UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ENERCORP SAND SOLUTIONS INC.
Petitioner,

v.

SPECIALIZED DESANDERS INC.,
Patent Owner

Case IPR2018-01748
Patent No. 8,945,256

PETITIONER'S REPLY

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EXHIBIT LIST

Exhibit No.	Description
1001	U.S. Patent No. 8,945,256 B2 to Hemstock (the "'256 Patent")
1002	Expert Declaration of David Simpson, P.E.
1003	Prosecution File History, U.S. Patent Application (U.S.13/372,291) ('256 Patent)
1004	U.S. Patent No. 6,983,852 to Hemstock et al. ("Hemstock")
1005	Sedimentation of Noncolloidal Particles at Low Reynolds Numbers, Robert H. Davis and Andreas Acrivos, Annual Review of Fluid Mechanics, Vol. 17, 1985, published by Annual Reviews Inc., pages 91-118 ("Davis")
1006	Rebuttal Declaration of David Simpson, P.E.
1007	U.S. Patent No. 1,458,234 to Miller ("Miller")
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Pursuant to 37 C.F.R. § 42.23, Petitioner provides this Reply to Patent Owner's Response to the institution of *inter partes* review of claims 1-16 of the '256 Patent.

I. INTRODUCTION

The '256 Patent claims as a new invention the inventor's prior art desander, merely inclined at an angle. The patent's claims are directed towards inclining the vessel, or the consequences that necessarily follow from inclining it. The ultimate issue here is simply whether it was obvious to a POSITA to consider inclining Hemstock's desander. The Petition shows that it was; Patent Owner's attacks are without merit.

Patent Owner's construction requiring the gas/liquid interface to be precisely at the same location as the fluid outlet is a negative limitation, unsupported and completely contradicted by the specification. Among other defects in its analysis, Patent Owner's negative limitation excludes an entire embodiment, which neither Patent Owner nor its expert considered in formulating their construction. Accordingly, Patent Owner's construction is not the broadest reasonable construction.

Patent Owner's claims that the asserted grounds lack various claim limitations are almost exclusively attacks on the individual references, not the asserted combinations, and thus are legal nullities. Moreover, Patent Owner's individual

attacks fail to account for what a POSITA would reasonably understand or infer from the references. Thus, Patent Owner presents Hemstock's prior art desander as an unmoving and completely static system, ignoring how a POSITA would understand the desander to operate or how its operation would change if inclined. For example, Patent Owner's arguments fail to account for even the effects of gravity on the liquid and sand in Hemstock's desander once it is inclined, or the liquid velocity in the vessel's belly portion (which would create a suspension).

Patent Owner's arguments with respect to the Data Book are similarly flawed. Patent Owner argues that the asserted combination of Hemstock and the Data Book's inclined slug catcher (a single phase separator) fails based on Patent Owner's analysis of a completely different and unasserted combination, involving a different type of slug catcher (a two phase separator). And Patent Owner's arguments that the Data Book's inclined pipe slug catchers are inapplicable to Hemstock's desander fail to recognize that Hemstock teaches that preferred embodiments of its desander are actually constructed from pipe.

All of Patent Owner's arguments are replete with citations to the prior art and/or the '256 Patent which, when examined, simply do not state or even support what Patent Owner asserts in the Response. Likewise, Patent Owner repeatedly cites to cross-examination testimony of Petitioner's expert, Mr. David Simpson, for very broad propositions in support of Patent Owner's positions. Again, a careful review

of Mr. Simpson's actual testimony (versus Patent Owner's paraphrasing) shows that Patent Owner is distorting Mr. Simpson's testimony by extrapolating narrow answers given in response to very specific questions. Because the actual evidence simply do not support Patent Owner's positions, Patent Owner is forced to play fast and loose with the record.

The Petition shows that it if Hemstock's desander were inclined, it would meet all the limitations of the challenged claims. Moreover, the Petition shows that it would have been obvious to incline Hemstock's desander based on either Davis or the Data Book, and a POSITA would have been had several different motivations to combine the references. Patent Owner's individual attacks do not and cannot overcome the asserted combinations. Patent Owner's attacks on Petitioner's asserted motivations to combine are shown, after a careful review of the evidence, to be without support. Accordingly, the Board should find all challenged claims unpatentable.

