
UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

PROLIME AGRICULTURAL LLC and
CAUDILL SEED AND WAREHOUSE CO., INC.
Petitioners

v.

SUL4R-PLUS, LLC
Patent Owner.

Inter Partes Review No. TBD
Patent No. 9,873,638

PETITION FOR *INTER PARTES* REVIEW OF PATENT NO. 9,873,638

TABLE OF CONTENTS

INDEX OF EXHIBITS.....	vii
MANDATORY NOTICES.....	viii
I. INTRODUCTION AND RELIEF REQUESTED	1
II. BACKGROUND	2
A. Agglomeration	2
B. The ‘638 Patent.....	3
C. Prosecution History	3
D. Scope and Content of the Prior Art	4
1. Harrison (Exhibit 1005)	5
2. Anderson (Exhibit 1006).....	6
3. Pietsch (Exhibit 1003).....	6
4. Veverka (Exhibit 1007).....	7
5. Shimada (Exhibit 1008)	7
6. Zanuccoli (Exhibit 1010)	8
III. IDENTIFICATION OF CHALLENGE AND STATEMENT OF RELIEF REQUESTED	9
A. Grounds	9
B. Level of Ordinary Skill in the Art	9
C. Claim Construction.....	10
IV. GROUND 1 – ANTICIPATION BY HARRISON.....	10
A. Claim 1	10
1. Preamble	11
2. Element 1a.....	11
3. Element 1b.....	13
4. Element 1c.....	14
5. Element 1d.....	15
B. Claim 11	16

1. Preamble	17
2. Element 11a	17
3. Element 11b	17
4. Element 11c	17
5. Element 11d	17
C. Claim 2	18
D. Claims 3 and 12	18
E. Claims 5 and 14	19
F. Claim 9	19
G. Claim 10	20
H. The Examiner Overlooked the Teachings of Harrison During Prosecution ..	20
V. GROUND 2 – OBVIOUSNESS OVER HARRISON	24
A. Claim 1	24
1. Preamble	24
2. Element 1a	25
3. Element 1b	25
4. Element 1c	26
5. Element 1d	27
B. Claim 11	28
1. Preamble	28
2. Element 11a	28
3. Element 11b	28
4. Element 11c	28
5. Element 11d	29
C. Claim 2	29
D. Claims 3 and 12	30
E. Claims 5 and 14	30
F. Claims 7 and 16	30
G. Claim 9	31

H. Claim 10	31
VI. GROUND 3 – OBVIOUSNESS OVER ANDERSON IN VIEW OF PIETSCH.....	31
A. Claim 1	32
1. Preamble.....	32
2. Element 1a.....	32
3. Element 1b.....	34
4. Element 1c.....	35
5. Element 1d.....	35
B. Claim 11	35
1. Preamble.....	35
2. Element 11a.....	35
3. Element 11b.....	36
4. Element 11c.....	37
5. Element 11d.....	37
C. Claim 2	37
D. Claims 3 and 12	37
E. Claim 8	38
F. Claim 9	38
G. Claim 10	38
VII. GROUND 4 – OBVIOUSNESS OVER VEVERKA IN VIEW OF HARRISON OR PIETSCH	38
A. Claim 1	39
1. Preamble.....	39
2. Element 1a.....	39
3. Element 1b.....	42
4. Element 1c.....	42
5. Element 1d.....	43
B. Claim 11	43

1. Preamble.....	43
2. Element 11a.....	43
3. Element 11b.....	44
4. Element 11c.....	44
5. Element 11d.....	44
C. Claim 17	45
1. Preamble.....	45
2. Element 17a.....	45
3. Element 17b.....	47
4. Element 17c.....	49
5. Element 17d.....	49
6. Element 17e.....	49
7. Element 17f.....	50
D. Claims 2 and 19	50
E. Claims 3 and 12	51
F. Claims 5 and 14	51
G. Claims 7, 16, and 22	52
H. Claim 8	53
I. Claims 10 and 23	53
J. Claim 18	53
VIII. GROUND 5 – OBVIOUSNESS OVER SHIMADA IN VIEW OF HARRISON OR VEVERKA	55
A. Claim 1	56
1. Preamble.....	56
2. Element 1a.....	56
3. Element 1b.....	56
4. Element 1c.....	58
5. Element 1d.....	58
B. Claim 11	59

1. Preamble.....	59
2. Element 11a.....	59
3. Element 11b.....	59
4. Element 11c.....	59
5. Element 11d.....	60
C. Claim 2	60
D. Claims 3 and 12	61
E. Claims 4 and 13	61
F. Claims 5 and 14.....	61
G. Claims 7 and 16.....	62
H. Claim 9	63
I. Claim 10	63
IX. GROUND 6 – OBVIOUS IN FURTHER VIEW OF ZANUCCOLI.....	63
X. GROUNDS FOR STANDING AND FEE PAYMENT	65
CERTIFICATION UNDER 37 CFR § 42.24(d)	66
CERTIFICATE OF SERVICE	67

INDEX OF EXHIBITS

Exhibit No.	Description
Exhibit 1001	U.S. Patent No. 9,873,638
Exhibit 1002	Declaration of Dr. Bryan J. Ennis
Exhibit 1003	Excerpts from <i>Agglomeration in Industry</i> , Wolfgang Pietsch
Exhibit 1004	File History for U.S. Patent No. 9,873,638
Exhibit 1005	U.S. Patent No. 4,954,134 (“Harrison”)
Exhibit 1006	International Patent Publication WO2011/13039 (“Anderson”)
Exhibit 1007	<i>A Comparison of Liquid Binders for Limestone Pelletizing</i> , Veverka et al.
Exhibit 1008	Japanese Patent Publication JP2004024266A (“Shimada”)
Exhibit 1009	Certified Translation of Shimada
Exhibit 1010	U.S. Patent No. 5,599,373 (“Zanuccoli”)
Exhibit 1011	Excerpts from <i>Micrometrics: The Technology of Fine Particles</i> , J.M. Dallavalle
Exhibit 1012	<i>Agglomeration Technology: Mechanisms</i> , Bryan J. Ennis
Exhibit 1013	<i>The Influence of Viscosity on the Strength of an Axially Strained Pendular Liquid Bridge</i> , Ennis et al.
Exhibit 1014	<i>Fundamental studies of granule consolidation Part 2: Quantifying the effects of particle and binder properties</i> , Iveson et al.
Exhibit 1015	Excerpts from <i>Balling and Granulation</i> , P.C. Kapur
Exhibit 1016	<i>Effect of Molecular Weight Distribution on Chemical, Structural, and Physiochemical Properties of Sodium Lignosulfonates</i> , Madad et al.
Exhibit 1017	CV of Dr. Bryan J. Ennis

MANDATORY NOTICES

Real Parties in Interest

The real parties in interest for this petition are Prolime Agricultural, LLC and Caudill Seed and Warehouse Co., Ltd. No unnamed entity is funding, controlling, or directing this petition, or otherwise has an opportunity to control or direct this petition or Petitioners' participation in any resulting *inter partes* review.

Related Matters

This petition for *inter partes* review concerns U.S. Patent No. 9,873,638 (“the ‘638 Patent”). The ‘638 Patent has been asserted against Petitioner Prolime Agricultural LLC in *Sul4r-Plus, LLC v. Prolime Agriculture, LLC*, Case No. 2:22-cv-12798-LJM-EAS pending in the Eastern District of Michigan.¹ Claims 1 and 11 of the ‘638 Patent are asserted.

Lead and Back-up Counsel

Petitioners designate the following lead and back-up counsel. A power of attorney for counsel is being filed with this Petition.

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¹ Though the defendant in the litigation is styled as Prolime Agriculture, LLC, the correct name of the company is Prolime Agricultural, LLC. Prolime Agricultural, LLC is the defendant in the litigation and a Petitioner in this matter.

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I. INTRODUCTION AND RELIEF REQUESTED

This Petition for *inter partes* review challenges all claims of U.S. Patent No. 9,873,638 (“the ‘638 Patent,” Exhibit 1001). Petitioners maintain that the application of prior art to the claims in the ‘638 Patent requires a finding that those claims are not patentable.

The ‘638 Patent relates to a method of making fertilizer from synthetic gypsum, which is a byproduct of industrial processes such as energy generation. The claimed method in the ‘638 Patent uses lignosulfonate binder to make synthetic gypsum fertilizer pellets having a certain particle size and crush strength. However, years before the ‘638 Patent was filed, energy producers such as the Tennessee Valley Authority (“TVA”) recognized the byproduct gypsum they were making could be transformed into useful fertilizer products and developed ways to do so. The TVA’s invention makes fertilizer pellets with the same material properties as claimed in the ‘638 Patent using the same synthetic gypsum and lignosulfonate binder inputs. This is no surprise as lignosulfonate has been a well-known binder for making fertilizer and other products for many decades. And, fertilizer pellets need to have certain material properties to be dispersible with modern farming equipment, so fertilizer manufacturers have aimed to meet those properties far before the ‘638 Patent was filed.

This Petition presents six grounds of unpatentability based on the TVA's work along with several other prior art references. It will show that the '638 Patent merely claims making a known fertilizer product using known ingredients with a known method. The Declaration of Dr. Bryan J. Ennis is submitted in support as Exhibit 1002.

II. BACKGROUND

As what is past is prologue, here is some background on the issues that are addressed in this Petition.

A. Agglomeration

Agglomeration is a natural phenomenon in which particles of material stick to one another. [Pietsch, Agglomeration in Industry (Exhibit 1003) at 13-14.] Ancient techniques for making bread, constructing shelters, and making medicine take advantage of agglomeration processes. [*Id.*] Now, industries from agriculture to pharmaceuticals use agglomeration on a large scale. In practice, agglomeration is a simple process, and even today, equipment operators often perform agglomeration by experience, feel, and observation. [Ex. 1002 at ¶34.] Two common types of agglomeration are pelletization and granulation. [*Id.* at ¶33.]

In the last several decades, agglomeration technologies have been developed to reformulate waste products into useful products. For example, concerns about acid rain led to legislation in the United States and other countries limiting the sulfur

content of flue gas emissions from power plants and metallurgical processes. [Ex. 1003 at 37-39; *see also* 19-20.] Companies started to implement flue gas desulfurization (“FGD”) systems and began innovating ways to deal with the waste minerals created by FGD such as gypsum and limestone. [*Id.*] In the 1980s, one electricity producer, the TVA, developed a way to agglomerate manmade gypsum and limestone into useful fertilizer pellets. The United States Patent and Trademark Office awarded a patent on this process to the TVA in 1990, U.S. Patent No. 4,954,134 (Exhibit 1005, “Harrison”). Harrison (among other patents to similar processes) anticipates or renders obvious the ‘638 Patent.

B. The ‘638 Patent

Just like Harrison, the ‘638 Patent relates to a method of turning FGD-produced synthetic gypsum into useful fertilizer pellets by agglomeration. [*See, e.g.*, Ex. 1001 at 1:8-2:11.] The ‘638 Patent teaches feeding synthetic gypsum to a “forming device” such as a pelletizer, granulator, or extruder along with a binder composition. [*Id.* at 2:13-18.] The synthetic gypsum and binder are pelletized to form pellets having a particular size (expressed as mean pellet size guide number or “SGN”) and crush strength. [*Id.* at 2:18-29.]

C. Prosecution History

Turning now to the prosecution of the ‘638 Patent, the application that lead to the ‘638 Patent started out by claiming the feeding of synthetic gypsum to a forming device, feeding a binder composition to the forming device, and forming the material

fed to the forming device to a particular mean pellet SGN. [File History for ‘638 Patent (Exhibit 1004) at 384.] In the first Office Action, the Examiner made Harrison of record “for disclosing the agglomeratio nof [sic] gypsum in the presence of lignosulfonate.” [*Id.* at 318.] The Examiner did not rely on Harrison as the basis for any rejection in the first or any subsequent Office Action.

The independent claims were amended several times during prosecution to specify crush strength, solids content of the binder composition, and identity of the binder composition [*Id.* at 296-299, 236-240, 200-204.] The claims were eventually allowed after the Examiner considered a declaration of one of the inventors and determined that the cited prior art did not teach the claimed crush strength. [*Id.* at 102-109.] However, prosecution was then reopened after the applicant submitted new prior art with a Request for Continued Examination and petitioned to have the application withdrawn from issue. [*Id.* at 76-77.] During this second round of prosecution, the independent claims were amended to narrow the range of solids content of the lignosulfonate binder composition from 18-48% solids to 18-40% solids. [*Id.* at 27-31.] After an interview discussing this change, the Examiner allowed the application. [*Id.* at 24-25, 9-10.]

