914-1001, ¶ 91. Second, the specification notes that under high humidity conditions, there is a need for greater sag resistance. NGC914-1038, 2:45-50; NGC914-1001, ¶ 91. Third, the specification describes a need for greater dimensional stability to limit shrinking or expanding of the product, particularly under conditions of changing temperature and humidity. NGC914-1038, 2:57-61; NGC914-1001, ¶ 91. The ’914 patent purports to solve at least one of these issues through the use of allegedly novel gypsum compositions that incorporate certain “enhancing materials” to reduce sag. NGC914-1001, ¶ 91. However, the enhancing material of the claims of the ’914 patent does not appear to be directed to improving the dimensional stability of the set gypsum product. *Id.*

Graux discloses all of the ingredients identified in the claimed composition. NGC914-1001, ¶ 92. In particular, Graux discloses a plaster composition containing calcined gypsum, water, starch, and STMP. NGC914-1006, 1:24-30, 7:32-33, 9:29-30, 10:29-30; NGC914-1001, ¶ 92. A PHOSITA would know that STMP is added to, among other things, increase sag resistance. NGC914-1001, ¶ 92. Before the priority date of the ’914 patent, improving strength, sag resistance, and dimensional

stability were common concerns in the gypsum product industry. NGC914-1001, ¶ 93.

A PHOSITA would also have been very knowledgeable about ASTM C473-95 and would have used it routinely for testing compressive strength, sag resistance, and dimensional stability. NGC914-1001, ¶ 94; NGC914-1014; NGC914-1009. In view of these ASTM tests, a PHOSITA would have been motivated to utilize the known enhancing materials disclosed in Graux. NGC914-1001, ¶ 94. In other words, it would have been obvious for a PHOSITA to apply the predictable solutions described in Graux to yield a product that provided the beneficial and claimed characteristics measured by the well-known ASTM test. *Id.*

The obviousness of the combination and predictable outcome is appropriate in this case because Graux and ASTM C473-95 are in the very same field. NGC914-1001, ¶ 95. In particular, both references relate to gypsum products, with Graux being directed to set gypsum-containing products having enhancing materials for improving sag resistance, and ASTM C473-95 being directed to measuring the sag resistance of such products. *Id.* Moreover, as noted above, the '914 patent repeatedly identifies ASTM C473-95 as the known testing standard before the priority date of the '914 patent, thereby making ASTM C473-95 admitted prior art. NGC914-1003, 18:60-64; NGC914-1001, ¶ 95. As such, a PHOSITA would know that the gypsum products described in Graux are tested for sag resistance using

ASTM C473-95, and would therefore have a reasonable expectation of success in achieving the characteristics described in ASTM C473-95. NGC914-1001, ¶ 95.

Hjelmeland also discloses a set gypsum-containing product including “a first component comprising calcined gypsum suspended in water, and a set retarding substance comprising...inorganic anions selected from the group consisting of polyphosphate and polyborate, or mixtures thereof,” NGC914-1008, 3:60-4:3, and containing the set retarding substance in an amount of “0.01-0.2% by weight of the gross water quantity in the first component.” NGC914-1008, 4:13-15; NGC914-1001, ¶ 96. A PHOSITA would understand that the set retarding substance of Hjelmeland is a condensed phosphoric acid or ion of a condensed phosphate. NGC914-1001, ¶ 96. Moreover, a PHOSITA would understand that STMP, as disclosed by Graux, is a salt of a condensed phosphate. NGC914-1001, ¶ 96. As such, a PHOSITA, understanding the similarities between Hjelmeland, which discloses the amount of condensed phosphoric acid or ion of condensed phosphate to include in a set gypsum-containing product, NGC914-1008, 4:13-15, and Graux, would find it obvious to use the amount of condensed phosphate specified by Hjelmeland in the plaster compositions of Graux because both references disclose a recipe for gypsum-containing product that includes STMP in order to achieve certain beneficial properties. Furthermore, the PHOSITA would have a reasonable expectation of success in combining these references. NGC914-1001, ¶ 96.

Moreover, Sucech, which is cited in the '914 patent, discloses the use of foaming agents in order to “produce[] a multiplicity of large voids substantially uniformly distributed throughout the foamed gypsum core” in set gypsum-containing products. NGC914-1036, 5:12-14; NGC914-1001, ¶ 97. Indeed, a PHOSITA would understand that foaming agents are commonly used in set gypsum-containing products in order to control the density of the products, which, in turn, helps provide strength to the set gypsum-containing products while lowering their weight and bulk density. As such, a PHOSITA, understanding the similarities between Sucech, which discloses the use of foaming agents in production of set gypsum-containing products to lower their weight and density, NGC914-1036, 1:30-35, 5:12-14; NGC914-1001, ¶ 97, and Graux, would find it obvious to add a foaming agent as taught by Sucech to the set gypsum-containing products of Graux and would have a reasonable expectation of success in doing so. Thus, a PHOSITA, understanding the similarities between Sucech, which discloses the use of foaming agents in production of set gypsum-containing products to lower their weight and density, NGC914-1036, 1:30-35, 5:12-14, and Graux, would find it obvious to add a foaming agent as taught by Sucech to the set gypsum-containing products of Graux and would have a reasonable expectation of success in doing so. NGC914-1001, ¶ 97. Indeed, this is precisely what Patent Owner did in the '914 patent when it pointed to Sucech as evidence that “[m]any such foaming agents are well known and readily

commercially available.” NGC914-1038, 10:52-63; NGC914-1001, ¶ 97.

Further, Summerfield, which is discussed in the '914 patent, discloses the basic process for manufacturing set gypsum-containing products, including gypsum board. NGC914-1017, 1:13-35; NGC914-1001, ¶ 98. In particular, Summerfield discloses a gypsum-containing slurry that flows out onto paper and is topped off with another sheet of paper. NGC914-1017, 1:17-30; NGC914-1001, ¶ 98. Thus, a PHOSITA, understanding the similarities between Summerfield, which discloses the basis process of manufacturing gypsum board, NGC914-1017, 1:13-35, and Graux, would find it obvious to manufacture the set gypsum-containing products of Graux with paper coverings as taught by Summerfield and would have a reasonable expectation of success in doing so. NGC914-1001, ¶ 98. Indeed, in the '914 patent, Patent Owner repeatedly cites to Summerfield to demonstrate that “set gypsum is the major component of paper-faced gypsum boards employed in typical drywall construction of interior walls and ceilings of buildings.” NGC914-1038, 1:55-66; NGC914-1001, ¶ 98.

Each of Graux, ASTM C473-95, Hjelmeland, Sucech, and Summerfield are narrowly and directly related to improvements of certain specific and well-known properties of set gypsum-containing products. NGC914-1001, ¶ 99. In particular, Graux, ASTM C473-95, Hjelmeland, Sucech, and Summerfield disclose additives or processes for improving the strength, sag resistance, and/or dimensional stability

of set gypsum-containing products, including the use of various enhancing materials, foams, host particles, paper coverings and the like. NGC914-1001, ¶ 99. Given the similarities between the problem to be solved by Graux, ASTM C473-95, Hjelmeland, Sucech, and Summerfield and the similarities in the solution itself, a PHOSITA would have a reasonable expectation of success in combining the teachings of ASTM C473-95, Hjelmeland, Sucech, and Summerfield with the teachings of Graux. NGC914-1001, ¶ 1009.