II. THE APPROPRIATE CONSTRUCTION OF THE "INTERFACE LIMITATIONS"

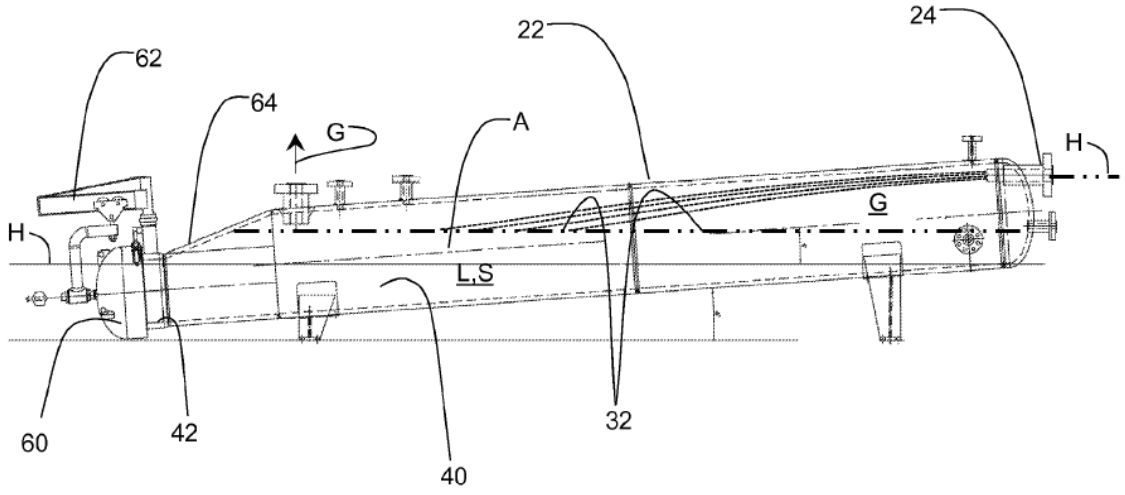
The Board invited the parties to address the proper construction of "gas/liquid interface formed at the fluid outlet having a belly storage portion therebelow." Paper 7 at 19 n.11. Patent Owner dubs this, along with a similar term in claim 9, the "Interface Limitations." Paper 10 ("POR") at 10-11.

Patent Owner first asserts that the "the gas/liquid interface level is the

boundary between the gas-filled freeboard portion of the vessel and the solid-and-liquid filled belly portion of the vessel." *Id.* at 11. Petitioner agrees that the interface is simply the liquid level in the vessel, and the freeboard and belly storage portions are therefore the portions of the vessel above and below the interface. *See* Ex. 1001, 4:50-52. However, Patent Owner's negative limitation requiring that "this interface must be at the same level as the fluid outlet, not above or below the fluid outlet" is not supported.

Although Claim 1 states that the interface is formed "at the fluid outlet," the issue is, does the specification support construing "at" to require the interface level to be at the exact same location/elevation as the fluid outlet, or is the broadest reasonable construction something less precise?

Claim 9 requires inclination such that the "fluid outlet is lower than the fluid inlet for forming a freeboard above the fluid outlet," and "establishing a liquid interface in a belly portion of the vessel, the belly portion being formed below the fluid outlet." These limitations do not recite "at the fluid outlet," but are satisfied even when the interface is not located at the exact location as the outlet. For example, Figure 7 shows interface 32 below the fluid outlet:



Here, claim 9 is satisfied, because there is freeboard formed above the outlet, and a belly portion below, even though there is ***also*** freeboard ***below*** the outlet. Ex. 1006 ¶¶ 212-213. Furthermore, Claim 9's requirement that the belly portion be formed ***below*** the fluid outlet, and the interface be established in the belly portion, indicates that the interface is actually located below the fluid outlet, as shown in Figure 7. *See id.* ¶ 214. Thus, claim 9 does not support Patent Owner's negative limitation.

Claim 10 also indicates that "at the fluid outlet" does not mean exactly at the fluid outlet. Claim 10 requires the interface to extend "from ***about*** the fluid outlet," which indicates to a POSITA merely close or near the fluid outlet. *Id.* ¶ 211. Because claim 1's "at the fluid outlet" must include the dependent claim's "from about the fluid outlet," "at the fluid outlet" in Claim 1 cannot be limited as asserted by Patent Owner. Claim 10 thus indicates that "at the fluid outlet" includes close or near the outlet.

The written description supports this conclusion, teaching that the interface is

merely "adjacent" the fluid outlet. Ex. 1001, 4:50-55 (referencing Fig. 2). The meaning to a POSITA of "adjacent," like "about," is merely close or near. Ex. 1006 ¶¶ 215-16. The specification uses "adjacent" to describe the location of Hemstock's weir: "a desander is disclosed … having an inlet at one end and an outlet at the other end, the outlet separated from the inlet by a downcomer flow barrier, such as a weir, ***adjacent the vessel's outlet*** or exit." *Id.*, 2:9-13. With one exception (Fig. 4c), Hemstock's flow barriers are not precisely at the same point as the fluid outlet, but merely near it. *See* Ex. 1004, Fig. 3, 4a, 4b. This confirms the ordinary understanding of "adjacent."

Conversely, Hemstock states that its weirs are "applied ***at the fluid outlet***." Ex. 1004, 3:22-23. Thus, "at the fluid outlet" as previously used by the inventor means close or near the fluid outlet. *See Laryngeal Mask Co. v. Ambu A/S*, 618 F.3d 1367, 1373 (Fed. Cir. 2010) (relying on prior art use of same term by inventor to inform as to the term's meaning to a POSITA).

Patent Owner argues that the '256 Patent teaches that having the interface at the fluid outlet is an improvement over the Hemstock vessel, as it eliminated the need for a weir, which prevented the liquid level in Hemstock from reaching the fluid outlet. POR at 13-14. But neither the '256 Patent nor Hemstock support Patent Owner's analysis.