D. Scope and Content of the Prior Art

As was clear from the prosecution of the ‘638 Patent, making fertilizer from synthetic gypsum by agglomeration was known in the prior art before the ‘638 Patent

was filed. The '638 Patent was only issued after specifying the character of the binder composition and the crush strength of the resulting fertilizer pellets. [See Section II(C), *supra*.] However, the Examiner overlooked that Harrison discloses these limitations, as will be addressed in detail below. In addition, several prior art references not before the Examiner render obvious the allowed claims.

1. Harrison (Exhibit 1005)

Harrison is a key reference that supports Petitioners' position that the claims of the '638 Patent are invalid. U.S. Patent No. 4,954,134 to Harrison et al. was issued to the TVA, an energy producer that developed a way to turn manmade gypsum into fertilizer pellets. Harrison was filed in 1989. Harrison teaches that gypsum is a calcium- and sulfur-rich mineral commonly used for the cropping of peanuts and in other agricultural applications. [Ex. 1005 at 2:12-35.] Prior to Harrison, agricultural gypsum was available in the form of very fine (small) particles or powders. [*Id.* at 2:36-44.] The small particle size allowed for ready release of the calcium and sulfur constituents into the soil. [*Id.*] However, modern fertilizer-application equipment was designed to distribute larger, free-flowing fertilizer granules, and did not work well for agricultural gypsum. [*Id.* at 2:44-52.]

Harrison sought to make gypsum fertilizer pellets large enough to be distributed by modern fertilizer-application equipment and sufficiently dissolvable to supply calcium and sulfur to the soil. [*Id.* at 3:62-4:4.] Harrison did so by

employing a previously known binder, lignosulfonate, in a particular quantity to agglomerate gypsum into fertilizer pellets. [*Id.* at 2:60-3:46, 4:10-40.] Petitioners will show how Harrison anticipates several claims of the ‘638 Patent.

2. Anderson (Exhibit 1006)

International Patent Publication No. WO 2011/113039 to Anderson et. al (“Anderson”) is a second prior art reference that anticipates or renders obvious claims of the ‘638 Patent. Anderson claims priority to a U.S. Provisional Patent Application filed in 2010 and was published in 2011. Like Harrison, Anderson teaches a way to make waste products into useful particles or pellets for agricultural applications. [*See generally* Ex. 1006 at ¶¶[0002]-[0010].] Anderson teaches making granules containing gypsum using a water-based lignosulfonate binder. [*Id.* at ¶¶[0018], [0026]-[0027], [0057]-[0059].] The binder is a water-based solution and includes lignosulfonate. Anderson also teaches that the granules can contain mineral or synthetic elements. [*Id.* at ¶[0017].]

3. Pietsch (Exhibit 1003)

Agglomeration in Industry: Occurrence and Applications by Wolfgang Pietsch (“Pietsch”) is a third reference that renders obvious claims of the ‘638 Patent. Pietsch is a textbook about agglomeration and its key applications across multiple industries. Pietsch was published in 2005. Section 8.2.2 addresses Agglomeration Technologies for the Size Enlargement of Wastes. In particular, Pietsch teaches

using waste product to make fertilizers, and more specifically, agglomeration of synthetic gypsum that is a byproduct of FGD processes. [Ex. 1003 at 37-39; *see also* 19-20.]

4. Veverka (Exhibit 1007)

A Comparison of Liquid Binders for Limestone Pelletizing by Jim Veverka and Robert Hinkle (“Veverka”) is a fourth reference that renders obvious claims of the ‘638 Patent. Veverka is a 2001 publication of the Institute for Briquetting and Agglomeration. Veverka describes a test conducted to determine the best binding agent for pelletizing limestone into fertilizer pellets and is intended to inform the design of larger-scale fertilizer producing operations. [Ex. 1007 at § 2.] Veverka tests several binders including lignosulfonate binders in an agglomeration process. [*Id.* at § 4.1; § 7.1, Binder #1 and Binder #2.]

5. Shimada (Exhibit 1008)

Japanese Patent Publication No. JP2004-024266 to Shimada et al. (“Shimada”) was filed in 2003 and published in 2004. Shimada renders obvious claims of the ‘638 Patent. A certified translation of Shimada is attached as Exhibit 1009 and references will be to the translation. Shimada relates to a gypsum fertilizer and method of making the gypsum fertilizer. Much like Harrison, Shimada discloses fertilizer pellets that are large enough and hard enough to be dispersed using

mechanical means but that still exhibit good disintegration properties in soil. [Ex. 1009 at ¶¶[0004]-[0007].]

To make its fertilizer pellets, Shimada teaches granulating synthetic gypsum such as by-product gypsum using as a forming device a drum-type granulator. [*Id.* at ¶¶[0014], [0019], [0049].] As a “granulation aid” or binder for its granulation process, Shimada teaches using a composition with lignosulfonate. [*Id.* at ¶¶[0011], [0049].]

6. Zanuccoli (Exhibit 1010)

U.S. Patent No. 5,599,373 to Zanuccoli (“Zanuccoli”) was filed in 1994. Zanuccoli is the sixth and final reference on which this Petition is based. Zanuccoli relates to a sulfur-based fertilizer, and more specifically, pellets containing fly sulfur powder and a wetting agent (or binder) which is preferably lignin sulfonate. [Ex. 1010 at 1:20-30, 2:18-38.] The pellets can also comprise gypsum. [*Id.* at 3:39-41.] Zanuccoli further teaches that in a fertilizer, sulfur provides the benefit of correcting alkalinity of soil and intervening with sodium-calcium ionic exchange. [*Id.* at 1:31-45.] Zanuccoli aims to create a granular sulfur fertilizer that is easy to handle and can rapidly disintegrate in soil water. [*Id.* at 2:38-43.]

III. IDENTIFICATION OF CHALLENGE AND STATEMENT OF RELIEF REQUESTED

A. Grounds

Petitioners request *inter partes* review of claims 1-23 of the '638 Patent on the following Grounds:

Ground	Prior Art	Claims Challenged
1	Anticipated under 35 U.S.C. § 102 by Harrison	1-3, 5, 9-12, 14
2	Obvious under 35 U.S.C. § 103 over Harrison	1-3, 5, 7, 9-12, 14, 16
3	Obvious under 35 U.S.C. § 103 over Anderson in view of Pietsch	1-3, 8, 9, 10-12
4	Obvious under 35 U.S.C. § 103 over Veverka in view of Harrison or in view of Pietsch	1-3, 5, 7, 8, 10-12, 14, 16-19, 22, 23
5	Obvious under 35 U.S.C. § 103 over Shimada in view of Harrison	1-5, 7, 9-14, 16
6	Obvious under 35 U.S.C. § 103 over Harrison, Anderson in view of Pietsch, Veverka in view of Harrison or Pietsch, or Shimada in view of Harrison, and in further view of Zanuccoli	5, 6, 14, 15, 20, 21

B. Level of Ordinary Skill in the Art

A person of ordinary skill in the art at the time of the alleged invention would have had a bachelor's degree or equivalent in chemical engineering, or at least two years of field experience with agglomeration processes. Dr. Ennis is a POSA. [Ex. 1002 at ¶¶4-11, 14-17; Exhibit 1017, CV of Dr. Ennis.]

C. Claim Construction

Petitioners submit that no construction of any terms is necessary for the institution phase of this proceeding. As discussed below, the prior art teaches each and every feature of the claims of the '638 Patent under any reasonable construction. However, Petitioners note that nothing in this Petition should be construed as Petitioner's acquiescence that the claims meet the requirements of 35 U.S.C. § 112.

IV. GROUND 1 – ANTICIPATION BY HARRISON

Petitioners will now show how the claims of the '638 Patent are anticipated or rendered obvious by the prior art. The first ground is anticipation under 35 U.S.C. § 102 by Harrison. This section shows how each feature of the relevant claims are taught by Harrison and is supported by Dr. Ennis's Declaration at ¶¶63-87. In particular this section will first address each of the two challenged independent claims, claims 1 and 11, and then the applicable dependent claims.

A. Claim 1

Claim 1 recites a preamble and four elements, as follows, which will be addressed in turn below:

[Preamble] 1. A method of producing a fertilizer comprising:

[1a] feeding synthetic gypsum to a forming device

[1b] feeding a binder composition comprising lignosulfonate having 18% to 40% solids to the forming device; and

[1c] forming the material fed to the forming device to a mean pellet size guide number (SGN) from approximately 100 to approximately 500,

[1d] wherein the resulting pelletized synthetic gypsum has a crush strength from approximately 2 lbf to approximately 12 lbf.

1. Preamble

Harrison teaches as the object of its invention a method of producing a fertilizer:

It is therefore a principal object of the present invention to perfect efficient and economical **methods for granulating** finely-divided gypsum, limestone, or mixtures thereof **to thereby produce** essentially nondusty, hard, nonfriable, **granular materials** of a size eminently **suitable for use as direct-application fertilizers, or in the preparation of bulk-blended fertilizers.**

[Ex. 1005 at 5:23-30 (emphasis added).]

2. Element 1a

Harrison teaches feeding synthetic gypsum to a forming device. Figure 2 from Harrison is annotated below to highlight gypsum (**red**) fed to a granulator (**blue**). [See also, e.g., Ex. 1005 at 10:40-52.] A granulator is a type of forming device as recognized in the specification of the ‘638 Patent. [Ex. 1001 at 2:14-16 (“...a forming device, which may comprise a pelletizer, granulator, or extruder”), claim 9 (“wherein the forming device comprises a granulator”); see also Ex. 1002 at ¶66.]

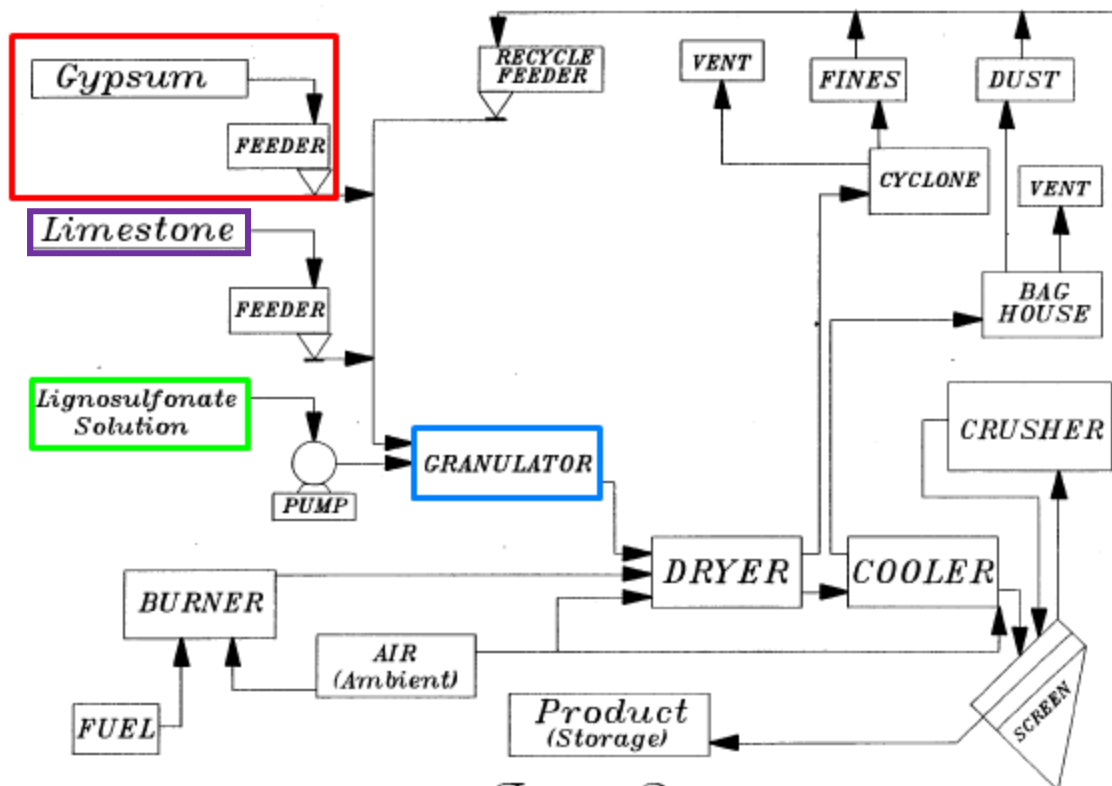


Fig. 2

Harrison teaches that its Figure 2 illustrates a process for granulating “finely-divided gypsum” in a full-scale production facility. [Ex. 1005 at 6:62-7:2.] In turn, Harrison defines the term “finely-divided gypsum” as including mined (natural) gypsum and manmade (synthetic) by-product gypsum:

As used herein, finely-divided gypsum is either mined and comminuted, or otherwise obtained as a manmade by-product.