A PHOSITA would readily reach to the teaching of one or more of these references because they describe the same products, and each are directed to improving characteristics that were known as desirable in the industry. NGC914-1001, ¶ 101. This is evidenced by the '914 patent. *Id.* When Patent Owner wished to express that certain aspects of its formulation were known, it pointed to related references in the prior art that taught a specific ingredient or element of its disclosed product. *Id.* Petitioner relies on certain of the same references here. *Id.* Petitioner also relies on additional references apparently unknown to Patent Owner and the examiner, but combines those in the same way as Patent Owner did for the Sucech, and Summerfield references. *Id.* Patent Owner's citation of Sucech, and Summerfield in the '914 patent, itself, is an admission that the teachings of at least these references were known to PHOSITAs, were part of the body of the prior art, and would readily be a component of an obvious combination. *Id.* As described

further above and below, Petitioner identifies certain additional references that are readily combined in the same way. *Id.*

To the extent any modifications of the features of Graux, ASTM C473-95, Hjelmeland, Sucech, and Summerfield would have been necessary, such modification would have been well within the skill of a PHOSITA as the set gypsum-containing products disclosed by the references are compatible and chemically similar. NGC914-1001, ¶ 102. The claims themselves contemplate that little more than the ingredients would be known, and otherwise expect those amounts to either be readily known or readily determined by a PHOSITA. *Id.* Petitioner notes that Sucech and Summerfield are only being used for certain claims that recite specific elements. Indeed, USG admits that these claim elements existed in the prior art in the '914 patent.

## **B. Element By Element Analysis**

### **Claim 1a: A gypsum board comprising:**

Graux discloses “a new plaster composition” wherein “[t]he term ‘plaster’ means . . . all building plasters, plasters for special building purposes, plasters for prefabrication and moulding plasters for the arts and industry.” NGC914-1006, 1:6-9; NGC914-1001, ¶ 103. Graux also discloses that this composition is “set” as it discloses “[f]or the preparation of these articles, it is compulsory that the amylaceous compounds have no detrimental influence on the fluidity, the hardening or the



setting” of the composition. NGC914-1006, 1:55-58; NGC914-1001, ¶ 103. Graux discloses that the compositions “must be considered . . . in the form of finished articles of all forms, properties . . . and intended uses,” which necessarily includes prefabricated products like gypsum board. NGC914-1006, 1:24-30; NGC914-1001, ¶ 103. Graux further discloses that compositions produced by this method include gypsum. NGC914-1006, 1:35-39; NGC914-1001, ¶ 103. Graux discloses that the gypsum included in the composition can take several forms: “[t]he origin, nature and concentration of any form of calcium sulphate contained in the plaster (dihydrate form gypsum, hydrated forms, particularly hemihydrates, calcined/rehydrated forms, anhydrous forms, . . . ) are in no way limiting within the context of the present invention.”: *Id.* Accordingly, a PHOSITA would understand that Graux discloses this claim element. NGC914-1001, ¶ 103.

**Claim 1b: a core of material sandwiched between cover sheets, wherein the core comprises an interlocking matrix of set gypsum,**

As Mr. Harlos opines, this claim merely discloses the basic preparation of gypsum board: the calcium sulfate hemihydrate is mixed with additives, including enhancing materials like STMP, and water; is deposited onto a sheet of paper; and is covered with another sheet of paper. NGC914-1001, ¶ 104. Accordingly, PHOSITA would understand that the gypsum-containing slurry, which includes any additives such as STMP, flows out onto paper and is topped off with another sheet

of paper. NGC914-1001, ¶ 104. Further, the '914 patent discloses this claim limitation as it discloses Summerfield, which is directed to manufacturing plasterboard from gypsum. NGC914-1017, 1:13-35; NGC914-1038, 9:19-27; NGC914-1001, ¶ 105. A PHOSITA would be motivated to combine the teachings of Summerfield with Graux at least because, as stated, Summerfield is disclosed in the '914 patent and because both references are in the same field. Indeed, a PHOSITA would be motivated to combine, with a reasonable expectation of success, the disclosure of Summerfield with Graux. NGC914-1001, ¶ 105

Further still, Graux discloses that the gypsum-containing slurry sets to become an interlocking matrix. Indeed, Graux discloses that the “compositions according to the invention must be considered both in the form of powders, these being ready to use or otherwise, and in the form of, for example, more or less homogeneous mixtures of plaster/water, more or less fluid pastes, hardened pastes or finished articles of all forms, properties (including mechanical properties, density and porosity) and intended uses.” NGC914-1006, 1:24-30; NGC914-1001, ¶ 106. Graux further discloses that the composition includes gypsum and that the method includes a “setting” step. NGC914-1006, 1:35-39, 1:55-58; NGC914-1001, ¶ 106. Moreover, Graux discloses mixing the materials, including the additives, for three minutes, and then introducing the mixed composition into a mold so that the composition can set. NGC914-1006, 9:39-46; NGC914-1001, ¶ 106. A PHOSITA

would understand that set gypsum necessarily includes an interlocking matrix of set gypsum. NGC914-1001, ¶ 106. In particular, the existence of an “interlocking matrix” of set gypsum is the reason that set gypsum-containing products have been used for centuries. NGC914-1001, ¶ 106. Accordingly, a PHOSITA would understand that Graux discloses this claim element. NGC914-1001, ¶ 106.

**Claim 1c: the board has been prepared by a method comprising:**

Graux discloses a method of producing a gypsum-board. NGC914-1006, 1:6-9, 1:24-30 (stating that the composition can include additives and the method of making the composition “may be carried out by a large number of different ways....”); NGC914-1001, ¶ 107. In particular, Graux discloses that it teaches a composition that can be used for building, prefabrication, and molding. NGC914-1006, 1:6-9; NGC914-1001, ¶ 107. Graux also discloses that this composition is “set.” NGC914-1006, 1:55-58; NGC914-1001, ¶ 107. Graux further discloses that the composition produced by this method includes gypsum. NGC914-1006, 1:35-39; NGC914-1001, ¶ 107. Graux discloses that the gypsum included in the composition can take several forms: “[t]he origin, nature and concentration of any form of calcium sulphate contained in the plaster (dihydrate form gypsum, hydrated forms, particularly hemihydrates, calcined/rehydrated forms, anhydrous forms,...) are in no way limiting within the context of the present invention.” *Id.* Accordingly, a PHOSITA would understand that Graux discloses this claim element. NGC914-

1001, ¶ 107.

**Claim 1d: forming or depositing a mixture between the cover sheets, wherein the mixture comprises a calcined gypsum, water, an accelerator, and one or more enhancing materials selected from the group consisting of. . . ,**

As Mr. Harlos opines, this claim merely discloses the basic preparation of gypsum board. *See* Ground 1, Claim 1b. NGC914-1017, 1:13-35; NGC914-1003, 9:32-37; NGC914-1001, ¶¶ 108-109.

Graux further discloses mixing “any form of calcium sulphate” including “dihydrate form gypsum, . . . calcined/rehydrated forms,” NGC914-1006, 1: 35-39, with “an equal weight of water,” NGC914-1006, 9:29-30, various “additives” including pregelatinized starch and an accelerator, NGC914-1006, 6:17-44, 7:32-33, and “cationic potato starch . . . , crosslinked with sodium trimetaphosphate.” NGC914-1006, 10:29-30; NGC914-1001, ¶ 110. Accordingly, a PHOSITA would understand that Graux discloses this claim element and, further, that Graux discloses STMP. NGC914-1001, ¶ 110.

Graux specifically discloses STMP as an enhancing material. NGC914-1001, ¶ 111. As stated, Graux discloses that starch is “crosslinked with sodium trimetaphosphate.” NGC914-1006, 10:29-30; NGC914-1001, ¶ 111. A PHOSITA would understand that crosslinking is at least one indicator that STMP is being used as an enhancing material, e.g., for improving at least one of resistance to permanent deformation, strength, and dimensional stability. *Id.* Graux teaches that in a

predominantly gypsum matrix, there is an interaction between gypsum, starch, and/or STMP that improves the quality of the gypsum product. *Id.*

**Claim 1e: maintaining the mixture under conditions sufficient for the calcined gypsum to form the interlocking matrix of set gypsum,**

*See* Ground 1, Claim 1b. NGC914-1006, 1:6-9, 1:24-30, 1:35-39, 1:55-58; NGC914-1001, ¶ 112.

