

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

GCE GAS CONTROL EQUIPMENT INC.,
Petitioner,

v.

VBOX, INC.,
Patent Owner.

IPR2023-00326
Patent 11,389,614 B2

Before GRACE KARAFFA OBERMANN, ELIZABETH M. ROESEL,
and JANE E. INGLESE, *Administrative Patent Judges*.

INGLESE, Administrative Patent Judge.

JUDGMENT
Final Written Decision
Determining Some Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

This is a Final Written Decision in an *inter partes* review of claims 1–16 of U.S. Patent No. 11,389,614 B2 (Ex. 1001, “the ’614 patent”). We have jurisdiction under 35 U.S.C. § 6 and enter this Decision pursuant to 35 U.S.C. § 318(a). For the reasons that follow, we determine that Petitioner does not establish that claims 1–11 and 15 are unpatentable, but does establish that claims 12–14 and 16 are unpatentable.

A. Procedural History

GCE Gas Control Equipment Inc. (“Petitioner”) filed a Petition (Paper 1, “Pet.”) for *inter partes* review of claims 1–16 of the ’614 patent. We entered an Institution Decision (Paper 10, “Dec.”) instituting review of the challenged claims based on all grounds of unpatentability asserted in the Petition. Thereafter, Patent Owner filed a Response (Paper 13, “Resp.”), Petitioner filed a Reply (Paper 16, “Reply”), and Patent Owner filed a Sur-reply (Paper 19, “Sur-reply”). Petitioner relies on declarations provided by Kent S. Knaebel, Ph.D. (Exs. 1003, 1078). Patent Owner cross-examined Dr. Knaebel and filed transcripts of his deposition testimony. Exs. 2003, 2009. Patent Owner relies on a declaration provided by Orhan Talu, Ph.D. (Ex. 2001). Petitioner cross-examined Dr. Talu and filed a transcript of his deposition testimony. Ex. 1074. The Board heard final oral arguments at a hearing conducted on March 20, 2024. *See* Paper 25 (“Tr.”).

B. Asserted Grounds

The Petition sets forth the following six grounds of unpatentability based on obviousness under 35 U.S.C. § 103(a):¹

¹ The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112–29, 125 Stat. 284 (Sept. 16, 2011), includes revisions to Sections 102 and 103 that

Ground	Challenged Claim(s)	Reference(s)
1	1–5, 7–16	Deane, ² Dubois, ³ Berntson ⁴
2	2, 3, 15	Deane, Dubois, Berntson, Hill ⁵
3	6	Deane, Dubois, Berntson, Basset ⁶
4	1–5, 7–16	Deane
5	2, 3, 15	Deane, Hill
6	6	Deane, Basset

Pet. 13–14.

C. Real Parties-in-Interest

Petitioner identifies itself, GCE Gas Control Equipment Inc., as the real party-in-interest. Pet. 73. Petitioner states that, “[t]o the extent identification of GCE’s ownership is necessary, GCE is . . . a wholly-owned indirect subsidiary of ESAB Corp.” *Id.* Patent Owner identifies itself, VBOX, Inc., along with 3B Medical Manufacturing, LLC, React Health Holdings, LLC, 3B Medical, Inc., Ventec Life Systems, Inc., Watermark Medical, Inc., Medicomp, Inc., and Medi-Lynx Cardiac Monitoring, LLC, as the real parties-in-interest. Paper 3, 1.

became effective on March 16, 2013. Because the challenged claims issued from an application filed before March 16, 2013, we apply pre-AIA law. *See* Pet. 14 n.5; Ex. 1001, codes (22), (63).

² US 2005/0072306 A1, published April 7, 2005 (Ex. 1004).

³ US 6,520,176 B1, issued February 18, 2003 (Ex. 1005).

⁴ WO 2005/009590 A2, published February 3, 2005 (Ex. 1006).

⁵ US 6,311,719 B1, issued November 6, 2001 (Ex. 1008).

⁶ US 2005/0028868 A1, published February 10, 2005 (Ex. 1007).