[Ex. 1005 at 2:21-23; *see also, e.g.,* 7:13-24; 9:16-45 (describing granulation of sulfogypsum and phosphogypsum, two types of synthetic gypsum).]

3. *Element 1b*

Harrison teaches feeding a binder composition comprising lignosulfonate having 18% to 40% solids to the forming device.

First, Harrison uses a binder composition comprising lignosulfonate:

The preferred liquid binder used in the practice of the present invention is a solution of lignosulfonate and water.

[Ex. 1005 at 10:53-55.]

Next, Harrison teaches that its lignosulfonate binder has 25% solids, which falls within the claimed range of 18% to 40% solids. Specifically, Harrison discloses two options for lignosulfonate binder solutions. Each is obtained from a material supplier and then diluted with water to have about 24% lignosulfonate for the first option or about 29% lignosulfonate for the second option. [Ex. 1005 at 10:55-11:12.]

Harrison sums up as follows:

... for purposes of describing the instant invention and the acceptable practice thereof, and for the convenience of the reader, such source of lignosulfonate will oftentimes be simply referred to as a 25 percent additive/dispersant solution, i.e., **on a total weight basis, 25 percent is lignosulfonate.**

[Ex. 1005 at 11:7-12 (emphasis added); *see also* 8:36-44.]

A POSA would understand that the percentage on a weight basis taught by Harrison is the same sort of value as the claimed “% solids” in the ‘638 Patent. [Ex.

1002 at ¶¶68-69; *see also* ¶¶40-43.] That is, using the terminology of the ‘638 Patent, a POSA would read Harrison as teaching its binder composition has 25% solids.

As shown in annotated Figure 2 above, Harrison feeds the lignosulfonate solution (**green**) to its forming device (granulator, **blue**). [See also Ex. 1005 at 11:23-41 (describing spraying or sparging the lignosulfonate into the granulator).]

4. Element 1c

After feeding synthetic gypsum and lignosulfonate binder into the granulator, Harrison teaches forming the material fed to the forming device to a mean pellet size guide number (SGN) from approximately 100 to approximately 500. SGN is a term in the agglomeration industry that refers to the diameter of the median particle in a set of particles (that is, half of the particles in the set are smaller than the SGN and the other half are larger). [Ex. 1002 at ¶¶43-45; *see also* Ex. 1001 at 5:62-67.] SGN expressed in millimeters and multiplied by 100. [*Id.*] An SGN of 100 means the median particle diameter is 1 millimeter and an SGN of 500 means the median particle diameter is 5 millimeters. For a given set of particles ranging from a minimum to a maximum diameter, the SGN of those particles necessarily falls between the minimum and maximum. [*Id.*]

Harrison does not use SGN and instead refers to particle size in terms of Tyler Standard Screen Scale mesh size, which is also common in the agglomeration industry. [Ex. 1002 at ¶¶46-49 (citing Ex. 1011).] Harrison teaches that the desired

particle size for fertilizers is minus 6 plus 16 Tyler mesh, which corresponds to particles with diameters between 1 mm and 3.36 mm and SGN of 100 to 336. [Ex. 1005 at 11:65-12:36; Ex. 1002 at ¶¶71-72.] Harrison further teaches that the onsize (desired size) particles produced by its method are retained on the 16 Tyler mesh (i.e., have particle size greater than 1 mm) and pass through the 6 mesh (i.e., have particle size less than 3.36 mm). [*Id.*] This set of particles necessarily has a median particle size between 1 mm and 3.36 mm (SGN of 100 to 336), which is within the claimed range. [*Id.*] Moreover, any offsize (too large or too small) particles are recycled back through the process to achieve the desired particle size on future trips through the process, indicating that Harrison aims to form its particles to SGN between 100 and 336. [*Id.*]

In addition, Harrison teaches that the product of its process is particles with size distribution is 36% plus 8 mesh or 2.38 mm, and 69% plus 9 mesh or 2 mm. [Ex. 1005 at 11:65-12:36.] The SGN of these particles is between 200 and 238, within the claimed range. [Ex. 1002 at ¶73.]

5. Element 1d

Harrison's resulting product is a pelletized synthetic gypsum with a crush strength of approximately 2 lbf to approximately 12 lbf. Crush strength in the agglomeration industry is the amount of force required to crush a particle. [Ex. 1002 at ¶50.] "Lbf" as used in the '638 Patent is an abbreviation for "pounds of force."

[*Id.*] Crush strength is sometimes reported simply in terms of pounds or, as abbreviated, “lb.” [*Id.*] A POSA would understand a crush strength reported in terms of pounds to be referring to “pounds of force” or “lbf” since it is understood a crush strength value corresponds to a force. [*Id.*]

Harrison teaches that the portion of its product in the size range plus 7 minus 8 Tyler mesh exhibits crushing strengths of “from about 4 to about 8 pounds” (or pounds of force). [Ex. 1005 at 8:36-64.] Harrison also notes this is the industry standard way of characterizing crush strength of a set of particles. [*Id.*] Based on these teachings Harrison’s pelletized synthetic gypsum product has a crush strength that falls within the claimed range. [Ex. 1002 at ¶¶50, 74.]

B. Claim 11

Claim 11 is the second of three independent claims in the ‘638 Patent. Much of claim 11 tracks closely to claim 1. Claim 11 recites a preamble and four elements as follows:

[Preamble] 11. A fertilizer comprising:

[11a] pellets, the pellets comprising synthetic gypsum

[11b] and a binder composition comprising lignosulfonate, wherein the binder composition initially has 18% to 40% solids at the time of contact with the synthetic gypsum,

[11c] the pellets further comprising mean pellet SGN from approximately 100 to approximately 500,

[11d] wherein the pellets have a crush strength from approximately 2 to approximately 12 lbf.

1. Preamble

Harrison teaches a fertilizer. [Ex. 1005 at 5:23-30.]

2. Element 11a

As noted above for the preamble, and for similar Element 1a, Harrison teaches making granules, or pellets, from finely-divided gypsum, which includes synthetic gypsum.

3. Element 11b

As discussed above for similar Element 1b, Harrison teaches preparing a lignosulfonate binder solution having 25% solids and feeding the solution to the forming device with the synthetic gypsum feedstock. Thus at the time of contact with the synthetic gypsum, the lignosulfonate binder composition has 25% solids, which falls within the claimed range.

4. Element 11c

As discussed above for similar Element 1c, Harrison teaches the accepted particle size in the fertilizer industry is SGN between 100 and 336, and that is process produces particles with SGN between 200 and 238, both of which fall within the claimed range.

5. Element 11d

As discussed above for similar Element 1d, Harrison's pellets have crushing strengths of from about 4 to about 8 pounds. This falls within the claimed range.

C. Claim 2

Claim 2 depends from claim 1 and further recites “wherein the synthetic gypsum fed to the forming device has a mean particle size of less than 100 microns.” While the type of “mean” is not specified in the ‘638 Patent, there are two common ways to calculate mean the mean of a set of particles: volume mean size (calculated by multiplying the percentage of product weight between two mesh sizes by the average of the mesh sizes in microns, and taking the sum of these values) and Sauter mean size (calculated by dividing the weight between mesh sizes the by the average mesh particle size, summing these values, and then taking the reciprocal to produce the mean size). [Ex. 1002 at ¶¶78-80.] Harrison teaches in one example using granular gypsum with a particular particle size distribution. [Ex. 1005 at 7:12-26.] Dr. Ennis calculated the volume mean and Sauter mean for a set of particles within Harrison’s distribution. [Ex. 1002 at ¶¶81-83.] The volume mean is 89 microns and the Sauter mean is 50 microns, both of which are less than 100 microns as in claim 2. [*Id.*]

D. Claims 3 and 12

Claim 3 depends from claim 1 and further recites “wherein the binder composition comprises a water soluble binder.” Claim 12 depends from claim 11 and recites the same. As discussed above for Elements 1b and 11b, Harrison uses a binder composition comprising lignosulfonate and water. Lignosulfonate is a water soluble binder. [Ex. 1002 at ¶¶40, 84.]

E. Claims 5 and 14

Claim 5 depends from claim 1 and recites “further comprising feeding an additive to the forming device, wherein the additive is selected from the group consisting of ground calcium carbonate, calcium bentonite, kaolin clays, manganese, zinc, boron, calcium, copper, and elemental sulfur.” Claim 14 depends from claim 11 and recites that the pellets further comprise the same. Harrison discloses granulating gypsum together with limestone, which is calcium carbonate:

It is therefore a principal object of the present invention to perfect efficient and economical methods **for granulating finely-divided gypsum, limestone, or mixtures thereof** to thereby produce essentially nondusty, hard, nonfriable, granular materials of a size eminently suitable for use as direct-application fertilizers, or in the preparation of bulk-blended fertilizers.

[Ex. 1005 at 5:23-30 (emphasis added); *see also* 2:1-2 (limestone is calcium carbonate), 10:7-52 (describing granulating mixtures of gypsum and limestone).] Likewise annotated Figure 2, above, shows limestone (**purple**) being fed to the granulator along with the gypsum and lignosulfonate binder.

F. Claim 9

Claim 9 depends from claim 1 and recites “wherein the forming device comprises a granulator or extruder.” As shown above for Element 1a, Harrison teaches that its forming device is a granulator.

G. Claim 10

Claim 10 depends from claim 1 and recites “[a] fertilizer made by the process of claim 1.” As shown above for the preamble of claim 1, Harrison discloses a fertilizer made by its method.

H. The Examiner Overlooked the Teachings of Harrison During Prosecution

Having shown that Harrison anticipates several claims of the ‘638 Patent, Petitioners will briefly address the Examiner’s failure to recognize as much during prosecution. In the following sections, Petitioners will also show that Harrison renders obvious many claims of the ‘638 Patent, on its own and in combination with other references.

As was mentioned above, in the first Office Action, the Examiner made Harrison of record “for disclosing the agglomeratio nof [sic] gypsum in the presence of lignosulfonate.” [Ex. 1004 at 318.] The Examiner did not rely on Harrison as the basis of any rejection in the first or any subsequent Office Action. As a result this Petition is the first time argument regarding Harrison is being presented to the Patent Office with respect to patentability of the ‘638 Patent.

When considering art that was previously before the Office, the PTAB uses an established framework to determine whether to use its discretion to elect not to institute a proceeding. *Advanced Bionics, LLC v. Med-El Elektromedizinische*

Geräte GmbH, IPR2019-01469, Paper 6 at 7 (PTAB Feb. 13, 2020) (precedential).

This in turn requires analysis of several factors:

(a) the similarities and material differences between the asserted art and the prior art involved during examination;

(b) the cumulative nature of the asserted art and the prior art evaluated during examination;

(c) the extent to which the asserted art was evaluated during examination, including whether the prior art was the basis for rejection;

(d) the extent of the overlap between the arguments made during examination and the manner in which Petitioner relies on the prior art or Patent Owner distinguishes the prior art;

(e) whether Petitioner has pointed out sufficiently how the Examiner erred in its evaluation of the asserted prior art; and

(f) the extent to which additional evidence and facts presented in the Petition warrant reconsideration of the prior art or arguments.

Becton, Dickinson & Co. v. B. Braun Melsungen AG, IPR2017-01586, Paper 8 (Dec. 15, 2017) (precedential as to § III.C.5, first paragraph). Factors (a), (b), and (d) are evaluated first as to whether and to what extent the same art was previously relied on before the Office and then factors (c), (e), and (f) relate to whether a petitioner

has demonstrated a material error by the office. *Advanced Bionics*, IPR2019-01469, Paper 6 at 10.

Beginning with the first step of the analysis, Harrison was before the Examiner during prosecution of the ‘638 Patent. This fact implicates § 325(d) but does not on its own merit discretionary denial of this Petition. In similar circumstances, the PTAB turns to the second step of the analysis under factors (c), (e), and (f), to determine whether discretionary denial is appropriate and has declined to deny Petitions. *See, e.g., Lyft, Inc. v. RideShare Displays, Inc.*, IPR2021-01602, Paper 7, 14-15 (April 11, 2022).