**Claim 1f: the enhancing material or materials having been included in the mixture in an amount such that the gypsum board has greater sag resistance than it would have if the enhancing material had not been included in the mixture, said board having a sag resistance as determined according to ASTM C473-95 of less than about 0.1 inch per two foot length of said board**

Graux discloses the inclusion of enhancing materials in the composition and specifically discloses STMP. NGC914-1006, 7:32-33, 9:29-30, 10:29-30; NGC914-1001, ¶ 113. A PHOSITA would understand that adding an “enhancing material” to the mixture would provide better resistance to deformation than if it was not added. NGC914-1001, ¶ 113. However, a PHOSITA would also understand that there is no standard amount of “enhancing material” to add to the mixture for forming a set gypsum-containing product. *Id.* A PHOSITA, understanding that the prior art discloses the inclusion of enhancing materials in a set gypsum-containing product, would find it obvious to include the enhancing materials in the mixture in amounts that provide for increased sag resistance and would have a reasonable expectation of success in doing so. *Id.*

Further, ASTM C473-95 teaches a method of testing for sag resistance. NGC914-1001, ¶ 114. A PHOSITA, understanding the similarities between ASTM C473-95, which teaches a test method for determining sag resistance, NGC914-1009, ¶ 49, and Graux, would find it obvious to use ASTM C473-95, to test the sag resistance of the composition disclosed by Graux and would have a reasonable expectation of success in doing so. NGC914-1001, ¶ 114.

A PHOSITA would understand that STMP was known in the art as improving the quality of set gypsum-containing products. NGC914-1001, ¶ 115. Further, a PHOSITA would understand that ASTM C473-95 measures one such quality, *i.e.* sag resistance. *Id.* Merely measuring an inherent property of an already-known composition does not make the composition patentable. *See Mexichem Amanco Holdings v. Honeywell Int’l Inc.*, Reexamination Appeal 2015-007833 at \*11-\*16 (Decision on Appeal, March 30, 2016) (rejecting the patentee’s argument that its disclosure of an allegedly previously unknown attribute of a composition already known in the art rendered the composition patentable); *Atlas Powder Co. v. Ireco, Inc.*, 190 F.3d 1342, 1347 (Fed. Cir. 1999) (holding that “the discovery of a previously unappreciated property of a prior art composition, or of a scientific explanation for the prior art’s functioning, does not render the old composition patentably new to the discoverer”). Accordingly, a PHOSITA would understand

that the combination of Graux and ASTM C473-95 discloses this claim element. NGC914-1001, ¶ 115.

Moreover, set gypsum-containing products having sag of less than 0.1 inch were known in the art prior to the priority date of the '914 patent. NGC914-1001, ¶¶ 69, 116. For example, FIGS. 2 and 3 of the '914 patent illustrate the National Gypsum Company Gold Bond® High Strength Ceiling Board as having a sag resistance of .075 inches after 48 hours of testing, the same length of testing prescribed by ASTM C473-95. NGC914-1003, FIGS. 2 & 3; NGC914-1001, ¶ 116. In this regard, the National Gypsum Company Gold Bond® High Strength Ceiling Board achieved improved sag resistance even better than the 0.1 inch requirement established by the '914 patent, and the '914 patent's specification makes clear that the difference in sag between Petitioner's *prior art products* and the alleged invention is irrelevant because it is not detectable to the human eye. NGC914-1003, FIG. 2, 14:46-54, 16:7-21 (stating that the boards were tested in 90 percent humidity at 90 degrees F for seven days); NGC914-1001, ¶ 116.

Furthermore, USG appears to believe that this is a conditional limitation to the extent that USG's Complaint in the related litigation accuses NGC's 5/8" thick gypsum board of literally infringing this claim. NGC914-1028, ¶¶ 46-47 (accusing NGC's "Gold Bond High Strength LITE 1/2-inch gypsum board products, its Gold Bond XP 1/2-inch and 5/8-inch gypsum board products" of infringing). Because, in no

circumstance, can NGC's Gold Bond XP 5/8-inch gypsum board literally infringe this claim, which requires a 1/2 inch board thickness, USG demonstrated that it views this claim limitation as lacking substantive meaning.

**Claim 1g: the accelerator having been included in an amount such that the gypsum board has greater strength than it would have if the accelerator had not been included in the mixture.**

Graux discloses the inclusion of additives in the composition. NGC914-1006, 7:32-33, 9:29-30, 10:29-30; NGC914-1001, ¶ 117. Accelerators are added to accelerate hardening of the gypsum-containing product. NGC914-1001, ¶ 117; NGC914-1008, Abstract; NGC914-1001, ¶ 117. Indeed, a PHOSITA would understand that adding an accelerator to the mixture would provide improved strength to gypsum-containing products over those to which it was not added. *Id.* However, a PHOSITA would also understand that there is no standard amount of accelerator to add to the mixture for forming a set gypsum-containing product. *Id.* Indeed, the amount of accelerator added to the mixture varies from day-to-day and plant-to-plant depending on various factors including temperature, production rates, etc. *Id.* A PHOSITA, understanding that the prior art discloses the inclusion of enhancing materials in a set gypsum-containing product, would find it obvious to include the enhancing materials, including an accelerator, in the mixture in amounts that provides for strength and would have a reasonable expectation of success in doing so. *Id.*



Moreover, Hjelmeland teaches that accelerators “accelerate the hardening process.” NGC914-1008, Abstract; NGC914-1001, ¶ 118. Because Hjelmeland and Graux are in the very same field (i.e. set gypsum-containing products) as previously discussed, a PHOSITA would understand that the descriptions of accelerators disclosed by Hjelmeland also apply to the accelerators of Graux. NGC914-1001, ¶ 118.

**Claim 2: The gypsum board of claim 1, wherein the concentration of the enhancing material in the mixture is from 0.004 to 2.0 percent by weight, based on the weight of the calcined gypsum.**

As stated, Graux discloses using “cationic potato starch . . . , crosslinked with sodium trimetaphosphate” in making the disclosed set gypsum board. NGC914-1006, 10:29-30; NGC914-1001, ¶ 119. Hjelmeland discloses a set gypsum product, which includes “a set retarding substance comprising (i) an organic acid containing at least two acid groups selected from the group consisting of . . . phosphate or phosphonate . . . and/or (ii) inorganic anions selected from the group consisting of polyphosphate . . . .” NGC914-1008, 3:60-4:2; NGC914-1001, ¶ 119. Hjelmeland further discloses that “the set retarding substance constitutes . . . 0.01-0.2% . . . by weight of the gross water quantity in the first component.” NGC914-1008, 4:13-15 NGC914-1001, ¶ 119. Accordingly, PHOSITA would further understand that Hjelmeland discloses the addition of the “set retarding substance” in the claimed range. NGC914-1001, ¶ 119. Further, a PHOSITA would understand that the “set

retarding substance” of Hjelmeland is STMP. NGC914-1001, ¶ 119

Although Hjelmeland discloses STMP as a “set retarding substance,” a PHOSITA would understand that, as with many reagents, the accelerating and retarding effects of STMP vary based on pH. NGC914-1001, ¶ 120. Indeed, a PHOSITA would understand that at a high pH STMP acts as a retarder, and at a lower pH STMP acts as an accelerator. *Id.* A PHOSITA would also understand that Hjelmeland is primarily directed to the use of plaster, which has a high pH. *Id.* As such, a PHOSITA would understand that because the plaster is at a high pH, STMP will act as a retarder. *Id.* Moreover, a PHOSITA would understand that Hjelmeland uses the term “set retarding substance” to refer to STMP’s ability to extend the induction time of gypsum, which delays the time at which the gypsum begins to set and, as such, allows the gypsum to be manipulated without subjecting growing crystals to shear. *Id.* Indeed, STMP increases the core strength of the set gypsum product because it allows a greater proportion of crystals to grow undisturbed. *Id.* In this regard, a PHOSITA would understand that Hjelmeland teaches an interaction between STMP and gypsum that results in a product with at least increased core strength. *Id.*

A PHOSITA would understand that the water quantity in Hjelmeland can be equated with the calcined gypsum quantity in Hjelmeland. In particular, for the applications described by Hjelmeland, a PHOSITA would understand that a

water/stucco ratio of 0.66 is used. NGC914-1001, ¶ 121. As such, although Hjelmeland discloses that “the set retarding substance constitutes . . . 0.01-0.2% . . . by weight of the gross water quantity in the first component,” NGC914-1008, 4:13-15, this range equates to an amount of STMP of 0.0066-0.132% by weight of the calcined gypsum. NGC914-1001, ¶ 121. Moreover, Examples 15 and 16 of Hjelmeland teach the use of an amount STMP of 0.033% by weight of the calcined gypsum. NGC914-1008, 12:24-26, 12:48-50; NGC914-1001, ¶ 121.