D. Related Matters

The parties identify the following proceeding involving the '614 patent: *GCE Gas Control Equip. Inc. v. 3B Medical Mfg., LLC*, No. 8:22-cv-02550-TDC (D. Md.). Pet. 73; Paper 3, 1. The Petitioner indicates that the '614 patent is in the same family as U.S. Patent No. 10,357,628, which is the subject of IPR2023-00527. Paper 5, 1. The Patent Owner indicates that the '614 patent is a continuation of application number 14/193,504 (now U.S. Patent No. 10,702,669), which is a continuation of application number 13/795,977, which is a continuation of application number 13/096,362, which is a continuation of application number 11/054,341 (now U.S. Patent No. 7,954,490). Paper 3, 1. The Patent Owner also indicates that pending application number 17/836,246 is a continuation of the '614 patent. *Id.*

II. BACKGROUND

A. The '614 patent (Ex. 1001)

The '614 patent relates to a portable oxygen concentrator ("POC"). Ex. 1001, 1:17–21, 26:14 (claim 1 preamble). According to the '614 patent, patients suffering from certain diseases and lung disorders require supplemental oxygen, and a need exists for home and ambulatory oxygen systems for such patients. *Id.* at 1:22–26. The '614 patent indicates that conventional systems used to provide such supplemental oxygen include oxygen concentrators that have the disadvantages of consuming relatively large amounts of electricity, being relatively large and heavy, emitting excessive heat, and being relatively noisy. *Id.* at 1:36–49.

The '614 patent purports to resolve these and other drawbacks of conventional oxygen concentrators by providing a wearable oxygen

concentrator that “is small, lightweight, quiet, and flexible.” *Id.* at 2:46–50. The ’614 patent explains that the concentrator separates oxygen from ambient air using vacuum swing adsorption, and includes a belt; a power module containing a power pack; a reservoir module; a control module containing a user interface; and a separation cartridge module. *Id.* at 3:38–41, 3:60–66, Fig. 2. Vacuum swing adsorption involves a series of cycles that may include a feed step, an evacuation step, and a repressurization step. *Id.* at 6:39–41. The ’614 patent discloses that the separation cartridge module includes a “removable” gas separation cartridge containing “a housing having an inlet port, an outlet port, and a bed of adsorbent material.” *Id.* at 2:54–58, Fig. 15.

Figure 7 of the ’614 patent is reproduced below.

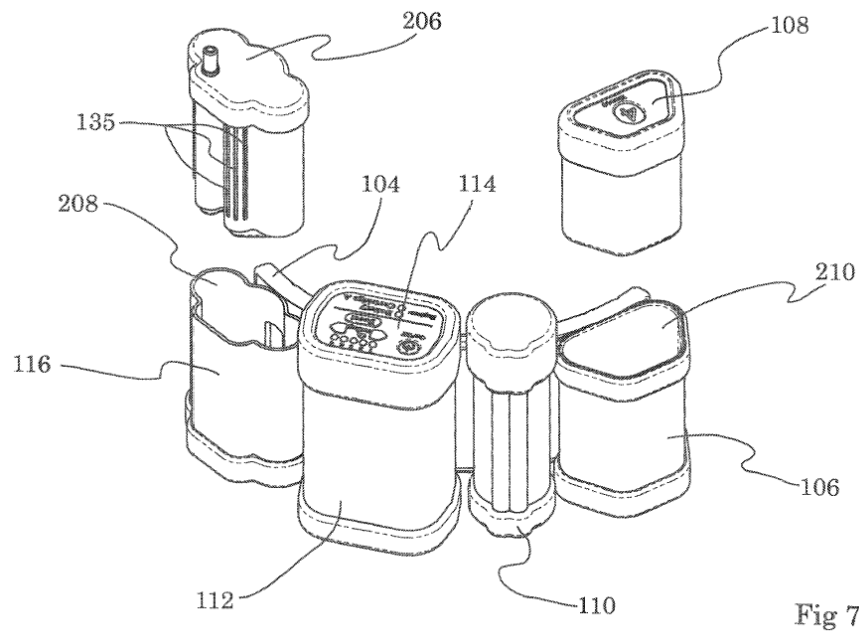


Figure 7 illustrates an exploded view of the ’614 patent’s oxygen concentrator in which power pack 108 and adsorbent cartridge 206 have been removed. Ex. 1001, 3:6–8. The oxygen concentrator includes belt 104 for carrying the concentrator modules, power module 106 that receives