Factor (c) weighs against discretionary denial. Harrison was never evaluated by the Examiner or the applicant during prosecution of the ‘638 Patent nor was it the basis of any rejection by the Examiner. *Id.*; *see also e.g., Advanced Energy Industries v. Reno Technologies*, IPR2021-01397, Paper 7, 7 (Feb. 16, 2022); *Samsung Electronics Co., Ltd. et al. v. Power2B, Inc.*, IPR2021-01190, Paper 11, 19 (Jan. 6, 2022).

The same is true for factor (e). In this Petition, Petitioners show that Harrison anticipates or renders obvious many claims of the ‘638 Patent. Just as in *Lyft*, Petitioners’ analysis “shows error by the Examiner in overlooking [Harrison’s] teachings material to patentability of the challenged claims.” *Lyft*, IPR2021-01602, Paper 7 at 14. As shown throughout this petition, Harrison discloses the numerical

values claimed in the '638 Patent, however, Harrison expresses its solids content, particle size, and crush strength in a different unit. This could be the reason the Examiner overlooked the applicability of Harrison to the claims now at issue. Whatever the case, a POSA would have understood Harrison to be disclosing exactly what was claimed.

This is further demonstrated by the fact that the amendment that ultimately lead to allowance of claims 1 and 11 of the '638 Patent along with their dependent claims (narrowing the range of solids content of the lignosulfonate binder composition from 18-48% solids to 18-40% solids) was futile in view of Harrison. [Ex. 1004 at 27-31.] In other words, if Harrison had been more closely evaluated by the Examiner, this amendment would not have led to allowance. As shown in Sections IV(A)(2), (IV)(B)(2), V(A)(2), and V(B)(2) of this Petition, Harrison meets the pre-amendment range of 18-48% solids as well as the post-amendment range of 18-40% solids because Harrison teaches 25% solids.

Finally, factor (f) weighs against denial because Petitioners are now presenting new evidence in the form of the declaration of Dr. Ennis in support of this Petition (Ex. 1002). *Lyft*, IPR2021-01602, Paper 7 at 14. For instance, as noted above, conversions are required to compare the units taught by Harrison to those claimed by the '638 Patent. Dr. Ennis sheds light on these conversions in a manner that was

apparently not appreciated by the Examiner yet renders multiple claims of the ‘638 Patent unpatentable.

V. GROUND 2 – OBVIOUSNESS OVER HARRISON

The second ground is obviousness under 35 U.S.C. § 103 over Harrison. This section shows how the features of claims of the ‘638 Patent are also obvious over a particular example, Example II, taught by Harrison and is supported by ¶¶88-113 of Dr. Ennis’ Declaration. Petitioners will refer to the same elements of claims 1 and 11 as discussed above in Ground 1.

A. Claim 1

1. Preamble

While Harrison’s Example II does not specify that it is a method of producing a fertilizer, Harrison teaches as the object of its invention a method of producing a fertilizer:

It is therefore a principal object of the present invention to perfect efficient and economical **methods for granulating** finely-divided gypsum, limestone, or mixtures thereof **to thereby produce** essentially nondusty, hard, nonfriable, **granular materials** of a size eminently **suitable for use as direct-application fertilizers, or in the preparation of bulk-blended fertilizers.**

[Ex. 1005 at 5:23-30 (emphasis added).] Moreover, Harrison teaches that its examples illustrate how to practice its invention. [*Id.* at 12:39-42.] Accordingly, a POSA would understand the product of Example II to be a fertilizer. [Ex. 1002 at ¶89.]

2. Element 1a

Harrison teaches feeding synthetic gypsum to a forming device. Specifically, in Example II, Harrison provides a mixture comprising 90% gypsum and 10% limestone to a drum granulator. [Ex. 1005 at 17:19-29 (referring to 12:11-25; Figure 1).] A granulator is a type of forming device as recognized in the specification of the ‘638 Patent. [Ex. 1001 at 2:14-16 (“...a forming device, which may comprise a pelletizer, granulator, or extruder”), claim 9 (“wherein the forming device comprises a granulator”); *see also* Ex. 1002 at ¶90.] In Table 1, which reports the result of Example II, Harrison indicates the gypsum used was sulfogypsum, a type of synthetic gypsum. [Ex. 1005 at 17:53-55, Table 1 at n. e; *see also* 12:51-52, 2:12-16.]

3. Element 1b

Harrison renders obvious feeding a binder composition comprising lignosulfonate having 18% to 40% solids to the forming device. Specifically, Harrison teaches starting with a 48% lignosulfonate solution in Example II. [Ex. 1005 at 17:29-34.] As explained in more detail in Ground 1 above, a POSA would understand the solution to be 48% solids using the terminology of the ‘638 Patent. [Ex. 1002 at ¶91; *see also* ¶¶40-42, 68-70.] The solution is diluted with additional water at ratios between 1:1 and 1:3, making a solution having between 12 and 24% solids, before being sprayed onto the synthetic gypsum material in the drum

granulator. [Ex. 1005 at 17:29-34.] This range overlaps the claimed range. Given the overlap, a POSA is presumed to have found it obvious to select within the claimed range. *See, e.g., UCB, Inc. v. Actavis Labs. UT, Inc.*, 65 F.4th 679, 689 (Fed. Cir. 2023). [See also Ex. 1002 at ¶91.]

4. Element 1c

After feeding synthetic gypsum and lignosulfonate binder into the granulator, Harrison teaches forming the mixture to a mean pellet size guide number (SGN) from approximately 100 to approximately 500. Harrison provides a detailed analysis of the particles produced by the Example II process, which is summarized in its Table 1. 99.7% of the product particles were sized between 5 and 16 mesh on the Tyler Standard Screed Scale, which corresponds to particles with diameters between 1 mm and 4 mm or SGN between 100 and 400. [Ex. 1005, Table 1; Ex. 1002 at ¶92.] 51.1% of the product particles were between the sizes of minus 6 mesh plus 8 mesh Tyler Standard Screen Scale, which corresponds to SGN between 238 and 336. [Ex. 1005, Table 1; Ex. 1002 at ¶93.] 68.2% of the particles exiting the dryer were between the sizes of minus 6 mesh plus 16 mesh Tyler Standard Screen Scale, which corresponds to SGN between 100 and 336. [Ex. 1005, Table 1; Ex. 1002 at ¶94.] 42 to 76 % of the material exiting the granulator was also between the sizes of minus 6 mesh plus 16 mesh Tyler Standard Screen Scale, which corresponds to SGN between 100 and 336. [Ex. 1005, Table 1; Ex. 1002 at ¶¶95-96.] Some portion of the product

which was used to test crush strength previously described falls within the Tyler Standard Screen Scale size range of minus 7 plus 8 mesh, which corresponds to SGN between 238 and 283. [Ex. 1005 at 17:38-49, Table 1; Ex. 1002 at ¶97.] All of these ranges fall within the claimed range, showing that Harrison's Example II product has SGN between 100 and 500 immediately after granulation, after drying, and after screening.

5. Element 1d

Harrison renders obvious pelletized synthetic gypsum with a crush strength from approximately 2 lbf to approximately 12 lbf. Harrison teaches that immediately after being discharged from the granulator, the particles falling in the minus 7 plus 8 mesh size range have a crushing strength ranging between about 1 to about 2 pounds. [Ex. 1005 at 13:78-45.] A POSA would understand this pounds value to mean “pounds of force” or “lbf.” [Ex. 1002 at ¶98.] Harrison also notes this is the industry standard way of characterizing crush strength of a set of particles. [Ex. 1005 at 8:36-64.] Thus the product of Harrison's Example II granulation process produces particles with crush strength overlapping the claimed crush strength. Given the overlap, a POSA is presumed to have found it obvious to select within the claimed range of crush strength. *See, e.g., UCB, Inc.*, 65 F.4th at 689. [*See also Id.*]

Moreover, after drying and screening the particle products from Example II, the particles falling in the minus 7 plus 8 mesh size range have a crushing strength

of about 4 pounds (or pounds of force). [Ex. 1005 at 17:45-49; Ex. 1002 at ¶99.] Thus Harrison's screened particles fall within the claimed range of crush strength.

B. Claim 11

1. Preamble

As discussed above for the preamble of claim 1, a POSA would understand the product of Harrison's Example II to be a fertilizer.

2. Element 11a

As noted above for the preamble, and for similar Element 1a discussed above, Harrison teaches granulating sulfogypsum, a type of synthetic gypsum, in Example II.

3. Element 11b

As discussed above for similar element 1b, Harrison's Example II uses a 48% solids binder in Example II which diluted to a solution having between 12 and 24% solids, before being sprayed onto the synthetic gypsum material in the drum granulator. Thus the binder has 12 to 24% solids at the time of contact with the synthetic gypsum, overlapping the claimed range. Given the overlap, a POSA is presumed to have found it obvious to select within the claimed range of % solids. *See, e.g., UCB, Inc.*, 65 F.4th at 689. [See also Ex. 1002 at ¶102.]

4. Element 11c

As discussed above for Element 1c, showing that Harrison's Example II product has SGN between 100 and 500 immediately after granulation, after drying, and after screening. [See Ex. 1002 at ¶¶92-97, 103.]

5. Element 11d

As discussed above for Element 1d, Harrison teaches that immediately after being discharged from the granulator, the particles falling in the minus 7 plus 8 mesh size range have a crushing strength ranging between about 1 to about 2 pounds, or pounds of force. This overlaps the claimed range. Given the overlap, a POSA is presumed to have found it obvious to select within the claimed range of crush strength. *See, e.g., UCB, Inc.*, 65 F.4th at 689. [Ex. 1002 at ¶104.]

Moreover, after drying and screening the particle products from Example II, the particles falling in the minus 7 plus 8 mesh size range have a crushing strength of about 4 pounds. This falls within the approximately 2 lbf to approximately 12 lbf range.

C. Claim 2

Harrison's Example II teaches synthetic gypsum fed to the forming device that has a mean particle size of less than 100 microns. Harrison's Example II uses a feedstock that is a combination of gypsum and limestone and provides the particle size distribution for these feedstocks. [Ex. 1005 at 17:19-22 (referring to 13:11-17).] Similar to his analysis for claim 2 in Ground 1 above, Dr. Ennis has calculated the

volume mean and Sauter mean for the individual and combined feedstock. [Ex. 1002 at ¶106-108.] The volume mean for the gypsum feedstock is 73 microns and the Sauter mean is 33 microns, both of which are less than 100 microns as in claim 2. [Id. at ¶106.] The volume mean for the combined feedstock is 83 microns and the Sauter mean is 35 microns, again, less than 100 microns as in claim 2. [Id. at ¶108.]

D. Claims 3 and 12

Harrison discloses a binder composition that comprises a water soluble binder. As discussed above for Elements 1b and 11b, Harrison uses a binder composition comprising lignosulfonate in Example II. Lignosulfonate is a water soluble binder. [Ex. 1002 at ¶¶40, 109.]

E. Claims 5 and 14

Harrison discloses feeding an additive to the forming device, wherein the additive is selected from the group consisting of ground calcium carbonate, calcium bentonite, kaolin clays, manganese, zinc, boron, calcium, copper, and elemental sulfur and pellets comprising the same. In Example II, Harrison uses a feedstock of 90% gypsum and 10% limestone which is provided to the drum granulator. [Ex. 1005 at 17:19-29.] Limestone is calcium carbonate. [Id. at 2:1-2.]

F. Claims 7 and 16

Claim 7 depends from claim 1 and recites “wherein the mean SGN is from approximately 250 to approximately 280.” Claim 16 depends from claim 11 and recites the same. As discussed above for Elements 1c and 11c, Harrison teaches

screening the product in Example II to isolate particles in the Tyler Standard Screen Scale size range of minus 7 plus 8 mesh, which corresponds to SGN 238 to 283. [Ex. 1002 at ¶111.] A POSA would consider this to be equivalent to the claimed range of approximately 250 to approximately 280. [*Id.*]

G. Claim 9

Harrison discloses that the forming device comprises a granulator or extruder. As shown above for Element 1a, Harrison uses a drum granulator in Example II.

H. Claim 10

Harrison discloses a fertilizer made by its method. As shown above for the preambles of claims 1 and 11, Harrison discloses fertilizers made by its Example II method.