A PHOSITA would understand that the set retarding substance of Hjelmeland is a condensed phosphoric acid or ion of a condensed phosphate. NGC914-1001, ¶ 122. Moreover, a PHOSITA would understand that STMP, as disclosed by Graux, is a salt of a condensed phosphate. *Id.* Furthermore, a PHOSITA would understand that the water quantity in Hjelmeland can be equated with the calcined gypsum quantity in Hjelmeland. *Id.* As such, a PHOSITA, understanding the similarities between Hjelmeland, which discloses the amount of condensed phosphoric acid or ion of condensed phosphate to include in a set gypsum-containing product, NGC914-1008, 4:13-15, and Graux, would find it obvious to use approximately the amount of condensed phosphate specified by Hjelmeland in the plaster compositions of Graux and would have a reasonable expectation of success in doing so. NGC914-1001, ¶ 122.

A PHOSITA would understand that when the prior art discloses a range that

falls within the claimed range, the claimed range is obvious over the prior art. *Id.*; see *Titanium Metals Corp. v. Banner*, 778 F.2d 775, 227 USPQ 773 (Fed. Cir. 1985) (stating that a titanium (Ti) alloy with 0.6-0.9% nickel (Ni) and 0.2-0.4% molybdenum (Mo) was anticipated by a graph containing a data point corresponding to a Ti alloy containing 0.25% Mo and 0.75% Ni, which was within the claimed range of compositions.). Accordingly, a PHOSITA would understand that the combination of Graux and Hjelmeland discloses this claim element. NGC914-1001, ¶ 122.

**Claim 3: The gypsum board of claim 1, wherein the calcined gypsum comprises one or more of: calcium sulfate anhydrite; calcium sulfate hemihydrate; or ions of calcium and sulfate.**

As stated, Graux discloses a set gypsum-containing product including “any form of calcium sulphate” including “dihydrate form gypsum, hydrated forms, particularly hemihydrates, calcined/rehydrated forms, anhydrous forms, . . .” NGC914-1006, 1:35-39; NGC914-1001, ¶ 124. Accordingly, a PHOSITA would understand that Graux discloses this claim element. NGC914-1001, ¶ 124.

**Claim 4: The gypsum board of claim 1, wherein the enhancing material comprises one or more of the following salts, or the anionic portions thereof: sodium trimetaphosphate and ammonium polyphosphate having 1000-3000 repeating phosphate units.**

See Ground 1, Claim 1d. NGC914-1006, 1:35-39, 9:29-30, 6:17-44, 10:29-30; NGC914-1001, ¶¶ 125-126.

**Claim 6: The gypsum board of claim 1, wherein the mixture further comprises a pregelatinized starch.**

Graux further discloses that the “amylaceous compound,” which is a starch, “may, before, at the same time as or after the cationization stage, undergo a physical treatment or several physical treatments, which may or may not be performed simultaneously” including “drum gelatinization.” NGC914-1006, 6:17-44; NGC914-1001, ¶ 127. Accordingly, a PHOSITA would understand that Graux discloses pregelatinized starch as it discloses that the amylaceous compound can be gelatinized in a drum before the cationization stage and would then be added to the slurry. NGC914-1001, ¶ 127. Moreover, Graux discloses the inclusion of pregelatinized starch as the reference recognizes that pregelatinized starch existed in the prior art and “is an advantageous water retaining agent.” NGC914-1006, 2:6-11 (citing EP 117 431); NGC914-1001, ¶ 128. Moreover, a PHOSITA would understand that the use of pregelatinized starch was a known alternative to other starches, because pregelatinized starches confer certain beneficial properties, such as improved mix rheology, bubble structure, and dry strength. NGC914-1001, ¶ 129.

**Claim 8: The gypsum board of claim 1, wherein: the core has voids uniformly distributed therein; and the mixture further comprises an aqueous foam.**

The '914 patent discloses to Sucech, which discloses the use of foaming

agents in order to “produce[] a multiplicity of large voids substantially uniformly distributed throughout the foamed gypsum core.” NGC914-1036, 5:12-14 (emphasis added); NGC914-1038, 9:60-62; NGC914-1001, ¶ 130. Accordingly, a PHOSITA would understand that foaming agents are routinely used in set gypsum-containing products in order to, *inter alia*, reduce the density of the products, decrease drying time, and decrease the use of raw gypsum. NGC914-1001, ¶ 131. A PHOSITA would further understand that the use of foaming agents help control the density of the composition, which helps to maintain the strength of the composition while lowering the weight and bulk density of the composition. NGC914-1001, ¶ 131. As stated, a PHOSITA, understanding the similarities between Sucech, which discloses the use of foaming agents in production of set gypsum-containing products to lower their weight and bulk density, NGC914-1036, 1:30-35, 5:12-14, and Graux, would find it obvious to add a foaming agent as taught by Sucech to the set gypsum-containing products of Graux and would have a reasonable expectation of success in doing so. NGC914-1001, ¶ 136.

**Claim 10: The gypsum board of claim 1, wherein the mixture further comprises a pregelatinized starch and an aqueous foam.**

*See* Ground 1, Claim 6 (discussing the pregelatinized starch). NGC914-1006, 2:6-11, 6:17-44; NGC914-1001, ¶¶ 132-134.

*See* Ground 1, Claim 8 (discussing the foaming agent). NGC914-1036, 1:30-

35, 5:12-14; NGC914-1038, 9:60-62; NGC914-1001, ¶¶ 135-136.

**XII. OBVIOUSNESS OF CLAIMS 1-4, 6, 8, AND 10 BASED ON SATTERTHWAITE IN VIEW OF HJELMELAND, ASTM C473-95, SUCECH, AND SUMMERFIELD**

**A. Motivation to Combine Satterthwaite, ASTM C473-95, Hjelmeland, Sucech, and Summerfield**

The '914 patent essentially emphasizes three points relevant to gypsum containing products. First, the specification notes there is a “continuing effort” to make set gypsum products lighter, and notes that the natural consequence of that is a need to increase the strength of the product beyond normal levels to increase overall strength. NGC914-1038, 2:27-35; NGC914-1001, ¶ 150-152. Second, the specification notes that under high humidity conditions, there is a need for greater sag resistance. NGC914-1038, 2:45-50; NGC914-1001, ¶ 150. Third, the specification describes a need for greater dimensional stability to limit shrinking or expanding of the product, particularly under conditions of changing temperature and humidity. NGC914-1038, 2:57-61; NGC914-1001, ¶ 150. The '914 patent purports to solve at least one of these issues through the use of allegedly novel gypsum compositions that incorporate certain “enhancing materials” to reduce sag. However, the enhancing material of the claims of the '914 patent does not appear to be directed to improving the dimensional stability of the set gypsum product.