The portions of Hemstock cited by Patent Owner do not state that the weir

prevents the liquid level from reaching the fluid outlet, but merely that the weir sets the maximum depth of the interface. Ex. 1004, 4:44-47; 5:9-38. Nothing indicates that this depth is below the intake of the flow outlet, that "flow would become unstable," or that the vessel would quit desanding if the liquid interface reached that level. Hemstock states that this will occur only if ***particulates S*** accumulate and reach that level, but not ***liquid L***. *Id.*, 4:62-5:7; Ex. 1006 ¶¶ 220-22,

Hemstock actually teaches that this maximum level is slightly ***above*** the lower edge of the weir. Ex. 1004 at 5:22-26 (explaining that, should liquid or sand levels "encroach[] ***above*** the lower edge 41, it will result in re-entrainment and "inherently result[] in a steady state maximum level of accumulation."); Ex. 1006 ¶¶ 223-25. Thus, Hemstock operates by allowing the gas/liquid interface to rise slightly above the weir's lower edge, which will result in re-entrainment and prevent the liquid level from rising further. *Id.* ¶ 226. Hemstock never states that the weir must extend to a level below the fluid outlet or that the gas/liquid interface must remain below the fluid outlet. *Id.* ¶ 227. In fact, a POSITA would understand that Hemstock (and the '256 Patent) both allow and require the fluid level to rise above the fluid outlet at points during operation. *Id.* ¶¶ 228-29; Ex. 1011 at 42:19-45:17, 46:17-47:17.

More importantly, Hemstock expressly contradicts Patent Owner's analysis. Figure 4c in Hemstock shows one embodiment where there is no separate flow barrier, but "the outlet 13 itself acts as the flow barrier 40." Ex. 1004, 5:28-31; *see*

generally id. at 5:16-39.

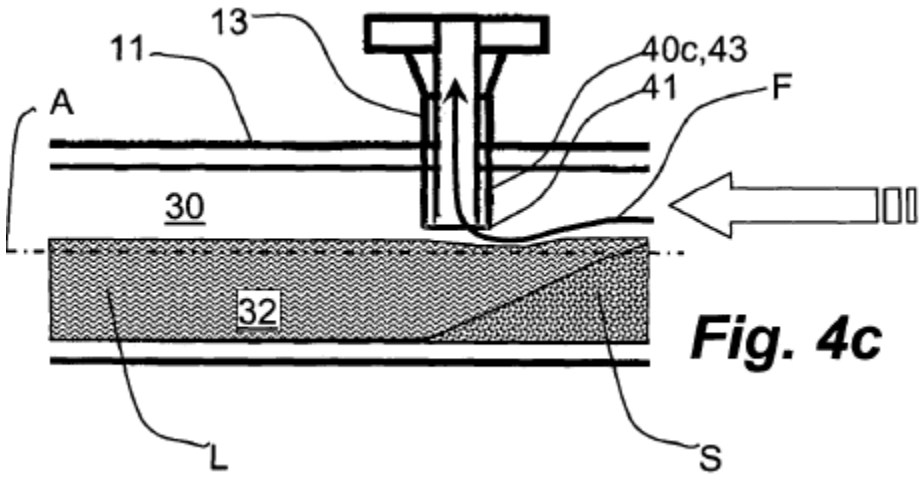


Fig. 4c

Because, as previously discussed, the maximum accumulation level is slightly above the bottom of the weir, which in Figure 4c ***is actually fluid outlet 13 itself***, this embodiment allows the gas/liquid interface to reach the fluid outlet. Patent Owner's argument that Hemstock does not disclose an interface "at the fluid outlet" simply cannot be true in view of Hemstock's Figure 4c embodiment. [1]

The '256 Patent itself also fails to support Patent Owner's analysis. Although Patent Owner repeatedly argues that the specification characterizes Hemstock as

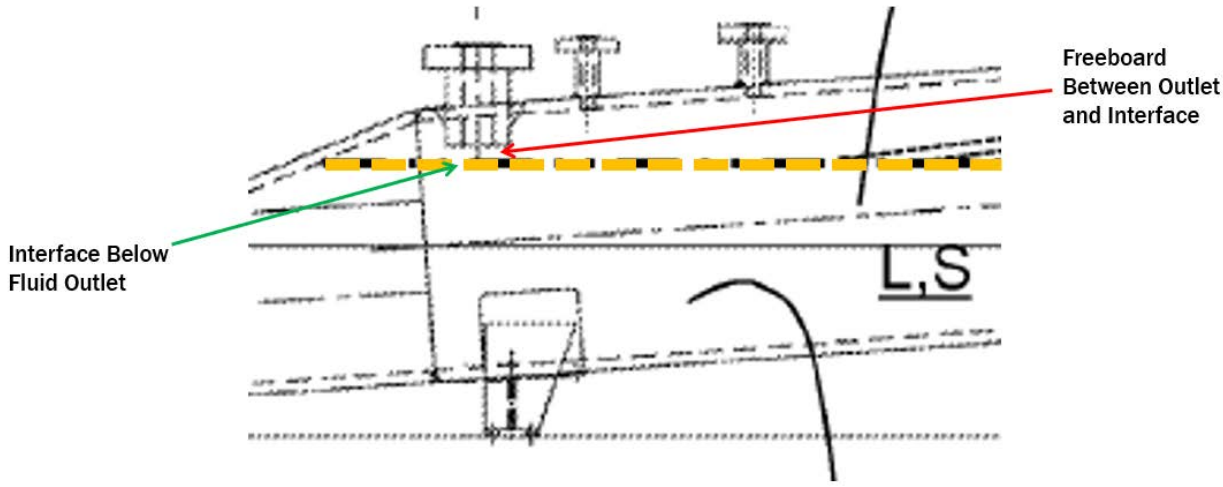
[1] Although Figure 4c shows the interface below the level of fluid outlet 13, Hemstock expressly states that the liquid level may rise or encroach above the bottom of the flow barrier, which may be fluid outlet 13 itself. Ex. 1004 at 5:22-26; *see also* Ex. 1006 ¶¶ 228-29.