VI. GROUND 3 – OBVIOUSNESS OVER ANDERSON IN VIEW OF PIETSCH

Moving on from Harrison, many claims of the ‘638 Patent are also obvious over the teachings of Anderson in view of Pietsch. Anderson teaches all features of the claims except for specifying that the gypsum is synthetic. However, Anderson recognizes that synthetic minerals can be used. Also, Pietsch teaches that synthetic gypsum byproducts can be used in place of natural gypsum for the purpose of turning a waste material into a useful product. A POSA would have used synthetic gypsum in the process of Anderson to make fertilizer. Anderson and Pietsch teach a common

goal of using waste products for beneficial purposes, both teach agglomeration of gypsum, and both teach agglomeration of minerals for agricultural purposes.

As above, this section will first address each of the two challenged independent claims, claims 1 and 11, and then the applicable dependent claims. This Ground is supported by ¶¶114-135 of Dr. Ennis' Declaration. Petitioners will refer to the same elements as discussed above in Ground 1.

A. Claim 1

1. Preamble

Anderson teaches a method of producing a fertilizer:

The invention further relates to **a method for making and using the water-dispersible particle...** As such, the invention **has utility as** an agricultural biomass, combustion residue, and/or biosolids stabilizer and **fertilizer**.

[Ex. 1006 at ¶[0014] (emphasis added).]

2. Element 1a

Anderson in view of Pietsch teaches feeding synthetic gypsum to a forming device. Specifically, Anderson teaches feeding an admixture to pelletizing equipment or granulation equipment. [Ex. 1006 at ¶[0047].] Pelletizers and granulators are types of forming device as recognized in the specification of the '638 Patent. [Ex. 1001 at 2:14-16 (“...a forming device, which may comprise a pelletizer, granulator, or extruder”), claim 8 (“wherein the forming device comprises a pelletizer”), claim 9 (“wherein the forming device comprises a granulator”); *see also*

Ex. 1002 at ¶116.] Anderson further teaches that the admixture includes gypsum. [Ex. 1006 at ¶¶[0018], [0046]; *see also* ¶[0059] (describing example process for forming granules with gypsum).] In addition, Anderson teaches that the granules can comprise synthetic chemical fragments. [Ex. 1006 at ¶[0017].]

Pietsch teaches using waste product to make fertilizers as well as agglomeration of synthetic gypsum that is a byproduct of FGD processes. [Ex. 1003 at 37-39; *see also* 19-20.] Anderson also teaches a way to make waste products into useful particles or pellets for agricultural applications. [*See generally* Ex. 1006 at ¶¶[0002]-[0010].] Since Anderson and Pietsch teach a common goal of using waste products for beneficial purposes, both teach agglomeration of gypsum, both teach agglomeration of minerals for agricultural purposes, and Anderson recognizes that synthetic material can be agglomerated by its process, one of skill in the art would have used synthetic gypsum as taught by Pietsch in the process of Anderson for the purpose of creating useful fertilizer products from synthetic gypsum byproduct. [Ex. 1002 at ¶¶117-119.] In doing so, a POSA would have expected to be successful combining synthetic gypsum, which was well known from Pietsch, into the process of Anderson to make a fertilizer. [*Id.* at ¶118.] Alternatively or additionally, a POSA would have seen using synthetic gypsum in place of the gypsum or other minerals taught by Anderson as a simple substitution of known elements to yield predictable results. [*Id.* at ¶119.]

3. Element 1b

Anderson renders obvious feeding a binder composition comprising lignosulfonate having 18% to 40% solids to the forming device. Specifically, Anderson teaches “at least part of the watersoluble binder may be added to the pelletizing apparatus during pelletizing.” [Ex. 1006 at ¶[0046].] The binder can be “a lignin derivative and is optionally calcium lignosulfonate.” [Ex. 1006 at ¶[0026] (also identifying as an option sodium lignosulfonate).] Anderson further teaches:

The binder is generally added to the composition as a solution. The solution is typically provided as a waterbased slurry having about **40% to 50% solids** by weight.

[Ex. 1006 at ¶[0027] (emphasis added).]

This range overlaps the claimed range. Given the overlap, a POSA is presumed to have found it obvious to select within the claimed range % solids. *See, e.g., UCB, Inc.*, 65 F.4th at 689. [See also Ex. 1002 at ¶¶120.]

Moreover, Anderson teaches that when the binder is added to the pelletizing apparatus, up to about 15% by weight of additional water “may be necessary for agglomeration.” [Ex. 1006 at ¶[0046].] Anderson recognizes that it may be advantageous to err on the side of more water, or lower solids content. Accordingly, a POSA would have found it obvious to select the bottom end of Anderson’s range, 40% solids, which falls within the claimed range. [Ex. 1002 at ¶121.]

4. Element 1c

Anderson also describes the characteristics of the granules made by its process. Anderson teaches forming the material fed to the forming device to a mean pellet size guide number (SGN) from approximately 100 to approximately 500. After pelletizing, Anderson teaches the its granules have a size guide number between 100 and 230, which is within the claimed range. [Ex. 1006 at ¶[0052].]

5. Element 1d

In addition to meeting the particle size range in claim 1 of the ‘638 Patent, Anderson’s pelletized synthetic gypsum has a crush strength from approximately 2 lbf to approximately 12 lbf. Anderson teaches its granules have a crush strength between 2 and 8 pounds. As discussed above for Harrison in Grounds 1 and 2, a POSA would understand a crush strength reported in terms of pounds to be referring to “pounds of force” or “lbf” since it is understood crush strength corresponds to a force. [Ex. 1002 at ¶123.] Anderson’s granules have a crush strength within the claimed range.

B. Claim 11

1. Preamble

As discussed above for Element 1a, Anderson teaches a fertilizer.

2. Element 11a

As noted above for similar Element 1a, Anderson teaches pelletizing material such as gypsum and that the granules can comprise synthetic chemical fragments.

Pietsch teaches using waste product to make fertilizers as well as agglomeration of synthetic gypsum that is a byproduct of FGD processes. A POSA would have used synthetic gypsum as taught by Pietsch to make fertilizer as taught by Anderson for the same reasons discussed above for Element 1a. Thus the combination of Anderson and Pietsch teaches pellets comprising synthetic gypsum.

3. Element 11b

As discussed above for similar Element 1b, Anderson teaches a lignosulfonate binder composition having about 40% to 50% solids. In addition, Anderson teaches that “at least part of the watersoluble binder may be added to the pelletizing apparatus during pelletizing” and after the admixture comprising gypsum is added to the pelletizer or granulator. [Ex. 1006 at ¶¶[0046]-[0047].] Thus the binder composition has 40% to 50% solids at the time of contact with the gypsum. Given the overlap, a POSA is presumed to have found it obvious to select within the claimed range of % solids. *See, e.g., UCB, Inc.*, 65 F.4th at 689. [See also Ex. 1002 at ¶126.]

Moreover, Anderson teaches that when the binder is added to the pelletizing apparatus, up to about 15% by weight of additional water “may be necessary for agglomeration.” [Ex. 1006 at ¶[0046].] Anderson recognizes that it may be advantageous to err on the side of more water, or lower solids content. Accordingly, a POSA would have found it obvious to select the bottom end of Anderson’s range,

40% solids, which falls within the claimed range, when contacting the binder with the gypsum. [Ex. 1002 at ¶127.]

4. Element 11c

As discussed above for Element 1c, Anderson teaches the its granules have a size guide number between 100 and 230, which is within the claimed range.

5. Element 11d

As discussed above for Element 1d, Anderson teaches its granules have a crush strength between 2 and 8 pounds, or pounds of force, which is within the claimed range.

C. Claim 2

Anderson teaches synthetic gypsum fed to the forming device having a mean particle size of less than 100 microns. In one example, Anderson teaches gypsum fragments with 100% passing through a 50 mesh screen and 80% or more passing through a 200 mesh screen as the starting material. [Ex. 1006 at ¶[0057] (referring to an example process beginning with limestone particles); ¶[0059] indicating the same process can be performed with gypsum).] Similar to the analysis for claim 2 in Grounds 1 and 2 above, Dr. Ennis has calculated the volume mean and Sauter mean for a set of particles within Anderson's range. [Ex. 1002 at ¶¶130-131.] The volume mean is 48 microns and the Sauter mean is 32 microns, both of which are less than 100 microns as in claim 2. [*Id.*]

D. Claims 3 and 12

Anderson teaches that its binder composition comprises a water soluble binder. As noted above for Elements 1b and 11b, Anderson teaches a “watersoluble binder.”

E. Claim 8

Anderson teaches that its forming device comprises a pelletizer. As discussed above for Element 1a, Anderson teaches feeding an admixture to pelletizing equipment such as a pelletizing pan.

F. Claim 9

Anderson teaches that its forming device comprises a granulator or extruder. As discussed above for Element 1a, Anderson teaches feeding an admixture to granulation equipment such as a drum granulator.

G. Claim 10

Anderson teaches a fertilizer made by its process. As shown above for the preamble of claim 1, Anderson discloses fertilizers made by its method.

VII. GROUND 4 – OBVIOUSNESS OVER VEVERKA IN VIEW OF HARRISON OR PIETSCH

The next ground relies on a new reference, Veverka, along with Harrison or Pietsch, and is supported by ¶¶136-178 of Dr. Ennis’ Declaration. Veverka tests binder compositions for making fertilizer and contemplates large-scale fertilizer production using its teachings. Veverka teaches all the features of the challenged claims except that Veverka uses limestone in place of synthetic gypsum. However,

Harrison teaches that synthetic gypsum, limestone, and mixtures thereof can be pelletized to make fertilizer by the same process and with the same resulting characteristics as Veverka. Pietsch also teaches agglomeration of synthetic gypsum to make useful products. Based on the teachings of Veverka and Harrison or Pietsch, one would have employed the process of Veverka to pelletize synthetic gypsum, which process and resulting fertilizer meets the claims of the ‘638 Patent.

As above, this section will first address each of the three challenged independent claims (1, 11, and 17) and then the applicable dependent claims. Petitioners will refer to the same elements as discussed above in Grounds 1-3 for claims 1 and 11.

A. Claim 1

1. Preamble

Veverka teaches a method of making fertilizer. Specifically, Veverka teaches the process of agglomerating limestone to make fertilizer pellets. [Ex. 1007 at § 2.]

2. Element 1a

Veverka teaches feeding limestone to a forming device. In particular, Veverka teaches using a screw feeder to feed material to a pin mixer. Veverka teaches that “[t]he Pin Mixer sprays binder on the material, thoroughly wetting the particles, and **partially agglomerates** the material to prepare it for final pelletizing.” [Ex. 1007 at § 4.1 (emphasis added).] A POSA would understand the pin mixer to be a forming device since it partially agglomerates the material fed to it. [Ex. 1002 at ¶138.]

Veverka does not teach feeding synthetic gypsum to a forming device. However, as discussed above for Grounds 1 and 2, Harrison teaches feeding synthetic gypsum to a forming device to make fertilizer. [See Sections IV(A)(2), IV(B)(2), V(A)(2), and V(B)(2), *supra*.] Moreover, as discussed in this section and in Grounds 1 and 2 above, Veverka and Harrison disclose similar agglomeration processes that employ the same binder (lignosulfonate) and that produce pellets with the same properties (particle size and crush strength). Since Veverka and Harrison teach a common goal of agglomerating a mineral to make fertilizer, both teach the same method and a finished product with the same properties, and Harrison teaches that its methods are suitable for “gypsum, limestone, or mixtures thereof” (Ex. 1005 at 5:23-30) indicating that synthetic gypsum and limestone can be used interchangeably, a POSA would have used synthetic gypsum as taught by Harrison in the process of Veverka. [Ex. 1002 at ¶¶139-142.] A POSA would have expected to be successful in so doing. [*Id.* at ¶141.] Alternatively or additionally, a POSA would have seen using synthetic gypsum in the process taught by Veverka as a simple substitution of known elements to yield predictable results. [*Id.* at ¶142.]