A PHOSITA would also have been very experienced and knowledgeable with ASTM C473-95 and similar testing methods and would have known the specific tests for testing strength, sag resistance, and dimensional stability. NGC914-1001, ¶ 151; NGC914-1009; NGC914-1014. In particular, in light of these ASTM tests specifying the characteristics that are indicative of a quality gypsum product, a PHOSITA would have been motivated to utilize the known enhancing materials disclosed in Satterthwaite and the accelerators disclosed by Hjelmeland and the '914 patent. NGC914-1001, ¶ 151. In other words, it would have been obvious for a PHOSITA to at least try the predictable solutions described in Satterthwaite, and there would have been a reasonable expectation that those ingredients would have yielded a product that provided the required characteristics described in the claim – strength and sag resistance. *Id.* Moreover, a PHOSITA would understand that Satterthwaite's disclosure of a slurry formed into acoustical tiles is equally applicable to other set gypsum-containing products including gypsum boards. *Id.* Indeed, the '914 patent states that “[t]he invention relates to a method and composition for preparing set gypsum-containing products, e.g., gypsum boards, reinforced gypsum composite boards, plasters, machinable materials, joint treatment materials, and acoustical tiles...” NGC914-1038, 1:25-30; NGC914-1001, ¶ 151. The specification further states that it relates to “products [that] contain set gypsum (calcium sulfate dihydrate)” to include “paper-faced gypsum boards,”



“gypsum/cellulose fiber composite boards,” “[p]roducts that fill and smooth the joints between edges of gypsum boards,” “[a]coustical tiles useful in suspended ceilings,” and “[t]raditional plasters.” NGC914-1038, 1:56-2:8; NGC914-1001, ¶ 151.

The obviousness of the combination and predictable outcome is heightened in this case because Satterthwaite and ASTM C473-95 are in the very same field. NGC914-1001, ¶ 154. In particular, both references relate to gypsum products, with Satterthwaite being directed to set gypsum-containing products having enhancing materials for improving sag resistance, and ASTM C473-95 being directed to measuring the sag resistance of such products. *Id.* Moreover, as noted above, the ’914 patent repeatedly identifies ASTM C473-95 as being the known testing standard at the time the ’914 patent was filed, thereby making ASTM C473-95 admitted prior art. NGC914-1002, 18:37-46; NGC914-1001, ¶ 154. As such, a PHOSITA, understanding the similarities between ASTM C473-95 and Satterthwaite, would find it obvious to use ASTM C473-95 to test the sag resistance of the gypsum-containing tile products of Satterthwaite and would have a reasonable expectation of success in doing so. NGC914-1001, ¶ 154.

Still further, Hjelmeland discloses a set gypsum-containing product including “a first component comprising calcined gypsum suspended in water, and a set retarding substance comprising...inorganic anions selected from the group

consisting of polyphosphate and polyborate, or mixtures thereof,” and containing the set retarding substance in an amount of “0.01-0.2% by weight of the gross water quantity in the first component.” NGC914-1008, 3:60-4:3, 4:13-15; NGC914-1001, ¶ 155. A PHOSITA would understand that the set retarding substance of Hjelmeland is a condensed phosphoric acid or ion of a condensed phosphate. NGC914-1001, ¶ 155. Moreover, a PHOSITA would understand that STMP, as disclosed by Satterthwaite, is a salt of a condensed phosphate. *Id.* As such, a PHOSITA, understanding the similarities between Hjelmeland, which discloses the amount of condensed phosphoric acid or ion of condensed phosphate to include in a set gypsum-containing product, NGC914-1008, 4:13-15, and Satterthwaite, would find it obvious to use the amount of condensed phosphate specified by Hjelmeland in the plaster compositions of Satterthwaite and would have a reasonable expectation of success in doing so. NGC914-1001, ¶ 155.

Moreover, Sucech, which is cited in the '914 patent, discloses the use of foaming agents in order to “produce[] a multiplicity of large voids substantially uniformly distributed throughout the foamed gypsum core” in set gypsum-containing products. NGC914-1036, 5:12-14; NGC914-1001, ¶ 156. Indeed, a PHOSITA would understand that foaming agents are commonly used in set gypsum-containing products in order to control the density of the products, which, in turn, helps provide strength to the set gypsum-containing products while lowering their

weight and bulk density. NGC914-1001, ¶ 156. As such, a PHOSITA, understanding the similarities between Sucech, which discloses the use of foaming agents in production of set gypsum-containing products to lower their weight and density, NGC914-1036, 1:30-35, 5:12-14, and Satterthwaite, would find it obvious to add a foaming agent as taught by Sucech to the set gypsum-containing products of Satterthwaite and would have a reasonable expectation of success in doing so. NGC914-1001, ¶ 156. Indeed, this is precisely what Patent Owner did in the '914 patent when it pointed to Sucech as evidence that “[m]any such foaming agents are well known and readily commercially available.” NGC914-1038, 10:52-63; NGC914-1001, ¶ 156.

Further, Summerfield, which is discussed in the '914 patent, discloses the basic process for manufacturing set gypsum-containing products, including gypsum board. NGC914-1017, 1:13-35; NGC914-1001, ¶ 157. In particular, Summerfield discloses a gypsum-containing slurry that flows out onto paper and is topped off with another sheet of paper. NGC914-1017, 1:17-30; NGC914-1001, ¶ 157. Thus, a PHOSITA, understanding the similarities between Summerfield, which discloses the basis process of manufacturing gypsum board, NGC914-1017, 1:13-35, and Satterthwaite, would find it obvious to manufacture the set gypsum-containing products of Satterthwaite with paper coverings as taught by Summerfield and would have a reasonable expectation of success in doing so. NGC914-1001, ¶ 157. Indeed,

in the '914 patent, Patent Owner repeatedly cites to Summerfield to demonstrate that “set gypsum is the major component of paper-faced gypsum boards employed in typical drywall construction of interior walls and ceilings of buildings.” NGC914-1038, 1:55-66; NGC914-1001, ¶ 157.

Each of Satterthwaite, ASTM C473-95, Hjelmeland, Sucech, and Summerfield are narrowly and directly related to improvements of certain specific and well-known properties of set gypsum-containing products. In particular, Satterthwaite, ASTM C473-95, Hjelmeland, Sucech, and Summerfield disclose additives or processes for improving the strength, sag resistance, and/or dimensional stability of set gypsum-containing products, including the use of various enhancing materials, foams, host particles, paper coverings and the like. NGC914-1001, ¶ 158. Given the similarities between the problems to be solved by Satterthwaite, ASTM C473-95, Hjelmeland, Sucech, and Summerfield and the similarities in their solutions, a PHOSITA would have a reasonable expectation of success in combining the teachings of ASTM C473-95, Hjelmeland, Sucech, and Summerfield with the teachings of Satterthwaite. NGC914-1001, ¶ 159.

A PHOSITA would readily reach to the teachings of one or more of these references because they describe the same products and each are directed to improving characteristics that were known as desirable in the industry. *Id.* This is evidenced by the '914 patent. *Id.* When Patent Owner wished to express that certain

aspects of its formulation were known, it pointed to related references in the prior art that taught a specific ingredient or element of its disclosed product. *Id.* Petitioner relies on certain of the same references here. *Id.* Petitioner also relies on additional references apparently unknown to Patent Owner and the examiner, but combines those in the same way as Patent Owner did for the Sucech, and Summerfield references. *Id.* Patent Owner's citation of Sucech, and Summerfield in the '914 patent, itself, is an admission that the teachings of at least these references were known to PHOSITAs, were part of the body of the prior art, and would readily be a component of an obviousness combination. *Id.* As described further above and below, Petitioner identifies certain additional references that are readily combined in the same way. *Id.*

To the extent any modifications of the features of Satterthwaite, ASTM C473-95, Hjelmeland, Sucech, and Summerfield would have been necessary, such modification would have been well within the skill of a PHOSITA as the set gypsum-containing products disclosed by the references are compatible and chemically similar. NGC914-1001, ¶ 160. Indeed, the asserted claims appear to directly support this conclusion to the extent that they do not recite specific amounts, but instead simply require an enhancing material “in an amount such that the set gypsum-containing product has greater resistance to permanent deformation,” and an accelerator “in an amount such that the set gypsum-containing product has greater

strength than it would have if the accelerator had not been included in the mixture.”

*Id.* As such, the claims themselves contemplate that little more than the ingredients would be known, and otherwise expect those amounts to either be readily known or readily determined by a PHOSITA. *Id.* Petitioner notes that Sucech and Summerfield are only being used for certain claims that recite specific elements. Indeed, USG admits that these claim elements existed in the prior art in the '914 patent.