power pack 108, control module 112 that receives user interface 114, separation cartridge module 116 having receptacle 208 for receiving adsorbent cartridge 206, and reservoir module 110 for storing oxygen-rich gas separated by cartridge module 116. *Id.* at 3:60–4:12, 11:61–12:3. Adsorbent cartridge 206 includes air inlet ports 135, which receive ambient air for separation. *Id.* at 12:11–12.

Figure 15 of the '614 patent is reproduced below.

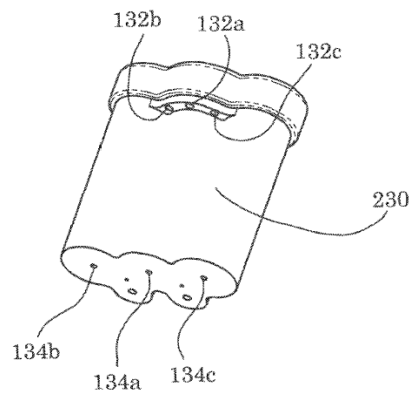


Fig 15

Figure 15 is a perspective view of cartridge 206 contained within cartridge module 116. Ex. 1001, 3:26–27. Cartridge 206 includes inlet ports 132a–132c, outlet ports 134a–134c, and casing 230. *Id.* at 18:30–34. Adsorption columns 130a–130c are contained within casing 230, and each column has one inlet port (132a–132c), and one outlet port (134a–134c). *Id.* at 18:34–37. Each adsorption column 130a–130c contains a bed of adsorption material, which is preferably a zeolite capable of adsorbing nitrogen gas. *Id.* at 18:37–40. Inlet ports 132a–134c receive either ambient air 162 or vacuum, while outlet ports 134a–134c expel product gas. *Id.* at 18:47–49.

B. Challenged Claims

The Petitioner challenges claims 1–16 of the '614 patent. Pet. 13. Claims 1, 12, and 13 are independent, claims 2–11 depend from claim 1, and claims 14–16 depend from claim 13. Ex. 1001, 26:14–28:47.

Claims 1 and 12 are representative of the claimed subject matter and read as follows:

1. A portable oxygen concentrator, comprising:
 - a separation cartridge selectively removable from a receptacle by movement relative to the receptacle in a first direction, the separation cartridge comprising an inlet oriented in a second direction opposite the first direction, an outlet oriented in the second direction, and a bed of adsorbent material configured to preferentially adsorb nitrogen;
 - wherein a first line extending parallel to the first and second directions passes through the outlet,
 - wherein a second line spaced-apart from the first line and extending parallel to the first line passes through the inlet, and
 - wherein the separation cartridge is configured such that, when fluid flows through the separation cartridge, fluid flowing along the first line contacts the adsorbent material of the bed and fluid flowing along the second line does not contact the adsorbent material of the bed.
12. A separation cartridge for a portable oxygen concentrator, comprising:
 - an inlet oriented in a direction;
 - an outlet oriented in the direction;
 - a bed of adsorbent material configured to preferentially adsorb nitrogen; and
 - wherein a first line extending parallel to the direction passes through the outlet,
 - wherein a second line spaced-apart from the first line and extending parallel to the first line passes through the inlet, and
 - wherein the separation cartridge is configured such that, when fluid flows through the separation cartridge, fluid flowing along the first line contacts the adsorbent material of the bed

and fluid flowing along the second line does not contact the adsorbent material of the bed.