Alternatively, Pietsch teaches using waste product to make fertilizers as well as agglomeration of synthetic gypsum that is a byproduct of FGD processes. [Ex. 1003 at 37-39; *see also* 19-20.] Since Veverka and Pietsch both teach agglomeration of minerals to make fertilizer, and Pietsch teaches the benefits of using synthetic

gypsum byproduct to make useful products, a POSA would have been motivated to use synthetic gypsum as taught by Pietsch in the process of Veverka for the purpose of creating useful fertilizer products from synthetic gypsum byproduct. [Ex. 1002 at ¶¶143-145.] In so doing, a POSA would have expected to be successful. [*Id.*] Alternatively or additionally, a POSA would have seen using synthetic gypsum in place of the limestone taught by Veverka as a simple substitution of known elements to yield predictable results. [*Id.*]

Moreover, Harrison teaches that its methods are suitable for “gypsum, limestone, or mixtures thereof,” indicating that synthetic gypsum and limestone can be used interchangeably. [Ex. 1005 at 5:23-30; Ex. 1002 at ¶146.] Given these teachings of Harrison, a POSA would have expected to be successful using synthetic gypsum as taught by Pietsch into the process of Veverka to make a fertilizer as evidenced by Harrison. [Ex. 1002 at ¶146.] Alternatively or additionally, a POSA would have seen using synthetic gypsum as taught by Pietsch in place of the limestone taught by Veverka as a simple substitution of known elements to yield predictable results as evidenced by Harrison. [*Id.*]

Accordingly, Veverka in view of Harrison or Pietsch renders obvious feeding synthetic gypsum to a forming device.

3. *Element 1b*

Veverka teaches feeding a binder composition comprising lignosulfonate having 18% to 40% solids to the forming device. Veverka teaches several binder options, two of which are lignosulfonate solutions. [*Id.* at Table 7.1 and 7.2, Binder #1 and Binder #2².] Binder #1 was obtained from the manufacturer at 52.0% solids and Binder #2 was obtained from the manufacturer at 57.4% solids. [*Id.* at Table 7.2.] Before being used in the pelletization process, Binder #1 was diluted at a rate of 38% binder to 62% water to make a 19.76% solids binder composition. [*Id.* at Table 4.4.1 (teaching “set-up parameters”); *see also* § 4.1 (describing batch mixing binder with water prior to pelletization).] Binder #2 was diluted at a rate of 35% binder to 65% water to make a 20.09% solids binder composition. [*Id.*] Both Binder #1 and Binder #2 as diluted fall within the claimed range of 18% to 40% solids in claim 1 of the ‘638 Patent. The diluted binders were fed to the forming device (the pin mixer) by spraying. [*Id.* at § 4.1.]

4. *Element 1c*

After feeding synthetic gypsum and lignosulfonate binder into the granulator, Veverka teaches forming the mixture to a mean pellet size guide number (SGN) from

² Binder #2 is Norlig A, which is the same binder used in the ‘638 Patent. [Ex. 1001 at 10:4-8, 10:25-28, Table 3, 11:1-4, Table 6, Table 7, 13:35-40.]

approximately 100 to approximately 500. As explained above, this refers to average particle size between 1 and 5 mm. [Ex. 1002 at ¶148.] Veverka teaches “acceptable particle size is considered to be passing through 4 mesh but retained on 20 mesh,” which corresponds to particles sizes between 0.841 mm and 4.76 mm or SGN of 84 to 476. [Ex. 1002 at ¶148.] This overlaps the claimed range. Given the overlap, a POSA is presumed to have found it obvious to select within the claimed range of particle size. *See, e.g., UCB, Inc.*, 65 F.4th at 689. [See also *Id.*]

5. Element 1d

In addition to the particle size range, Veverka’s granulated product renders teaches a pelletized synthetic gypsum with a crush strength of approximately 2 lbf to approximately 12 lbf. Veverka teaches that the fertilizer pellets should have a crush strength of 4.0 # (which is a symbol for pounds (lbs) and would be understood by a POSA to refer to pounds of force as discussed above for Harrison and Anderson in Grounds 1-3). [Ex. 1007 at § 6.1.4; *see also* Ex. 1002 at ¶149.] This falls within the claimed range.

B. Claim 11

1. Preamble

As discussed above for the preamble of claim 1, Veverka teaches a fertilizer.

2. Element 11a

Veverka teaches fertilizer pellets made of limestone. [Ex. 1007 at § 2.] Veverka does not teach pellets comprising synthetic gypsum. However, as discussed

above for Element 1a, Harrison teaches pellets of synthetic gypsum. Alternatively, Pietsch teaches using waste product to make fertilizers as well as agglomeration of synthetic gypsum that is a byproduct of FGD processes. A POSA would have used synthetic gypsum in Veverka's process for the same reasons as discussed above for Element 1a. Accordingly, the combination of Veverka and Harrison or Pietsch as evidenced by Harrison teaches pellets comprising synthetic gypsum.

3. Element 11b

As discussed above for similar Element 1b, Veverka teaches Binder #1 having 19.76% solids and Binder #2 having 20.09% solids prior to being contacted with the limestone during pelletization. Both Binder #1 and Binder #2 fall within the claimed range.

4. Element 11c

As discussed above for Element 1c, Veverka teaches particles between 0.841 mm and 4.76 mm (SGN 84 to 476). This overlaps the claimed range. Given the overlap, a POSA is presumed to have found it obvious to select within the claimed range of particle size. *See, e.g., UCB, Inc.*, 65 F.4th at 689. [*See also* Ex. 1002 at ¶153.]

5. Element 11d

As discussed above for Element 1d, Veverka teaches that the fertilizer pellets should have a crush strength of 4.0 lbf, which falls within the claimed range.

C. Claim 17

Claim 17 recites a preamble and six elements as follows:

[Preamble] 1. A process for producing a fertilizer comprising:

[17a] feeding synthetic gypsum to a dryer;

[17b] feeding dried synthetic gypsum and a binder composition comprising lignosulfonate having 18% to 40% solids to a mixer; mixing the material fed to the mixer;

[17c] feeding the mixed material to a forming device; pelletizing the material fed to the forming device;

[17d] feeding the pelletized material to a dryer; drying the pelletized material;

[17e] feeding the dried pelletized material to a screener; and screening the material fed to the screener to a mean pellet size guide number (SGN) from approximately 100 to approximately 500, wherein

[17f] the resulting pelletized synthetic gypsum has crush strength from approximately 2 lbf to approximately 12 lbf.

Petitioners will address the preamble and elements in turn below.

1. Preamble

As discussed above for the preamble of claim 1, Veverka teaches a process for making fertilizer.

2. Element 17a

Veverka does not teach feeding synthetic gypsum to a dryer. However, Pietsch teaches using waste product to make fertilizers as well as agglomeration of synthetic gypsum that is a byproduct of FGD processes. [Ex. 1003 at 37-39; *see also* 19-20.] Pietsch further teaches that the product from FGD processes is a slurry which is mechanically dewatered to produce a filter cake of finely divided synthetic gypsum solids. [*Id.* at 39.] Pietsch further teaches drying the finely divided synthetic gypsum

solids before converting them into other products by agglomeration. [*Id.* at 39-40.] Pietsch teaches numerous examples of dryers for drying particular material including for the purpose of recycling or using up secondary/byproduct materials such as FGD gypsum. [*See, e.g., Id.* at 65-67.] Moreover dryers are well-known in the area of agglomeration and a POSA would have known how to select a dryer of many known options for drying the finely divided synthetic gypsum solids before converting them into other products by agglomeration. [Ex. 1002 at ¶157.] In fact, Veverka teaches a dryer for drying its fertilizer pellets as discussed below for Element 17e.

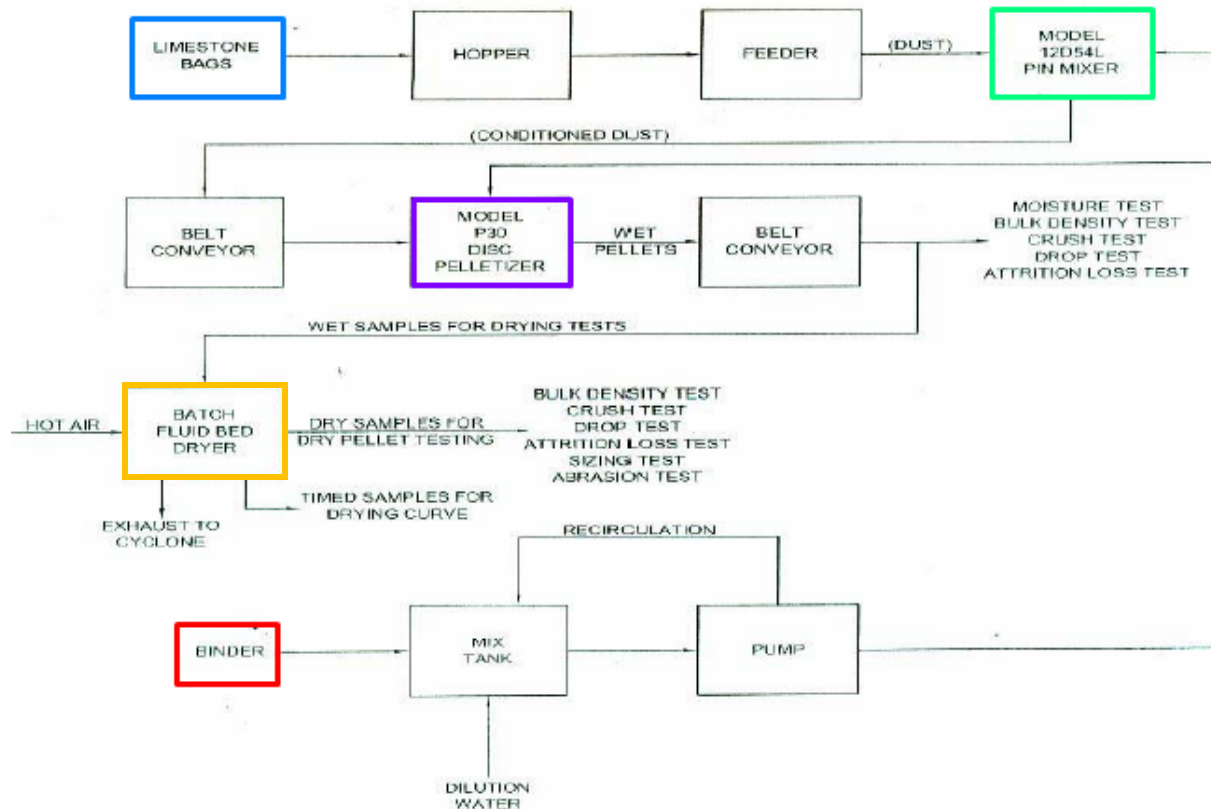
Since Veverka and Pietsch both teach agglomeration of minerals to make fertilizer, and Pietsch teaches the benefit of using synthetic gypsum byproduct to make useful products, a POSA would have been motivated to use synthetic gypsum as taught by Pietsch in the process of Veverka for the purpose of creating useful fertilizer products from synthetic gypsum byproduct. [*Id.* at ¶158.] A POSA would also have been motivated to dry the synthetic gypsum before making it into fertilizer to improve its portability and handling, especially in view of the fact that Veverka already contemplates using a dryer to dry particles. [*Id.*] Moreover, a POSA would have expected to be successful combining synthetic gypsum and the step of drying synthetic gypsum, both of which were well known from Pietsch, into the process of Veverka to make a fertilizer. [*Id.* at ¶159.]

In addition, Harrison teaches that its methods are suitable for “gypsum, limestone, or mixtures thereof,” indicating that synthetic gypsum and limestone can be used interchangeably. [Ex. 1005 at 5:23-30; Ex. 1002 at ¶160.] Save for Veverka’s use of limestone, Harrison and Veverka teach the same process using the same binder composition (lignosulfonate) and which results in the particles having the same material properties (particle size and crush strength). A POSA would have expected to be successful using synthetic gypsum as taught by Pietsch in the process of Veverka as taught by Pietsch and evidenced by Harrison, and drying the synthetic gypsum as taught by Pietsch, to make a fertilizer product. [Ex. 1002 at ¶160.]

Accordingly, Veverka in view of Pietsch renders obvious feeding synthetic gypsum to a dryer.

3. Element 17b

Veverka as modified by Pietsch for Element 17a discussed in the preceding section teaches feeding dried synthetic gypsum and a binder composition comprising lignosulfonate having 18% to 40% solids to a mixer and mixing the material. Veverka teaches feeding its limestone feed material (**blue**) and binder (**red**) to a pin mixer (**green**) as shown in annotated Figure 1 below:



Veverka further teaches mixing in the pin mixer to wet the limestone particles with the binder and partially agglomerate the material:

The material is initially processed through a Mars Mineral Pin Mixer where the majority of the binder is applied. (The Pin Mixer sprays binder on the material, thoroughly wetting the particles, and partially agglomerates the material to prepare it for final pelletizing.)