requiring the gas/liquid interface to be below the fluid outlet (*see, e.g.* POR at 7), a careful review of Patent Owner's citations show that this is never stated. *See, e.g.*, Ex. 1001, 2:7-17, 2:44-47, 6:38-52; Ex. 1006 ¶ 230-34. Nothing in Hemstock or the '256 Patent supports Patent Owner's characterization that Hemstock's flow barrier prevents the liquid level from reaching the fluid outlet.

The figures of the '256 Patent also conclusively show that the interface level in the claimed desander may be below and not necessarily at the exact same level as the fluid outlet. Figures 2 and 4, which form the basis of Patent Owner's arguments, were clearly not intended to show precise details. Patent Owner's expert admits these figures are merely "cartoons" (Ex. 1011 at 124:23-24), which a POSITA would not rely on to depict precise details of the vessels at issue. Ex. 1006 ¶¶ 235-37.

In contrast, Figure 7—which Patent Owner completely omits from its analysis—appears to be a scale drawing. *Id.* ¶ 239.[2] Figure 7 shows interface 32 ***below*** a fluid outlet identical to Hemstock's Figure 4c:

[2] Although Mr. McGowen also fails to consider Figure 7 in construing the terms, he strangely re-creates it, drawing the liquid level at precisely the fluid outlet. Ex. 2001 at 11; Ex. 1006 ¶ 242.



Ex. 1001; Ex. 1006 ¶¶ 240-241. This is consistent with the specification's explanation that "[t]he shallowest operating angle α is limited by … a minimum freeboard 44 cross-sectional area … once the interface 32 builds ***to about the fluid outlet 26***." Ex. 1001, 5:62-65; Ex. 1006 ¶ 241. The correct construction should not include a negative limitation that excludes this embodiment.

Finally, Patent Owner's construction requiring a liquid level at a precise location in the desander is contrary to how a POSITA would understand the desander to work. A POSITA would understand that the liquid level in the vessel would vary both by location and over time, variously rising and falling above the fluid outlet. Ex. 1006 ¶¶ 217-19; Ex. 1011 at 55:9-15. Thus, a POSITA would never understand that references to the liquid "level" in the vessel refer to precise locations, but only an approximate indication of the average level. *Id.*

Therefore, pursuant to the broadest reasonable construction, the "Interface Limitations" must allow for the gas/liquid interface to be adjacent, about, close, or

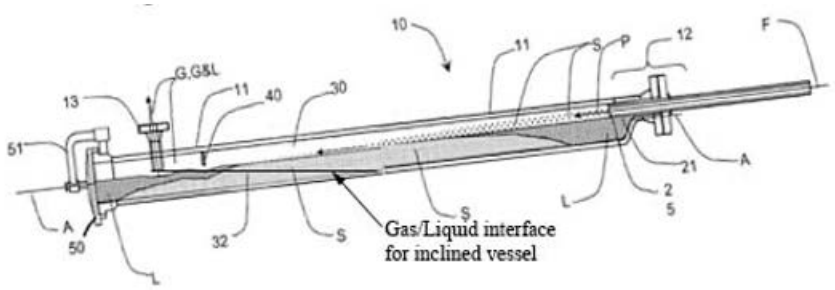
near the fluid outlet.

III. THE COMBINATION OF HEMSTOCK AND DAVIS RENDERS CLAIMS 1-7 , 9-11, 13, AND 16 OBVIOUS.

A. The Combination of Hemstock and Davis Possess All Elements of the Relevant Claims

Patent Owner asserts that neither Hemstock nor Davis ***individually*** disclose a gas/liquid interface at the fluid outlet. POR at 24-25. But the test is what the asserted ***combination*** suggested in light of a POSITA's creativity and common sense. *In re Keller*, 642 F.2d 413, 426 (C.C.P.A. 1981) ("[O]ne cannot show non-obviousness by attacking references individually where, as here, the rejections are based on combinations of references."); *Duramed Pharm., Inc. v. Watson Labs., Inc.*, 413 F. App'x 289, 294-95 (Fed. Cir. 2011). Patent Owner is also simply wrong, as Hemstock's Fig. 4c discloses exactly the same thing disclosed in the '256 Patent's Fig. 7, except without inclination. Ex. 1006 ¶ 240. Patent Owner's arguments also fail because they rely on Patent Owner's erroneous construction of the Interface Limitations.

Further, Petitioner explained that a POSITA would expect the combination's interface to be at the fluid outlet, which is lower than the inlet (especially when the desander is tilted):



Pet. at 32; Ex. 1002 ¶ 94.