Ex. 1001, 26:14–31, 27:12–28.⁷

III. ANALYSIS

A. Level of Ordinary Skill in the Art

The level of ordinary skill in the art at the time of the invention is a factual determination that provides a primary guarantee of objectivity in an obviousness analysis. *Al-Site Corp. v. VSI Int’l Inc.*, 174 F.3d 1308, 1324 (Fed. Cir. 1999) (citing *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966); *Ryko Mfg. Co. v. Nu-Star, Inc.*, 950 F.2d 714, 718 (Fed. Cir. 1991)).

Based on Petitioner’s contention, which Patent Owner does not dispute, we find that a person of ordinary skill in the art would have had a bachelor’s degree in mechanical engineering, chemical engineering, or a related field, and two years of experience in the research, design, or development of POCs and related hardware, software, and firmware. *Compare* Pet. 21, *with* Resp. 11. Our finding is supported by Dr. Knaebel’s testimony. Ex. 1003 ¶¶ 226–228. The level of ordinary skill in the art, as defined above, appears consistent with the disclosures of the asserted prior art and the written description of the invention provided in the ’614 patent.

Based on their respective statements of qualifications and curricula vitae, we determine that both witnesses—Dr. Knaebel and Dr. Talu—are qualified to opine about the perspective of a person of ordinary skill in the art at the time of the invention. Ex. 1003 ¶¶ 466–468; Ex. 2001 ¶¶ 12–23;

⁷ Pet. 26–72, CLAIM APPENDIX.

Ex. 1078 ¶ 234 (statements of qualifications); *see also* Ex. 1003, Appendix 1; Ex. 2002 (curricula vitae).

B. Claim Construction

We interpret claims “using the same claim construction standard that would be used to construe the claims in a civil action held under 35 U.S.C. 282(b).” 37 C.F.R. § 42.100(b). Under that standard, the “words of a claim ‘are generally given their ordinary and customary meaning,’” which is “the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention, i.e., as of the effective filing date of the patent application.” *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–13 (Fed. Cir. 2005) (en banc) (quoting *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996)). We construe terms in controversy only to the extent necessary to resolve the controversy. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

“a separation cartridge selectively removable from a receptacle by movement relative to the receptacle in a first direction”

Claim 1 includes the above recitation, which we refer to as the “removal direction limitation.” Petitioner does not present a proposed construction of the entirety of this limitation. Instead, Petitioner construes a first sub-phrase of the limitation in the Petition, arguing that a separation cartridge “selectively removable [from a receptacle]” refers to a separation cartridge that is “withdrawable or separable as a whole from a receptacle.” Pet. 26 (citing Ex. 1003 ¶¶ 282, 284). Petitioner construes a second sub-phrase in the Reply, arguing that “by movement relative to the receptacle in

a first direction” requires the cartridge to be capable of relative movement vis-à-vis the receptacle in the first direction. Reply 11–15.

Patent Owner, by contrast, construes the entirety of the removal direction limitation to require the separation cartridge to be physically movable in the first direction, relative to the receptacle, for removal from the receptacle. Resp. 36. For reasons discussed below, we agree with Patent Owner’s construction. We interpret the removal direction limitation to mean that the separation cartridge must be movable in reference to or in comparison with the receptacle to remove the separation cartridge from the receptacle.

The parties’ proposed constructions raise the issue of whether the removal direction limitation should be construed in its entirety, as Patent Owner proposes, or with separate constructions for its sub-phrases, as Petitioner proposes. The parties also dispute whether the removal direction limitation requires movement of the separation cartridge. We address each these substantive claim construction issues below. As an initial matter, we address Patent Owner’s contention that Petitioner improperly raises an untimely new construction in the Reply.

a) Petitioner presents an improper new construction in the Reply

Petitioner’s Reply introduces a construction of a subphrase of the removal direction limitation that was not presented in the Petition.