[Ex. 1007 at § 4.1 (emphasis in original).]

As discussed above for similar Elements 1b and 11b, Veverka teaches two example lignosulfonate binders: Binder #1 having 19.76% solids and Binder #2 having 20.09% solids. [*Id.*] Both Binder #1 and Binder #2 fall within the claimed range of 18% to 40% solids.

4. Element 17c

Veverka teaches feeding the mixed material to a forming device and pelletizing the material fed to the forming device. The forming device is a disc pelletizer shown in **purple** in annotated Figure 1 above. Veverka teaches:

The conditioned material [from the pin mixer is] dropped onto a belt conveyor and transferred to a Mars Mineral Disc Pelletizer. (The Disc Pelletizer compacts the material through tumble growth agglomeration.)

[Ex. 1007 at § 4.1 (emphasis in original).] A pelletizer is a type of forming device as recognized in the specification of the ‘638 Patent. [Ex. 1001 at 2:14-16 (“...a forming device, which may comprise a pelletizer, granulator, or extruder”), claim 8 (“wherein the forming device comprises a pelletizer”).] Tumble growth agglomeration in a disc pelletizer is a pelletizing process. [Ex. 1002 at ¶163.]

5. Element 17d

Veverka teaches feeding the pelletized material to a dryer and drying the pelletized material. The dryer is shown in **orange** in annotated Figure 1 above. Pellets from the pelletizer are fed to the dryer by a conveyor and dried. [Ex. 1007 at Fig. 1; § 4.1.]

6. Element 17e

Veverka teaches feeding the dried pelletized material to a screener. Specifically, Veverka teaches feeding its pellets to a screener after drying, and agitating screens in the screener. [Ex. 1007 at §§ 4.1, 4.2.] Veverka also teaches

screening the material fed to the screener to a mean pellet size guide number (SGN) from approximately 100 to approximately 500. As discussed above for Elements 1c and 11c Veverka teaches screening the particles to sizes between 0.841 mm and 4.76 mm or SGN 84 to 476, which overlaps the claimed range. Given the overlap, a POSA is presumed to have found it obvious to select within the claimed range of average particle size. *See, e.g., UCB, Inc. v. Actavis Labs. UT, Inc.*, 65 F.4th 679, 689 (Fed. Cir. 2023). [See also Ex. 1002 at ¶165]

7. Element 17f

Veverka teaches the resulting pellets have crush strength between approximately 2 lbf to approximately 12 lbf. As discussed above for similar Elements 1d and 11d, Veverka teaches pellets having a crush strength of 4# (or pounds of force), which falls within the claimed range.

D. Claims 2 and 19

Claim 19 depends from claim 17 and is similar to claim 2. Veverka in view of Harrison renders obvious synthetic gypsum fed to the forming device (claim 2) or mixer (claim 19) has a mean particle size of less than 100 microns.

As discussed above in Sections IV(C) and V(C) for claim 2, Harrison teaches or renders obvious synthetic gypsum having mean particle size of less than 100 microns fed to the forming device. Veverka teaches source limestone material with particle size distribution similar to the distribution taught by Harrison. For instance,

Veverka teaches in one example about 50% of the source material is retained on 200 mesh screen and in another example almost 40% of the source material is retained on 200 mesh screen. [Ex. 1007 at §§ 7.3-7.4.] Harrison teaches in one example that its source material has 35 to 50% particles that are plus 200 mesh, meaning those particles are retained on the 200 mesh. [Ex. 1005 at (17:19-26 (referring to 13:11-14).)]

Given that the feedstock particles taught by Harrison and Veverka are around the same size, a POSA would have used the synthetic gypsum feedstock having mean particles size of less than 100 microns as taught by Harrison in the process of Veverka for the same reasons discussed above for Elements 1a and 11a. [Ex. 1002 at ¶¶167-168.]

E. Claims 3 and 12

Veverka teaches a binder composition comprising a water soluble binder. As discussed above for Elements 1b and 11b, Veverka uses lignosulfonate binder compositions. Lignosulfonate is a water soluble binder. [Ex. 1002 at ¶169.]

F. Claims 5 and 14

Veverka in view of Harrison renders obvious feeding an additive to the forming device, wherein the additive is selected from the group consisting of ground calcium carbonate, calcium bentonite, kaolin clays, manganese, zinc, boron, calcium, copper, and elemental sulfur. As discussed above in Sections IV(E) and V(E), Harrison teaches using a combination of synthetic gypsum and limestone

(which is calcium carbonate) in the forming device. [Ex. 1005 at 2:1-2; 5:23-30; 10:7-52; 17:19-29.] Based on the teachings of Harrison, and in view of the fact that Veverka teaches pelletizing limestone to make fertilizer by the same process, using the same binder, and with the same resulting material properties, a POSA would have expected to be successful using a feedstock with a combination of synthetic gypsum and limestone as taught by Harrison in the process of Veverka to make a fertilizer for the same reasons discussed above for Elements 1a and 11a. [Ex. 1002 at ¶¶170-171.] Alternatively or additionally, a POSA would have seen using a combination synthetic gypsum and a limestone additive in the process taught by Veverka as a simple substitution of known elements to yield predictable results. [*Id.*]

G. Claims 7, 16, and 22

Claim 22 depends from claim 17 and is similar to claims 7 and 16. Veverka in view of Harrison teaches pellets with mean SGN from approximately 250 to approximately 280. As discussed above for Elements 1c, 11c, and 17e, Veverka teaches screening its particles to average particle size between 0.841 mm and 4.76 mm (SGN 84 to 476). As discussed above in Section V(C) in Ground 2, Harrison teaches that some portion of the product in Example II falls within the Tyler Standard Screen Scale size range of minus 7 plus 8 mesh, which corresponds to particle sizes ranging from 2.38 to 2.83 mm or SGN from 238 to 283. A POSA would see this

range as equivalent to the claimed SGN range of approximately 250 to approximately 280. [Ex. 1002 at ¶173; *see also* ¶111.]

In addition, a POSA would have expected to be successful in isolating the narrower range particle size taught by Harrison in the process of Veverka since both teach pelletizing minerals with lignosulfonate binder to make fertilizer, and the resulting fertilizers have the same crush strength as discussed in this section and for Grounds 1 and 2 above. [Ex. 1002 at ¶174.] Moreover, the claimed range of SGN 250 to 280 falls within the range of particle sizes that Harrison teaches are suitable for fertilizer. [Ex. 1005 at 11:65-12:31.]

H. Claim 8

Veverka teaches that its forming device comprises a pelletizer. As shown above for Element 1a, Veverka uses a pin mixer, which is a type of pelletizer.

I. Claims 10 and 23

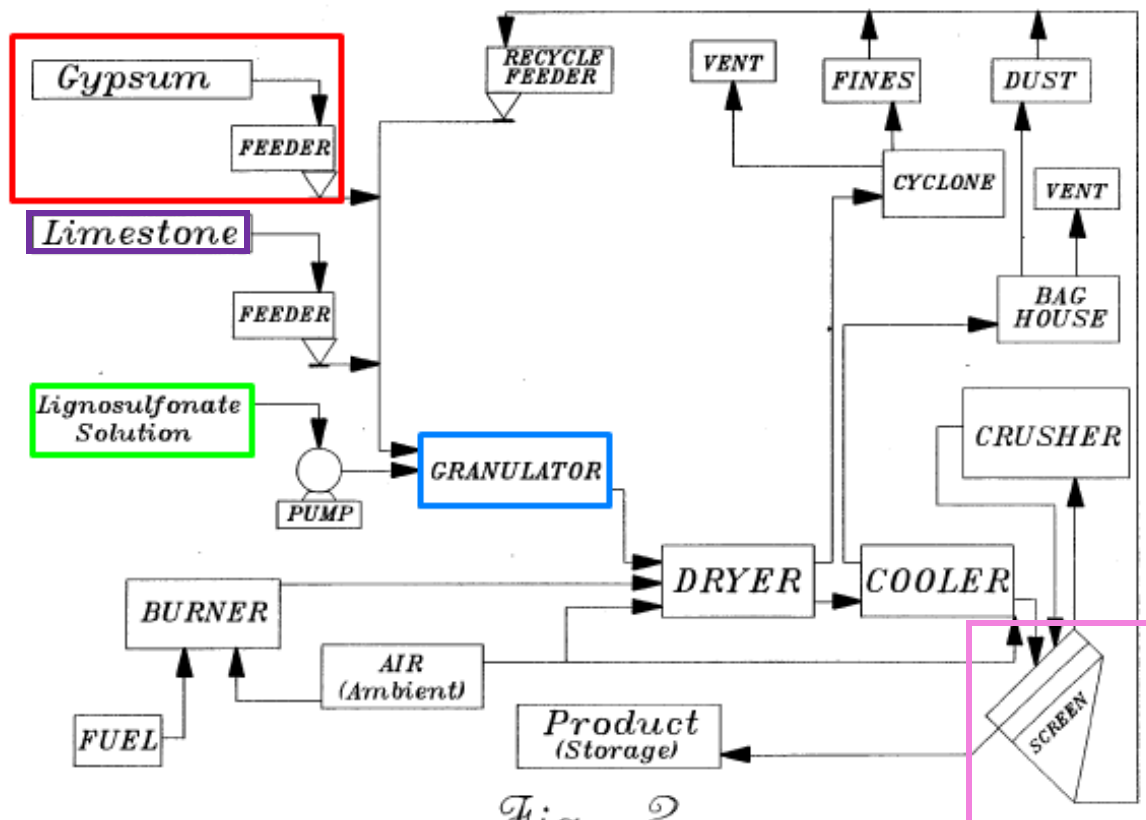
Veverka teaches a fertilizer made by its method, as shown above for the preambles of claims 1 and 17.

J. Claim 18

Veverka in view of Harrison renders obvious recycling unders and overs removed during screening to the mixer. Veverka teaches that in a pelletizing process, “[o]ff-size material must be handled through a recycle material handling system or disposed.” [Ex. 1007 at § 6.3.] Thus Veverka contemplates recycling off-size

material, which would be understood by a POSA to be “unders and overs” or in other words, under- and over-sized particles. [Ex. 1002 at ¶177.]

Harrison teaches a screener (shown in pink in annotated Figure 2 below). Harrison further teaches that oversize material is crushed and re-screened in the screener. [Ex. 1005 at 8:9-14.] Undersize material from the granulator and the crusher are both recycled to the granulator. [*Id.* at 8:14-21; *see also* 10:40-52, 11:13-16, 12:30-36.] Given that Veverka contemplates recycling, and Harrison describes a similar process with similar resulting fertilizer particles as Veverka as discussed above and in this Section, a POSA would have been motivated to implement recycling as suggested by Veverka in the manner taught by Harrison in order to reduce waste in the pelletization process. [Ex. 1002 at ¶178.]



same resulting fertilizer process, to select an appropriate solids content for the lignosulfonate binder used in Shimada's process.

As above, this section will first address each of the two challenged independent claims, claim 1 and 11, and then the applicable dependent claims. Petitioners will refer to the same elements as discussed above in Ground 1.

A. Claim 1

1. Preamble

Shimada teaches a method for making fertilizer. [Ex. 1009 at ¶¶[0007]-[0008].]

2. Element 1a

Shimada teaches feeding synthetic gypsum to a forming device. Specifically, Shimada teaches using a drum-type granulator to granulate synthetic gypsum such as by-product gypsum. [*Id.* at ¶¶[0014], [0019], [0049].] A granulator is a type of forming device as recognized in the specification of the '638 Patent. [Ex. 1001 at 2:14-16 (“...a forming device, which may comprise a pelletizer, granulator, or extruder”), claim 9 (“wherein the forming device comprises a granulator or extruder”); *see also* Ex. 1002 at ¶181.]