Patent Owner argues with respect to the combination that a POSITA would incline Hemstock in the opposite direction, because "there is no sand in the liquid adjacent the wall past the fluid outlet." POR at 25, 26-27 (citing Ex. 2001 ¶¶ 94-99). But McGowen concedes that the written portions of Hemstock cited in support teach no such thing. Ex. 1011 at 144:3-147:16; 1006 ¶¶ 278-80. He further admits that Hemstock's figures cannot be relied on as reflecting where sand accumulates. Ex. 1011 at 219:21-221:6. Nor would a POSITA rely on Hemstock's figures, which are non-scale drawings, to show such details. *Hockerson-Halberstadt, Inc. v. Avia Group Int'l*, 222 F.3d 951, 956 (Fed. Cir. 2000) ("[I]t is well established that patent drawings do not define the precise proportions of the elements and may not be relied on … if the specification is completely silent on the issue."); Ex. 1006 ¶ 280.

McGowen's analysis also fails to account for gravity, wrongly assuming that accumulated liquid and sand are somehow unaffected by it:

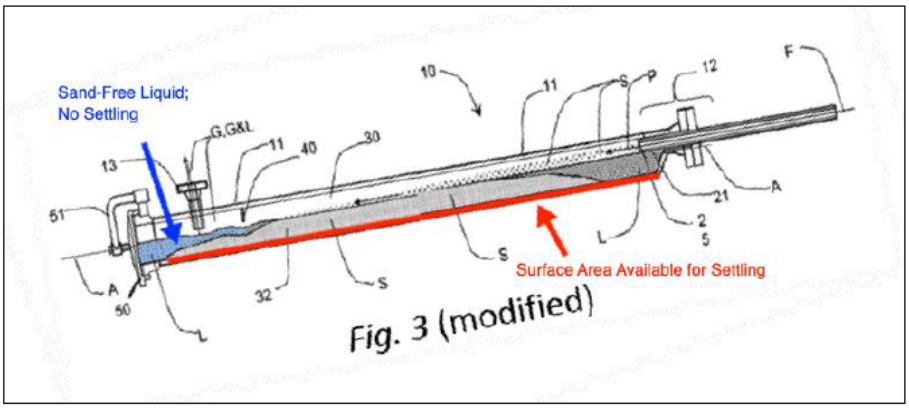


Figure 3 – Inclined Hemstock, outlet higher than inlet, no extra surface available for settling because no sand in liquid on the left

See Ex. 2001 ¶ 98. But if Hemstock is tilted, liquid and sand will settle toward the lowest point, as McGowen concedes, and the far side wall would therefore provide additional surface area for settling. Ex. 1011 at 83:12-24; Ex. 1006 ¶ 281.

Finally, a POSITA would never incline the vessel as asserted by Patent Owner. Mr. McGowen admits the desander would cease to remove sand from the inlet stream in this position, because the liquid and sand would cover the fluid inlet, causing repetitive cycling of gas and liquid slugs which would carry sand out of the fluid outlet. Ex. 1011 at 140:11-142:25; Ex. 1006 ¶ 282.

B. Patent Owner's Attacks on the Asserted Motivation to Combine are Without Merit

1. A POSITA would have been motivated to improve Hemstock by reducing settling time.

Patent Owner alleges there is no reason to modify Hemstock to improve sand settling time because (1) in Hemstock, fluid leaving the vessel is already particulate-free (and thus there is no room for further improvement); and (2) "Hemstock does

not disclose anything about 'sand settling in a liquid.'" POR at 27-29.

First, the fluid leaving Hemstock's desander is not particulate free. Hemstock expressly contemplates the possibility of sand re-entrainment. Ex. 1004, 4:65-5:2, 5:22-25. And Hemstock teaches that only a "substantial portion" of the particulates are captured. Ex. 1004, 3:37-42; Ex. 1006 ¶¶ 246-49. Moreover, as Mr. McGowen concedes, Hemstock teaches that sand particles in the incoming stream may fall into the liquid immediately below the weir (which could be the outlet itself), and that liquids below the outlet (and therefore any sand particles therein) will be re-entrained. Ex. 1011 at 52:11-53:12, 117:4-25; *see also* Ex. 1006 ¶ 247. Thus, a POSITA would have a motivation to improve sand settling time in the liquid. Ex. 1006 ¶ 250.[3]

Second, the issue is not what Hemstock expressly describes; it is what a POSITA would understand after reviewing Hemstock. *See, e.g., KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 419 (2007) ("The obviousness analysis cannot be confined … by overemphasis on the importance of published articles and ***the explicit content*** of issued patents. The diversity of inventive pursuits and of modern

[3] The '256 Patent itself contradicts Patent Owner's position, as it expresses a desire for "further improvement in separation efficiency," which would not be required if Hemstock already provided particulate-free fluid at the outlet. Ex. 1001, 2:25-26.

technology counsels against limiting the analysis in this way."); *see also In re Preda*, 401 F.2d 825, 826 (C.C.P.A. 1968) ("[I]n considering the disclosure of a reference, it is proper to take into account … the inferences which one skilled in the art would reasonably be expected to draw therefrom.").

Here, a POSITA would understand that the particulates in Hemstock enter the desander with a forward horizontal velocity which will carry some sand, depending on its size, very close to the fluid outlet. Ex. 1006 ¶ 247; Ex. 1011 at 114:22-115:6, 116:9-117:25. Any particles that do not settle quickly will be re-entrained and leave the fluid outlet. Ex. 1006 ¶ 247. Thus, a POSITA would be motivated to increase the settling rate to reduce the particulates re-entrained and carried out of the fluid outlet. *Id.* ¶ 250.