## **B. Element By Element Analysis**

### **Claim 1a: A gypsum board comprising:**

Satterthwaite discloses the “manufacture of acoustical ceiling tile and other tile products made from a mixture of water, gypsum, mineral wool and other ingredients.” NGC914-1007, 1:16-18; NGC914-1001, ¶ 161. Satterthwaite further discloses that the tile products are gypsum boards and that “the mixture is blended and formed into sheets . . . ., [t]he tile is then cut into sections, dried in an oven, cooled, cut, and processed for sale.” NGC914-1007, 3:40-42; NGC914-1001, ¶¶ 151, 161. Accordingly, a PHOSITA would understand that Satterthwaite discloses this claim element.

### **Claim 1b: a core of material . . . interlocking matrix of set gypsum,**

As Mr. Harlos opines, this claim merely discloses the basic preparation of gypsum board. *See* Ground 1, Claim 1b. NGC914-1017, 1:13-35; NGC914-1003,

9:32-37; NGC914-1001, ¶ 162. A PHOSITA would be motivated to combine the teachings of Summerfield with Satterthwaite at least because, as stated, Summerfield is disclosed in the '914 patent and because both references are in the same field. NGC914-1001, ¶ 163. Indeed, a PHOSITA would be motivated to combine, with a reasonable expectation of success, the disclosure of Summerfield with Satterthwaite. NGC914-1001, ¶ 163.

Further, Satterthwaite discloses set gypsum-containing products as it is directed to the “manufacture of acoustical ceiling tile and other tile products made from a mixture of water, gypsum, mineral wool and other ingredients.” NGC914-1007, 1:16-18; NGC914-1001, ¶ 164. Satterthwaite further discloses that the tile products are set gypsum-containing products and states that “the mixture is blended and formed into sheets . . . ., [t]he tile is then cut into sections, dried in an oven, cooled, cut, and processed for sale.” NGC914-1007, 3:40-42; NGC914-1001, ¶ 164. A PHOSITA would understand that set gypsum necessarily includes an interlocking matrix of set gypsum. In particular, the existence of an “interlocking matrix” of set gypsum is the reason that set gypsum-containing products have been used for centuries. NGC914-1001, ¶ 164. Accordingly, a PHOSITA in the art would understand that Satterthwaite discloses this claim element. NGC914-1001, ¶ 164.

**Claim 1c: the board has been prepared . . . :**

Satterthwaite discloses the “manufacture of acoustical ceiling tile and other

tile products made from a mixture of water, gypsum, mineral wool and other ingredients.” NGC914-1007, 1:16-18; NGC914-1001, ¶ 165. Satterthwaite further discloses that the tile products are set gypsum-containing products and states that “the mixture is blended and formed into sheets . . . , [t]he tile is then cut into sections, dried in an oven, cooled, cut, and processed for sale.” NGC914-1007, 3:40-42; NGC914-1001, ¶ 165. Accordingly, a PHOSITA would understand that Satterthwaite discloses this claim element. NGC914-1001, ¶ 165.

**Claim 1d: forming or depositing a mixture between the cover sheets, . . . and,**

As Mr. Harlos opines, this claim merely discloses the basic preparation of gypsum board. *See* Ground 2, Claim 1b. NGC914-1017, 1:13-35; NGC914-1003, 9:32-37; NGC914-1001, ¶¶ 167-168.

Satterthwaite discloses mixing “water, gypsum, mineral wool and other ingredients.” NGC914-1007, 1:16-18; NGC914-1001, ¶ 168. As stated, although Satterthwaite only discloses the term “gypsum,” a PHOSITA would understand that the term “gypsum,” when used so broadly and in such context, may refer to any form of gypsum, including, for example, calcium sulfate hemihydrate (*i.e.* calcined gypsum) or calcium sulfate dihydrate (*i.e.* raw or set gypsum). NGC914-1001, ¶ 168. Moreover, Satterthwaite discloses including STMP as it describes “treating the starch in aqueous alkali slurry with reagents such as...sodium trimetaphosphate...or



others which form cross-links between the starch molecules.” NGC914-1007, 2:9-13; NGC914-1001, ¶ 168

Patent Owner may argue that Satterthwaite merely discloses gypsum used as an inert filler and that it discloses starch as the binder that is crosslinked by STMP. NGC914-1001, ¶ 169. Further, Patent Owner may argue that Satterthwaite’s disclosure of gypsum is meant to refer only to the raw form and not calcined gypsum that is hydrated to create an interlocking matrix of set gypsum. NGC914-1001, ¶ 169. It would be a very small step for a PHOSITA to replace gypsum as the binder or use gypsum as a co-binder along with starch as disclosed in Satterthwaite. NGC914-1001, ¶ 169. In fact, the ’914 patent specifically indicates that, as early as 1966, it was known in the art that acoustical ceiling tiles could be made using rehydrated calcium sulfate hemihydrate, *i.e.* set gypsum. NGC914-1038, 2:9-22; *see also*, NGC914-1027. Further, it was well-known in the art prior to the earliest priority date of the ’914 patent that gypsum could be either used as a filler or a binder and that when gypsum is to be used as a binding agent, the calcined form of gypsum is used so that when mixed with water, the hemihydrate form of gypsum hydrates to form calcium sulfate dihydrate, which is also known as set gypsum. NGC914-1001, ¶ 69, 169.

It is sufficient that Satterthwaite discloses STMP; however, Satterthwaite specifically discloses STMP as an enhancing material. NGC914-1001, ¶¶ 170-172.

As stated, Satterthwaite discloses treating starch with STMP. NGC914-1007, 2:9-13; NGC914-1001, ¶ 172. Enhancing materials are additives that improve at least one of resistance to permanent deformation, strength, and dimensional stability in set gypsum-containing products, with such enhancing materials including STMP. NGC914-1001, ¶ 172. Satterthwaite further discloses that “the finished tile shows...increased resistance to warp or sag,” NGC914-1007, 1:60-62, and that “[w]hen used in tile making, my starch composition...increases the resistance to sag or warp.” NGC914-1007, 4:24-27; NGC914-1001, ¶ 172.

Indeed, Hjelmeland also discloses STMP. NGC914-1001, ¶ 173. Although Hjelmeland discloses STMP as a “set retarding substance,” a PHOSITA would understand that Hjelmeland uses the term “set retarding substance” to refer to STMP’s ability to extend the induction time of gypsum, which delays the time at which the gypsum begins to set and, as such, allows the gypsum to be manipulated without subjecting growing crystals to shear. NGC914-1001, ¶ 173. In this regard, a PHOSITA would understand that Hjelmeland teaches an interaction between STMP and gypsum that results in a product with at least increased core strength. *Id.* Accordingly, a PHOSITA would understand that STMP is being used as an enhancing material, e.g., for improving at least one of resistance to permanent deformation, strength, and dimensional stability. *Id.*

Hjelmeland teaches the inclusion of accelerators that “accelerate the hardening process.” NGC914-1008, Abstract; NGC914-1001, ¶ 171. Accelerators are added to accelerate hardening of the gypsum-containing product. NGC914-1001, ¶ 171. Indeed, a PHOSITA would understand that adding an accelerator to the mixture would provide improved strength to set gypsum-containing products over those to which it was not added. Because Hjelmeland and Satterthwaite are in the very same field (i.e. set gypsum-containing products) as previously discussed, a PHOSITA would understand that the accelerators disclosed by Hjelmeland can be used in the set gypsum-containing tile products of Satterthwaite. NGC914-1001, ¶ 171.

**Claim 1e: maintaining the mixture . . . ,**

*See* Ground 2, Claim 1b. NGC914-1007, 1:16-18, 3:40-42; NGC914-1001, ¶ 174.