3. Element 1b

Shimada in view of Harrison renders obvious feeding a binder composition comprising lignosulfonate having 18% to 40% solids to the forming device. Shimada teaches using a composition with lignosulfonate as a “granulation aid” for its

process. [*Id.* at ¶¶[0011], [0049].] A POSA would understand a granulation aid to be a binder composition. [Ex. 1002 at ¶182.] The granulation aid is added to the granulator with the gypsum. [Ex. 1009 at ¶[0019].] Shimada does not disclose a solids content for its granulation aid. Shimada does teach, however, adding water to the granulator along with the gypsum and granulation aid. [*Id.*]

As discussed above in Sections IV(A)(3), IV(B)(3), V(A)(3), and V(B)(3), Harrison teaches or renders obvious feeding a binder composition comprising lignosulfonate having 18% to 40% solids to a forming device for agglomerating synthetic gypsum. Since Harrison and Shimada both teach agglomerating synthetic gypsum in the same type of equipment (a granulator), fertilizers having the same material properties (particle size and crush strength) as will be discussed in this section and is discussed for Grounds 1 and 2 above, and using lignosulfonate binder with water during agglomeration, a POSA would have used the binder composition taught by Harrison in the process of Shimada. [Ex. 1002 at ¶¶182-185.] A POSA would have expected to be successful using the lignosulfonate binder taught by Harrison in the process of Shimada to make a fertilizer. [Ex. 1002 at ¶184.] Alternatively or additionally, a POSA would have seen using the lignosulfonate binder of Harrison in place of the granulation aid taught by Shimada as a simple substitution of known elements to yield predictable results. [*Id.* at ¶185.]

4. *Element 1c*

After feeding synthetic gypsum and lignosulfonate binder into the granulator, Shimada teaches forming the mixture to a mean pellet size guide number (SGN) from approximately 100 to approximately 500. Shimada teaches its fertilizer has particle size from 1 to 4 mm or SGN 100 to 400. [Ex. 1009 at ¶¶[0019], [0030]; Ex. 1002 at ¶186.] In a particular example Shimada teaches gypsum and lignosulfonate particles having particles size 2 mm to 4 mm or SGN 200 to 400. [*Id.* at ¶[0049].] These particles fall within the claimed range.

5. *Element 1d*

In addition to meeting the particle size range, Shimada's fertilizer renders obvious a pelletized synthetic gypsum with a crush strength of approximately 2 lbf to approximately 12 lbf. Shimada teaches its fertilizer has average hardness of 1kg/grain (2.2lb/grain) or more. [Ex. 1009 at ¶[0020].] A POSA would understand "average hardness" to correspond to crush strength, and the value of 1 kg to mean 2.2 pounds, and further know that the kg or pounds refers to kg or pounds of force. [Ex. 1002 at ¶187.] This overlaps the claimed range. Given the overlap, a POSA is presumed to have found it obvious to select within the claimed range of crush strength. *See, e.g., UCB, Inc. v. Actavis Labs. UT, Inc.*, 65 F.4th 679, 689 (Fed. Cir. 2023). [*See also Id.*]

B. Claim 11

1. Preamble

As discussed above for the preamble of claim 1, Shimada teaches a fertilizer.

2. Element 11a

As discussed above for similar Element 1a, Shimada teaches granulating synthetic gypsum such as by-product gypsum to make pellets.

3. Element 11b

As discussed above for similar Element 1b, Shimada teaches using a composition with lignosulfonate as a “granulation aid,” or binder, for its process. [Ex. 1002 at ¶190.] Shimada does not disclose a solids content for its binder composition. Shimada does teach, however, adding water to the granulator along with the gypsum and granulation aid. Harrison teaches or renders obvious a binder composition comprising lignosulfonate having 18% to 40% solids at the time of contact with the gypsum. A POSA would have known to use the binder composition taught by Harrison in Shimada’s process for the same reasons discussed above for Element 1b. [*Id.*]

4. Element 11c

As discussed above for Element 1c, Shimada teaches its fertilizer has particle size from 1 to 4 mm or SGN 100 to 400. In a particular example Shimada teaches gypsum and lignosulfonate particles having particles size 2 mm to 4 mm or SGN 200 to 400, falling within the claimed range. [*Id.* at ¶191.]

5. *Element 11d*

As discussed above for Element 1d, Shimada teaches its fertilizer has average hardness of 1kg/grain (2.2lb/grain) or more. A POSA would understand “average hardness” to correspond to crush strength, and the value of 1 kg to mean 2.2 pounds of force. This overlaps the claimed range. [Ex. 1002 at ¶192.] Given the overlap, a POSA is presumed to have found it obvious to select within the claimed range of crush strength. *See, e.g., UCB, Inc. v. Actavis Labs. UT, Inc.*, 65 F.4th 679, 689 (Fed. Cir. 2023). [*See also Id.*]

C. Claim 2

Shimada in view of Harrison renders obvious that the synthetic gypsum fed to the forming device has a mean particle size of less than 100 microns. Shimada is silent as to the particle size of the synthetic gypsum fed to the forming device. However, as discussed above in Section V(C), Harrison teaches synthetic gypsum having mean particle size of less than 100 microns fed to the forming device. Harrison and Shimada both teach agglomerating the same material, synthetic gypsum, using the same binder, lignosulfonate, to produce fertilizer with the same properties (particle size and crush strength) as discussed above for Grounds 1 and 2 and in this section. Given these teachings, a POSA would have used the feedstock taught by Harrison in the process of Shimada. [Ex. 1002 at ¶¶193-194.] A POSA would have expected success using Harrison’s feedstock in Shimada’s process. [*Id.*]

D. Claims 3 and 12

Shimada teaches that its binder composition comprises a water soluble binder.

As discussed above for Elements 1b and 11b, Shimada uses lignosulfonate, which is a water soluble binder. [Ex. 1002 at ¶195.]

E. Claims 4 and 13

Claim 4 depends from claim 1 and recites “wherein the binder composition also comprises one or more binders selected from the group of...starch.” Claim 13 depends from claim 11 and recites the same. Shimada teaches a granulation aid or binder that can include one or multiple of several options. The options include lignosulfonates and starches. [Ex. 1008 at ¶[0011].] A POSA would understand that Shimada therefore teaches the use of a combination of lignosulfonate and starch as a binder. [Ex. 1002 at ¶196.]

F. Claims 5 and 14

Shimada in view of Harrison renders obvious feeding an additive to the forming device, wherein the additive is selected from the group consisting of ground calcium carbonate, calcium bentonite, kaolin clays, manganese, zinc, boron, calcium, copper, and elemental sulfur. As discussed above in Sections IV(E) and V(E), Harrison teaches using a combination of synthetic gypsum and limestone (which is calcium carbonate) in the forming device. [Ex. 1005 at 2:1-2; 5:23-30; 10:7-52; 17:19-29.] Based on the teachings of Harrison, and in view of the fact that Shimada teaches pelletizing limestone to make fertilizer by the same process, using

the same binder and contemplates fertilizers containing lime, with the same resulting material properties, a POSA would have used a feedstock with a combination of synthetic gypsum and limestone as taught by Harrison in the process of Shimada to make a fertilizer for the same reasons discussed above for Elements 1b and 11b. [Ex. 1002 at ¶¶197-199.] A POSA would have expected to be successful in so doing. [Id. at ¶198.] Alternatively or additionally, a POSA would have seen using a combination synthetic gypsum and a limestone additive in the process taught by Shimada as a simple substitution of known elements to yield predictable results. [Id. at ¶199.]

G. Claims 7 and 16

Shimada in view of Harrison renders obvious that its pellets have mean SGN is from approximately 250 to approximately 280. As discussed above for Elements 1c, 11c, and 17c, Shimada teaches its fertilizer has particle size from 1 to 4 mm (SGN 100 to 400) or more particularly 2 to 4 mm (SGN 200 to 400).

Harrison teaches that some portion of the product in Example II falls within the Tyler Standard Screen Scale size range of minus 7 plus 8 mesh, which corresponds to particle sizes ranging from 2.38 to 2.83 mm (SGN 238 to 283). [Ex. 1005 at 13:38-49, Table 1; Ex. 1002 at ¶111.] A POSA would have expected to be successful in isolating the narrower range particle size taught by Harrison in the process of Shimada since both teach pelletizing minerals with lignosulfonate binder to make fertilizer, and the resulting fertilizers have the same crush strength as

discussed in this section and for Grounds 1 and 2 above. [Ex. 1002 at ¶201.] Moreover, the claimed range of SGN 250 to 280 falls within the range of particle sizes that Harrison teaches are suitable for fertilizer. [Ex. 1005 at 11:65-12:31.]

H. Claim 9

Shimada teaches that its forming device comprises a granulator or extruder.

As shown above for Element 1a, Shimada uses a drum granulator.

I. Claim 10

Shimada teaches a fertilizer made by its process, as shown above for the preamble of claim 1.

IX. GROUND 6 – OBVIOUS IN FURTHER VIEW OF ZANUCCOLI

The sixth and final ground pertains only to certain dependent claims that recite the fertilizer includes a sulfur additive. In this ground, Petitioners will explain that Zanuccoli teaches the sulfur additive, and would have been combined with any of the references discussed above by a POSA. This Ground is supported by Dr. Ennis’s Declaration at ¶¶204-208.

Claim 5 depends from claim 1 and recites “further comprising feeding an additive to the forming device, wherein the additive is selected from the group consisting of ground calcium carbonate, calcium bentonite, kaolin clays, manganese, zinc, boron, calcium, copper, and elemental sulfur.” Claim 6 depends from claim 5 and further recites “wherein the additive comprises elemental sulfur.” Claims 14 and 15 depend from claim 11 and are otherwise identical to claims 5 and 6. Claim 20

depends from claim 17 and similarity recites an additive selected from the group consisting of manganese, zinc, boron, calcium, copper, and elemental sulfur. Claim 21 depends from claim 17 and like claims 6 and 15 recites that the additive is elemental sulfur.

Zanuccoli teaches pellets containing fly sulfur powder and a wetting agent (or binder) which is preferably a lignosulfonate. [Ex. 1010 at 1:20-30, 2:18-38.] A POSA would know that fly sulfur powder consists of elemental sulfur. [Ex. 1002 at ¶206.] The pellets taught by Zanuccoli can also comprise gypsum. [*Id.* at 3:39-41.] Zanuccoli further teaches that in a fertilizer, sulfur provides the benefit of correcting alkalinity of soil and intervening with sodium-calcium ionic exchange. [*Id.* at 1:31-45.]

Given the teachings of Zanuccoli, a POSA would have added elemental sulfur as taught by Zanuccoli to any of the fertilizers taught by Harrison (Grounds 1 and 2), Anderson in view of Pietsch (Ground 3), Veverka in view of Harrison or Pietsch (Ground 4), or Shimada in view of Harrison (Ground 5).

Specifically, a POSA would have been motivated to add elemental sulfur to the fertilizers taught by Harrison, Anderson in view of Pietsch, Veverka in view of Pietsch or Harrison, or Shimada in view of Harrison for the purpose of correcting alkalinity of soil and intervening with sodium-calcium ionic exchange as taught by Zanuccoli. [*Id.* at 1:31-45; Ex. 1002 at ¶¶207-208.] Moreover, a POSA would have

expected to be successful in adding elemental sulfur to the fertilizers Harrison, Anderson in view of Pietsch, Veverka in view of Pietsch or Harrison, or Shimada in view of Harrison because Zanutcolli teaches that the combination of gypsum and sulfur is possible, beneficial, and useful, and further teaches making its pellets with the same binder (lignosulfonate). [*Id.*]

X. GROUNDS FOR STANDING AND FEE PAYMENT

Petitioners hereby certify that the '638 Patent is available for *inter partes* review, and that Petitioners are not barred or estopped from requesting *inter partes* review on the identified grounds in the Petition. Pursuant to 37 C.F.R. § 42.103, the undersigned authorizes the charge of any required fees to Deposit Account No. 50-1482 in the name of Carlson, Gaskey & Olds and authorizes the same account to be credited for any overpayment.

CARLSON, GASKEY & OLDS, P.C.

/Jessica Fleetham /

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Dated: November 28, 2023

CERTIFICATION UNDER 37 CFR § 42.24(d)

I hereby certify that the foregoing Petition for *Inter Partes* Review complies with the type-volume limitation of 37 C.F.R. § 42.24(a)(1)(i). Specifically, this Petition totals 13,926 words as counted by the word count feature of the software used to prepare this Petition, Microsoft Word, excluding those sections specified in 37 CFR § 42.24(a)(1).

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Dated: November 28, 2023

CERTIFICATE OF SERVICE

Pursuant to 37 CFR § 42.105, I hereby certify that a true and correct copy of the foregoing Petition for *Inter Partes* Review and supporting evidence was served on Henry Ward on November 28, 2023, via FedEx Priority Overnight to the following address:

MOORE & VAN ALLEN PLLC
ATTN: IP DEPARTMENT
100 North Tryon Street
Suite 4700
Charlotte, NC 28202
UNITED STATES

and via email to the following address:

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