2. Davis applies to Hemstock because a POSITA would understand Hemstock to disclose a suspension.

Patent Owner argues that because Davis is limited to suspensions, and Hemstock does not describe sand as being in suspension, a POSITA would not be motivated to apply Davis' teaching to Hemstock. POR at 29, 35. Again, Hemstock is not limited to its express teachings. Here, a POSITA would understand Hemstock as teaching as suspension of sand in the liquid belly portion. Ex. 1006 ¶¶ 251-60.

First, nothing in Hemstock suggests, as asserted by Mr. McGowen, that there is no suspension and sand simply falls straight through to the desander's bottom. *Id.* ¶¶ 252-53. In fact, the only passage cited to support his assertion explicitly suggests

a suspension, as it teaches "particulates S deposit and accumulate ***over time*** in the belly portion 32." *Id.*; Ex. 1004, 4:40-43. This indicates that particles settle over some period of time in the desander, meeting even Patent Owner's definition of "suspension." Ex. 1006 ¶ 253; POR at 35.

Even if this were ignored, a POSITA would understand Hemstock to disclose a suspension. This is because, as conceded by Mr. McGowen, a POSITA would expect there to be at some horizontal liquid velocity in Hemstock's liquid-filled belly portion. Ex. 1011 at 86:17-88:7, 134:2-137:20, 217:17-219:19; Ex. 1006 ¶¶ 253-55. A POSITA would understand that settling of particles in a fluid is a function of particle size and settling velocity, as well as the fluid velocity; as the fluid velocity increases, the size of a particle that can remain suspended increases. Ex. 1006 ¶ 256. This is why even extremely large objects (boulders, cars) can be suspended and carried in a fast-moving stream or flash-flood. *Id.* Given the very small particles expected in Hemstock (100 mesh sand, having a maximum size of 146 μm), a POSITA would expect there to be sufficient liquid fluid velocity in Hemstock's vessel to create a suspension of sand particles. *Id.* ¶¶ 256-59. This is sufficient to motivate a POSITA to incline Hemstock, as taught by Davis, to attempt to improve the settling rate. *Id.* ¶ 260.

3. Davis does not teach away from application to Hemstock

a. A POSITA would have expected laminar and even quiescent conditions in Hemstock's liquid phase.

Although Petitioner agrees that the flow regime in Hemstock's gas-filled freeboard portion will probably never be laminar, this is a red-herring. The relevant inquiry is the flow regime in the ***liquid*** phase, where Davis teaches how to improve particulate settling times. Ex. 1006 ¶ 262. Mr. McGowan concedes that there will be laminar and even quiescent conditions in Hemstock's belly portion, describing a velocity profile in the vessel having potentially turbulent conditions at the liquid surface and transitioning to quiescent conditions close to the bottom. Ex. 1011 at 86:17-88:7, 134:2-137:20, 217:17-219:19; *see also* Ex. 1006 ¶ 263. Thus, even if Davis were limited to laminar flow (which it is not),[4] it would still be applicable to Hemstock. Ex. 1006 ¶ 264, 266.

b. A POSITA would consider Davis applicable to Hemstock because it discloses a narrow channel.

Davis is not limited to application in "narrow vertical channels" or "plates within a large tank." POR at 31. While these are examples of commercial settlers provided in Davis, nowhere does Davis limit the principles of enhanced

[4] While equation 4.1 in Davis is limited to laminar flow, Davis itself is not. Ex. 1006 ¶ 265.

sedimentation to these devices. *See* Ex. 1005; Ex. 1006 ¶ 269.

Even if Davis were so limited, a POSITA would understand Hemstock to disclose a narrow vertical channel. First, "narrow" is a relative term. Ex. 1006 ¶ 270. Second, Hemstock discloses a desander having only a 6" diameter, which Mr. McGowan concedes is the distance used in Davis' equation 4.1 for the distance between inclined plates. Ex. 1006 ¶ 268; Ex. 1011 at 189:7-9. This is sufficiently "narrow" that a POSITA would consider Davis as applicable. Ex. 1006 ¶¶ 270-71.

c. A POSITA would consider Davis applicable to Hemstock even though it is a horizontal vessel.

Patent Owner's assertions that a POSITA would not apply Davis to Hemstock's horizontal desander are based on Mr. McGowen's calculations using Davis' equation 4.1. POR at 31-33; Ex. 2001 ¶¶ 52-57, 106. But, as Patent Owner repeatedly asserts, equation 4.1 is limited to laminar flow, and therefore a POSITA would not use it to predict the increase in settling rates from inclining Hemstock's desander. Ex. 1006 ¶ 273. Further, Mr. McGowen determined that even using this equation, a POSITA ***would*** expect an improvement in settling rates over a horizontal vessel. Ex. 2001 ¶¶ 52-57; Ex. 1011 at 197:8-12. This alone would be sufficient to motivate a POSITA. Ex. 1006 ¶ 274. Even disregarding all of the foregoing, a POSITA would still have been motivated to incline Hemstock's vessel based on Davis, because he would have recognized there would be an increased surface area for settling. *Id.* ¶¶ 275-76. This is so even though Davis predicts an even greater