**Claim 1f: the enhancing material or materials having been included in the mixture in an amount . . .**

Satterthwaite discloses STMP as it describes “treating the starch in aqueous alkali slurry with reagents such as...sodium trimetaphosphate...or others which form cross-links between the starch molecules,” that “the finished tile shows...increased resistance to warp or sag,” and that “[w]hen used in tile making, my starch composition...increases the resistance to sag or warp.” NGC914-1007,

1:60-62, 2:9-13, 4:24-27; NGC914-1001, ¶ 175. A PHOSITA would understand that adding an “enhancing material” to the mixture would provide better sag resistance than if it was not added. NGC914-1001, ¶¶ 175-176. However, a PHOSITA would also understand that there is no standard amount of “enhancing material” to add to the mixture for forming a set gypsum-containing product. *Id.* A PHOSITA, understanding that the prior art discloses the inclusion of enhancing materials in a set gypsum-containing product, would find it obvious to include the enhancing materials in the mixture in amounts that provide for increased sag resistance and would have a reasonable expectation of success in doing so. *Id.*

A PHOSITA, understanding the similarities between ASTM C473-95, which teaches a test method for determining sag resistance, NGC914-1009, ¶ 49, and Satterthwaite, would find it obvious to use ASTM C473-95 to test the sag resistance of the tile products of Satterthwaite and would have a reasonable expectation of success in doing so. NGC914-1001, ¶ 177.

A PHOSITA would understand that STMP was known in the art as improving the quality of set gypsum-containing products. NGC914-1001, ¶ 178. Further, a PHOSITA would understand that ASTM C473-95 measures one such quality, *i.e.* sag resistance. *Id.* Merely measuring an inherent property of an already-known composition does not make the composition patentable. *See Mexichem Amanco Holdings*, Reexamination Appeal 2015-007833 at \*11-\*16; *Atlas Powder Co. v.*

*Ireco, Inc.*, 190 F.3d at 1347. Accordingly, a PHOSITA would understand that the combination of Satterthwaite and ASTM C473-95 discloses this claim element. NGC914-1001, ¶ 178.

Moreover, set gypsum-containing products having sag of less than 0.1 inch were known in the art prior to the priority date of the '914 patent. NGC914-1001, ¶ 69, 179. For example, FIGS. 2 and 3 of the '914 patent illustrate the National Gypsum Company Gold Bond® High Strength Ceiling Board as having a sag resistance of .075 inches after 48 hours of testing, the same length of testing prescribed by ASTM C473-95. NGC914-1003, FIGS. 2 & 3; NGC914-1001, ¶ 179. In this regard, the National Gypsum Company Gold Bond® High Strength Ceiling Board achieved improved sag resistance even better than the 0.1 inch requirement established by the '914 patent, and the '914 patent's specification makes clear that the difference in sag between Petitioner's *prior art products* and the alleged invention is irrelevant because it is not detectable to the human eye. NGC914-1003, FIG. 2, 14:46-54, 16:7-21 (stating that the boards were tested in 90 percent humidity at 90 degrees F for seven days); NGC914-1001, ¶ 179.

Furthermore, USG appears to believe that this is a conditional limitation to the extent that USG's Complaint in the related litigation accuses NGC's 5/8" thick gypsum board of literally infringing this claim. NGC914-1028, ¶¶ 46-47 (accusing NGC's "Gold Bond High Strength LITE 1/2-inch gypsum board products, its Gold

Bond XP ½-inch and ⅝-inch gypsum board products” of infringing). Because, in no circumstance, can NGC’s Gold Bond XP ⅝-inch gypsum board literally infringe this claim, which requires a ½ inch board thickness, USG demonstrated that it views this claim limitation as lacking substantive meaning.

**Claim 1g: the accelerator having been included . . . .**

Accelerators are added to accelerate hardening of the gypsum-containing product. NGC914-1001, ¶ 180. Indeed, a PHOSITA would understand that adding an accelerator to the mixture would provide improved strength to set gypsum-containing products over those to which it was not added. *Id.* However, a PHOSITA would also understand that there is no standard amount of accelerator to add to the mixture for forming a set gypsum-containing product. *Id.* Indeed, the amount of accelerator added to the mixture varies from day-to-day and plant-to-plant depending on various factors including temperature, production rates, etc. *Id.* A PHOSITA, understanding that the prior art discloses the inclusion of an accelerator in a set gypsum-containing product, would find it obvious to include the accelerator in the mixture in an amount that provides for increased strength and would have a reasonable expectation of success in doing so. *Id.*

Moreover, Hjelmeland teaches that accelerators “accelerate the hardening process.” NGC914-1008, Abstract; NGC914-1001, ¶ 1814. Because Hjelmeland and Satterthwaite are in the very same field (*i.e.* set gypsum-containing products), a

PHOSITA would understand that the accelerators disclosed by Hjelmeland can be used in the set gypsum-containing tile products of Satterthwaite. NGC914-1001, ¶ 181. Accordingly, a PHOSITA would understand that a combination of Satterthwaite and Hjelmeland discloses this claim element. *Id.*

**Claim 2: The gypsum board of claim 1, wherein the concentration of the enhancing material in the mixture is from 0.004 to 2.0 percent by weight. . . .**

Satterthwaite discloses STMP as it describes “treating the starch in aqueous alkali slurry with reagents such as...sodium trimetaphosphate...or others which form cross-links between the starch molecules.” NGC914-1007, 2:9-13; NGC914-1001, ¶ 182. Hjelmeland discloses a set gypsum-containing product, which includes “a set retarding substance comprising (i) an organic acid containing at least two acid groups selected from the group consisting of...phosphate or phosphonate...and/or (ii) inorganic anions selected from the group consisting of polyphosphate....,” and that “the set retarding substance constitutes...0.01-0.2%...by weight of the gross water quantity in the first component.” NGC914-1008, 3:60-4:2, 4:13-15; NGC914-1001, ¶ 182. Accordingly, a PHOSITA would further understand that Hjelmeland discloses the addition of the “set retarding substance” in the claimed range. NGC914-1001, ¶ 182. Further, a PHOSITA would understand that the “set retarding substance” of Hjelmeland includes STMP. *Id.*

Although Hjelmeland discloses STMP as a “set retarding substance,” a PHOSITA would understand that Hjelmeland uses the term “set retarding substance” to refer to STMP’s ability to extend the induction time of gypsum, which delays the time at which the gypsum begins to set and, as such, allows the gypsum to be manipulated without subjecting growing crystals to shear. NGC914-1001, ¶ 183. In this regard, a PHOSITA would understand that Hjelmeland teaches an interaction between STMP and gypsum that results in a product with at least increased core strength. *Id.*

A PHOSITA would understand that the set retarding substance of Hjelmeland is a condensed phosphoric acid or ion of a condensed phosphate. NGC914-1001, ¶ 184. Moreover, a PHOSITA would understand that STMP, as disclosed by Satterthwaite, is a salt of a condensed phosphate. *Id.* Furthermore, a PHOSITA would understand that the water quantity in Hjelmeland can be equated with the calcined gypsum quantity in Hjelmeland. NGC914-1001, ¶ 185. As such, a PHOSITA, understanding the similarities between Hjelmeland, which discloses the amount of condensed phosphoric acid or ion of condensed phosphate to include in a set gypsum-containing product, NGC914-1008, 4:13-15, and Satterthwaite, would find it obvious to use approximately the amount of condensed phosphate specified by Hjelmeland in the tile products of Satterthwaite and would have a reasonable expectation of success in doing so. NGC914-1001, ¶ 185.



A PHOSITA would understand that when the prior art discloses a range that falls within the claimed range, the claimed range is obvious over the prior art. *Id.*; see *Titanium Metals Corp.*, 778 F.2d 775. Accordingly, a PHOSITA would understand that the combination of Satterthwaite and Hjelmeland discloses this claim element. NGC914-1001, ¶ 185.