In the Petition, Petitioner provides a proposed construction of a first sub-phrase of the removal direction limitation: “selectively removable [from a receptacle].” Pet. 26 (citing Ex. 1003 ¶¶ 282, 284). Petitioner does not interpret any further sub-phrases of the removal direction limitation in the Petition. For the first time in the Reply, Petitioner introduces a proposed

construction of a second sub-phrase of the removal direction limitation: “by movement relative to the receptacle in a first direction.”

In particular, Petitioner asserts for the first time in the Reply that this second sub-phrase of the removal direction limitation requires only the capability of movement, and requires only relative movement of the separation cartridge, rather than absolute movement. Reply 11–12 (citing Ex. 1078 ¶¶ 102–104; Ex. 1074, 83:14–20). Petitioner asserts that restricting the second sub-phrase to absolute movement of the separation cartridge away from a stationary receptacle is incorrect, and the intrinsic evidence does not support this interpretation. *Id.* at 12–15 (citing Ex. 1078 ¶¶ 105–115; Ex. 1052, 14–16, 19, 149–155; Ex. 1053, 230, 237).

Petitioner is required to identify—in the Petition—how the challenged claims are to be construed. 37 C.F.R. § 42.104(b)(3). Presenting a new proposed claim construction for the first time in a Reply does not fulfill this requirement. In the present case, Petitioner’s new construction of a second sub-phrase of the removal direction limitation in the Reply is an improper attempt to circumvent this requirement. Although Petitioner may respond to claim construction issues raised by Patent Owner in the Response, Petitioner cannot raise new claim construction issues in the Reply that were not previously raised in its Petition. *See Consolidated Trial Practice Guide* 44–45. Petitioner’s proposed construction of the second sub-phrase of the removal direction limitation in the Reply is not simply a response to claim construction issues raised by Patent Owner in the Response, but instead improperly introduces a new claim construction that was not raised in the Petition.

Petitioner's construction of the second sub-phrase of the removal direction limitation in the Reply serves as the basis for two new theories of unpatentability Petitioner also presents for the first time in the Reply, as discussed below.

b) The removal direction limitation must be construed in its entirety

Petitioner provides a proposed construction of a first sub-phrase of the removal direction limitation in the Petition, asserting that “selectively removable [from a receptacle]” refers to a separation cartridge that is “withdrawable or separable as a whole from a receptacle.” Pet. 26 (citing Ex. 1003 ¶¶ 282, 284). For the first time in the Reply, Petitioner provides a proposed construction of a second sub-phrase of the removal direction limitation, asserting that “by movement relative to the receptacle in a first direction” requires the separation cartridge to be capable of relative movement vis-à-vis the receptacle in the first direction. Reply 11–15 (citing Ex. 1078 ¶¶ 102–115; Ex. 1074, 83:14–20).

Patent Owner contends that Petitioner's piecemeal construction of two separate sub-phrases of the removal direction limitation is improper, contending that the sub-phrases must be interpreted together because “by movement relative to the receptacle in a first direction” modifies how the separation cartridge is “selectively removable” from the receptacle. Resp. 36.

We agree with the Patent Owner that the first and second sub-phrases of the removal direction limitation are interrelated, and, consequently, should be interpreted together. According to the plain language of the removal direction limitation, “by movement relative to the receptacle” refers to—and thus specifies—how the separation cartridge “is selectively

removable from a receptacle.” Petitioner’s piecemeal interpretation and the corresponding testimony of Dr. Knaebel are contrary to the interrelated nature of the plain language of the removal direction limitation. Resp. 36.

In particular, interpreting “a separation cartridge selectively removable from a receptacle” in isolation ignores the immediately following recitation of *how* the separation cartridge must be moved to remove it from the receptacle (“by movement relative to the receptacle in a first direction”). *Id.* Similarly, interpreting “by movement relative to the receptacle in a first direction” in isolation ignores the immediately preceding recitation of “a separation cartridge selectively removable from a receptacle,” which indicates that movement of the separation cartridge is what permits its removal from the receptacle. *Id.*