improvement in settling rate by inclining vertical vessels. *Id.*

C. The combination of Hemstock and the Data Book renders claims 1-13 and 16 obvious.

1. The Combination of Hemstock and the Data Book Possesses All Elements of the Relevant Claims

Patent Owner attacks Hemstock and the Data Book individually (POR at 40-43) for failing to teach the Interface Limitations (as Patent Owner construes them); such attacks fail under *Keller* as previously discussed. Patent Owner is also wrong in its assertion that, because slug catchers have three different modes of operation, they do not necessarily have a gas/liquid interface formed at and extending from the gas outlet. POR at 42. Mr. Simpson testified that all three modes of operation would necessarily be present in a working slug catcher at various times. Ex. 1002 ¶ 103-104; *see also* Ex. 1006 ¶¶ 283-85. The fact that at any ***particular*** time the gas/liquid interface may be elsewhere does not mean that the prior art slug catcher does not ***necessarily*** have a gas/liquid interface at the fluid outlet at least ***some*** of the time. Ex. 1006 ¶¶ 285-86; Ex. 1002 ¶ 104. This is true even though such devices may normally operate with a different liquid level. Ex. 1006 ¶ 285.

Patent Owner then distinguishes the claims from the combination of Hemstock and the 2004 Data Book (Ex. 2003) and Rhinesmith (Ex. 2004). POR at 43-46. These arguments, directed to an unasserted combination, are a strawman. This is because the slug catcher designs analyzed by Patent Owner are two phase

separators, unlike the single phase separators discussed in the Petition and the Data Book. Ex. 1006 ¶¶ 287-92.

Rhinesmith provides only an "example of slug catcher design." Ex. 2003 at 20. The design analyzed by Patent Owner, according to Mr. McGowen, is intended to remove essentially all slug-flow liquid, yielding a "liquid-free vapor" out of the outlet, and thus always maintains the liquid level below the gas outlet. POR at 43; Ex. 2001 ¶ 110. This is done via a liquid level controller, which automatically opens a valve to prevent the liquid level from reaching the gas outlet. Ex. 2001 ¶ 110; Ex. 1011 at 168:21-169:22; Ex. 1006 ¶¶ 289-90. Thus, these devices are two phase separators, which have two outlet streams that function without manual intervention. Ex. 1006 ¶¶ 287-88; Ex. 1002 ¶ 46.

The slug catchers described by Petitioner are instead single phase separators, like Hemstock's desander, with only a single non-manual outlet stream. Ex. 1002 ¶ 104. Unlike two phase slug catchers, these devices sometimes necessarily operate with the gas/liquid interface at or above the fluid outlet (steady state and liquid flooded modes). *Id.*; Ex. 1006 ¶ 291. Thus, these devices do not always "catch" all liquid, but instead convert damaging short term slug-flow events into manageable,

long term events having a different form of multiphase flow. Ex. 1002 ¶ 104.[5] Patent Owner's arguments regarding Rhinesmith's two phase design are irrelevant to the asserted combination.[6]

Although Petitioner explained that the asserted combination discloses all claimed limitations (Pet. at 35, 58-59 (citing Ex. 1002 ¶¶ 103-04, 152-53)), Patent Owner never explains why the combination Petitioner actually asserted, versus Patent Owner's strawman, does not teach the Interface Limitations. POR at 45-46.

[5] Rhinesmith recognizes this as an appropriate design objective. *See* Ex. 2004 at 14 (explaining that "slug catcher design often sets a much less demanding goal of establishing stratified flow to separate the gas and liquid phases"); Ex. 1006 ¶ 292 (explaining that this means the slug catcher is designed to modify the type of multiphase flow from slug flow to stratified flow, necessitating that liquid leaves the slug catcher).

[6] Patent Owner's attempts to limit slug catcher design based on the Data Book's definition of "separators" (POR at 40) fail because a POSITA would not understand this definition to somehow restrict the design of slug catchers. Ex. 1006 ¶¶ 293-96.

2. Patent Owner's Attacks on the Motivation to Combine Hemstock and the Data Book are without Merit

a. A POSITA would have been motivated to improve Hemstock's ability to handle slug flow.

Hemstock teaches that unstable slug flow in desanding service was common. Pet. at 50. Slug flow is common in all oil and gas operations; it does not appear only when filter desanders are used. Ex. 1004, 2:7-9. Patent Owner admits that Hemstock does not work well in this service: "Hemstock does not disclose any way to 'handle liquid slugs.'" POR at 46.

Patent Owner misrepresents Mr. Simpson's testimony in arguing that he conceded that Hemstock's desander could handle the expected multiphase flow, including slug flow. POR at 47. He never stated that Hemstock's desander could handle the "expected" multiphase flow or slug flow. Ex. 2005 at 83:1-10; Ex. 1006 ¶¶ 297-99. He was asked if it could handle multiphase flow, not "the expected multiphase flow." *Id.* ¶¶ 299-300; Ex. 2005, 83:8-10. But handling multiphase flow in general is not the same thing as handling slug flow, because slug flow is only one type of multiphase flow. *See, e.g.* Ex. 1008 at 36, Fig. 17-14 (showing examples of multiphase flow including annular flow, stratified flow, and slug flow).