**Claim 3: The gypsum board of claim 1, wherein the calcined gypsum comprises one or more of: . . . .**

Satterthwaite discloses the “manufacture of acoustical ceiling tile and other tile products made from a mixture of water, gypsum, mineral wool and other ingredients.” NGC914-1007, 1:16-18; NGC914-1001, ¶ 187. Satterthwaite further discloses that “the mixture is blended and formed into sheets . . . ., [t]he tile is then cut into sections, dried in an oven, cooled, cut, and processed for sale.” NGC914-1007, 3:40-42; NGC914-1001, ¶ 187. Accordingly, a PHOSITA would understand that Satterthwaite discloses this claim element given that the aforementioned acoustical tiles would be made containing calcined gypsum, which is calcium sulfate hemihydrate. NGC914-1001, ¶ 187

Patent Owner may argue that Satterthwaite merely discloses gypsum used as an inert filler and that it discloses starch as the binder that is crosslinked by STMP. NGC914-1001, ¶ 188. Further, Patent Owner may argue that Satterthwaite’s disclosure of gypsum is meant to refer only to the raw form and not calcined gypsum

that is hydrated to create an interlocking matrix of set gypsum. *Id.* It would be a very small step for a PHOSITA to replace gypsum as the binder or use gypsum as a co-binder along with starch as disclosed in Satterthwaite. *Id.* In fact, the '914 patent specifically indicates that, as early as 1966, it was known in the art that acoustical ceiling tiles could be made using rehydrated calcium sulfate hemihydrate, *i.e.* set gypsum. NGC914-1038, 2:9-22; *see also*, NGC914-1027. Further, it was well-known in the art prior to the earliest priority date of the '914 patent that gypsum could be either used as a filler or a binder and that when gypsum is to be used as a binding agent, the calcined form of gypsum is used so that when mixed with water, the hemihydrate form of gypsum, calcium sulfate hemihydrate, hydrates to form calcium sulfate dihydrate, which is also known as set gypsum. NGC914-1001, ¶ 69, 188.

**Claim 4: The gypsum board of claim 1, wherein the enhancing material comprises . . .**

*See* Ground 2, Claim 1d. NGC914-1007, 2:9-13; NGC914-1001, ¶ 189.

**Claim 6: The gypsum board of claim 1, wherein the mixture further comprises a pregelatinized starch.**

Pregelatinized starch is pretreated before being added to the gypsum-containing slurry in order to increase its ability to absorb water. NGC914-1001, ¶ 190. Accordingly, less pregelatinized starch may be used to achieve the same effect the same starch in a non-pregelatinized form during the gypsum board

manufacturing process. Satterthwaite discloses processing starch by, for example, gelatinization. NGC914-1007, 1:13-18; 2:34-46; NGC914-1001, ¶ 190. Moreover, Satterthwaite discloses crosslinking starches. NGC914-1007, 2:9-13; NGC914-1001, ¶ 191. A PHOSITA would understand that pregelatinization and crosslinking of starches serve substantially the same purpose because they both add strength and/or sag resistance to a set gypsum-containing product. NGC914-1001, ¶ 191. Therefore, whether the starch is pregelatinized or crosslinked later, the desirability of the crosslinking is the same, and a PHOSITA, therefore, would understand that Satterthwaite contemplates pregelatinized starch as it discloses that gelatinization of starch and crosslinking of starch. *Id.*

Moreover, a PHOSITA would understand that the use of pregelatinized starch was a known alternative to other starches. NGC914-1001, ¶ 192 Using pregelatinized starch confers certain beneficial properties such as improved mix rheology, bubble structure, and dry strength. *Id.* In general, a smaller volume of pregelatinized starch than non-pregelatinized starch is necessary to achieve the aforementioned benefits. Similar properties can be achieved simply by adding more non-pregelatinized starches. *Id.*

**Claim 8: The gypsum board of claim 1, wherein: the core has voids uniformly distributed therein; and the mixture further comprises an aqueous foam.**

*See* Ground 1, Claim 8 (discussing foaming agent). NGC914-1036, 1:30-35,

5:12-14; NGC914-1038, 9:60-62; NGC914-1001, ¶¶ 193-194.

As stated, a PHOSITA, understanding the similarities between Sucech, which discloses the use of foaming agents in production of set gypsum-containing products to lower their weight and density, NGC914-1036, 1:30-35, 5:12-14, and Satterthwaite, would find it obvious to add a foaming agent as taught by Sucech to the set gypsum-containing products of Satterthwaite and would have a reasonable expectation of success in doing so. NGC914-1001, ¶ 193. Indeed, a PHOSITA would understand that foaming agents are routinely used in set gypsum-containing products in order to reduce the density of the products, increase ease of handling, increase thermal insulation and sound proofing, decrease drying time, reduce brittleness of the product, and decrease the use of raw gypsum. *Id.* A PHOSITA would understand that foaming agents are used to control the density of the board, which, in turn, helps provide strength to the gypsum board while lowering its weight and bulk density. *Id.*

**Claim 10: The gypsum board of claim 1, wherein the mixture further comprises a pregelatinized starch and an aqueous foam.**

*See* Ground 2, Claim 10. NGC914-1007, 1:13-18; 2:9-13, 2:34-46; NGC914-1001, ¶¶ 195-197.

*See* Ground 2, Claim 8 (discussing foaming agent). NGC914-1036, 1:30-35, 5:12-14; NGC914-1038, 9:60-62; NGC914-1001, ¶¶ 198-199.

### **XIII. SECONDARY CONSIDERATIONS**

Patent Owner will be unable to prove a nexus between any commercial success and the '914 patent at least because the product that Patent Owner is expected to identify for purposes of commercial success was not developed until 2010, thirteen years after the priority date of the '914 patent, and twelve years after Patent Owner allegedly incorporated STMP into its products. NGC914-1028, ¶ 25; NGC914-1001, ¶¶ 69, 200-201. Moreover, to the extent that Patent Owner points to the commercial success of its lightweight boards, it should be noted that the alleged novelty in the the challenged claims have nothing to do with lightweight gypsum products. NGC914-1001, ¶ 201. Not only did Patent Owner admit in its specification that the use of foaming agents to make “lighter weight” products was “conventional” and “well known,” but Patent Owner also accused Petitioner’s heavy weight XP line of products of infringement in its district court Complaint. NGC914-1038, 9:53-63; NGC914-1028, ¶¶ 26-32, 45-48; NGC914-1001, ¶ 201. Thus, Patent Owner will be unable to demonstrate a nexus between alleged commercial success of its lightweight product and its claimed invention.

To the extent any “long-felt need” for products that satisfy the sag resistance criterion recited in the patent would have existed, it would have been met by any one of the various gypsum boards sold by, for example, National Gypsum, CertainTeed, Georgia-Pacific, and the like. NGC914-1001, ¶ 202. Indeed, and as stated, the '914

patent discloses National Gypsum's *prior art* Gold Bond® High Strength Ceiling Board as having a sag resistance of .075 inches after 48 hours of testing, the same length of testing prescribed by ASTM C473-95. NGC914-1038, Figs. 2 & 3; NGC914-1001, ¶ 202. In this regard, the '914 patent identifies that National Gypsum's *prior art* boards satisfied any purported need for sag resistance "of less than about 0.1 inch per two foot length" of board. NGC914-1001, ¶ 202.

#### **XIV. CONCLUSION**

Claims 1-4, 6, 8, and 10 of the '914 patent are unpatentable over the prior art pursuant to the grounds set forth above. NGC914-1001, ¶ 203. Accordingly, Petitioner requests cancellation of claims 1-4, 6, 8, and 10.

Respectfully submitted,

Date: May 3, 2017

By:           /Ross R. Barton/            
Ross R. Barton (Reg. No. 51,438)  
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## **XV. CERTIFICATE OF WORD COUNT**

Pursuant to 37 C.F.R. § 42.24, the undersigned attorney for the Petitioner, Petitioner declares that the argument section of this Petition (Sections II-XIV) has a total of 13,995 words, according to the word count tool in Microsoft Word™.

Date: May 3, 2017

By: /Ross R. Barton/  
Ross R. Barton (Reg. No. 51,438)  
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## **CERTIFICATE OF SERVICE**

Pursuant to 37 C.F.R. §§ 42.6(e), 42.105, and the agreement of the parties, the undersigned hereby certifies service on the Patent Owner of a copy of this Petition and its respective exhibits via electronic means to counsel for USG at krfink@fitcheven.com.

Date: May 3, 2017

By:           /Ross R. Barton/            
Ross R. Barton (Reg. No. 51,438)  
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