Even if Hemstock could handle some slug flow, a POSITA would still have wanted to improve the vessel's design to ***better*** handle slug flow, as the '256 Patent itself states: "[t]he maximum inclination angle … ***allow[s] substantial freedom to***

handle slug flow." Ex. 1001, 6:3-6. Mr. McGowen admits that if the desander does not handle liquid slugs, the vessel can fill with liquid, allowing accumulated sand to exit via the fluid outlet thereby causing downstream equipment erosion. Ex. 1011 at 61:22-62:8, 63:25-64:7; Ex. 1004, 1:34-46. Thus, a POSITA had ample motivation to improve Hemstock's ability to handle slug flow. Ex. 1006 ¶ 300.

Moreover, as Patent Owner fails to rebut the additional motivations to combine asserted in the Petition (Pet. at 50-51), they stand unrebutted.

b. The Data Book would have motivated a POSITA to incline Hemstock's desander.

A POSITA would have considered the Data Book's teachings regarding pipe-style slug catchers applicable to Hemstock's desander, because Hemstock expressly teaches that its vessel can be constructed of Schedule 160 pipe. Hemstock explains that "[a] typical vessel … can be a 6" or 8" diameter. Using an **8" diameter, schedule 160** shell for the vessel 11 …." Ex. 1004, 5:62-65. "Schedule 160" indicates to a POSITA a particular thickness pipe and that the "vessel" is actually made from an nominal 8" schedule 160 pipe. Ex. 1006 ¶¶ 301-04; Ex. 1008 at 45. Mr. McGowen admits this and that such schedule numbers are never used to refer to pressure vessels. Ex. 1011 at 175:16-176:1. Therefore, a POSITA would have naturally considered improving Hemstock's desander by looking to the Data Book's teachings regarding similar devices also made of pipe, such as the Data Book's slug catchers. Ex. 1006 ¶ 305.

Patent Owner's further arguments are premised on a slug catcher design requiring a gas/liquid interface "that is well below the gas outlet." POR at 49-50. This simply repackages Patent Owner's arguments that the proposed combination does not disclose the Interface Limitation, which were addressed in section III.C.1. above. Further, as there is no level control on the single phase slug catchers disclosed in the Data Book, a POSITA would have understood that there is no way to "set the gas/liquid" level. Ex. 1006 ¶ 306. As stated in the Petition, a POSITA would have understood the inclined slug catchers disclosed in the Data Book (when in steady-state operation) to function identically to the Hemstock desander. Pet. at 50-51; Ex. 1002 ¶ 173. This alone would have motivated a POSITA to incline the desander as suggested by the Data Book. Pet. at 50-51.

D. Grounds 3 and 4 (Combinations with Miller) Render the Challenged Claims Obvious

Petitioner asserted that a POSITA would have been motivated, based on Miller's teaching of an eccentrically located smaller diameter outlet pipe located at its lower end and used to remove solids, to include a smaller diameter section of the pressure vessel itself. Pet. at 56-57. This was based on the fact that similar pressure vessels were well known, and in order to minimize the cost of vessel cleanout connection closures. *Id.* Petitioner explained that a POSITA would have placed this on the lower end of Hemstock's vessel—that is, downstream of the fluid outlet—because this is where solids would accumulate. *Id.* at 57.

Patent Owner again argues that Miller individually does not disclose the limitations of claims 14 or 15. POR at 52. Patent Owner's arguments fail because they attack Miller individually, and in any event, are wrong. Ex. 1006 ¶¶ 308-09. Moreover, contrary to Patent Owner's implication (POR at 53) there is no requirement that the prior art references themselves contain the motivations to modify Hemstock, as opposed to common sense and background knowledge of a POSITA. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 417-18 (2007); *Real Time Data, LLC v. Iancu*, 912 F.3d 1368, 1374 (Fed. Cir. 2019). As Patent Owner never rebuts the Petition's showing that the proposed ***combinations*** possess the claimed limitations (Pet. at 46), or that a POSITA would have been motivated to combine the references as claimed (Pet. at 56-58), Petitioner's arguments and evidence are unrebutted.

IV. CONCLUSION

Patent Owner's response is premised on an incorrect and narrow claim construction, individual attacks against the asserted combinations, and arguments against the asserted motivations to combine without sufficient evidentiary support. Accordingly, the Board should issue a final written decision finding all challenged claims unpatentable.

Dated: August 22, 2019

Respectfully submitted,

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CERTIFICATE OF SERVICE

I hereby certify that on this 22nd day of August, 2019, a copy of this *Petitioner's Reply*, and Petitioner's Exhibits 1006, 1011, and 1014 were served via e-mail to Patent Owner's counsel at the addresses below as authorized by Patent Owner pursuant to 37 C.F.R. §§ 42.6(e) and 42.8(b)(4):

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CERTIFICATE OF COMPLIANCE

Pursuant to 37 C.F.R. § 42.24 *et seq.*, the undersigned certifies that this document complies with the type-volume limitations. This document, excluding the table of contents, appendix of exhibits, certificates of service and compliance, contains 5,447 words as calculated by the "Word Count" feature of Microsoft Word for Office 365, the program used in creating it.

/James H. Hall/
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