The first and second sub-phrases thus must be interpreted together due to their interrelated nature in order to gain a complete understanding of the meaning of the removal direction limitation. Petitioner’s interpretation of each sub-phrase in isolation does not allow the full meaning of the removal direction limitation to be captured because it does not take into consideration the interdependence of the two sub-phrases.

c) The removal direction limitation requires the separation cartridge to be moveable in a particular direction

Petitioner asserts that the removal direction limitation encompasses movement of the receptacle away from a stationary separation cartridge and does not require movement of the separation cartridge. Reply 12 (citing Ex. 1078 ¶ 103). Patent Owner contends that the removal direction limitation requires the separation cartridge to be movable to remove it from the receptacle and does not encompass a stationary separation cartridge. Resp. 36; *see also* Sur-Reply 3, 5. We agree with Patent Owner that the claim

language itself requires that the separation cartridge to be movable. Our findings and reasoning follow.

We are not persuaded by Petitioner’s assertion that claim 1 encompasses relative movement, including: (i) movement of a cartridge in a first direction away from a stationary receptacle; (ii) movement of a receptacle in a second direction (opposite the first) away from a stationary cartridge; and (iii) simultaneous movement of a cartridge and a receptacle away from each other. Reply 12. Petitioner asserts that, “[i]n each instance, the cartridge moves ‘relative to the receptacle in a first direction.’” *Id.* (citing Ex. 1078 ¶ 103). Petitioner’s contention is not consistent with the claim language and is not supported by other intrinsic evidence.

The removal direction limitation does not recite “relative movement,” as Petitioner’s assertions imply. Petitioner’s interpretation of the term “relative movement,” therefore, does not constitute construction of the actual claim language. To the contrary, the claim recites “a separation cartridge selectively removable from a receptacle by movement relative to the receptacle in a first direction.” Ex. 1001, 26:15–17. Patent Owner is correct that the claim specifies movement of the separation cartridge relative to the receptacle. Sur-Reply 5. The separation cartridge is the moving object, and the receptacle is the frame of reference for the movement. *Id.*

As Patent Owner correctly points out, and as Dr. Talu opines, the removal direction limitation specifies that the frame of reference for the separation cartridge’s movement is the receptacle. *Id.* (citing Ex. 1074, 22). Petitioner’s separate interpretation of “selectively removable [from a receptacle]” and “by movement relative to the receptacle in a first direction”

ignores that, when taken together, the two phrases specify that the receptacle provides a frame of reference for the separation cartridge's movement.

In particular, in order for the recited movement relative to the receptacle to occur, something else—the separation cartridge—must move with reference to or in comparison with the receptacle, which serves as the frame of reference for such movement.

Giving effect to “by *movement relative to the receptacle*,” when interpreting this phrase in combination with “a separation cartridge selectively removable from a receptacle,” requires that the separation cartridge is removable from the receptacle by movement of the separation cartridge *itself*. Interpreting the removal direction limitation to encompass a stationary separation cartridge, as Petitioner proposes, would render “by movement relative to the receptacle” superfluous.

Specifically, Petitioner's interpretation of “relative movement” does not accord weight to the recitation “movement relative to the receptacle,” which requires something other than the receptacle—the separation cartridge—to move in order for movement to occur with reference to or in comparison with the receptacle. Petitioner's interpretation of “relative movement” as permitting removal of the separation cartridge from the receptacle when the separation cartridge remains stationary, is inconsistent with the plain language of removal direction limitation as a whole.

The plain language of the removal direction limitation indicates that the separation cartridge must be removable from the receptacle *by movement of the separation cartridge* in a specified (first) direction. Claim 1 defines the first direction as a direction opposite the (second) direction in which the inlet and outlet are oriented. The plain language of the removal direction

limitation, therefore, requires that the separation cartridge is removable from a receptacle by movement of the separation cartridge in comparison to the receptacle in a direction opposite the direction in which the separation cartridge's inlet and outlet are oriented.

The Specification, including the figures of the '614 patent, is consistent with our interpretation of the plain language of the removal direction limitation as requiring that the separation cartridge to be moveable, and we find no disclosure in the '614 patent that supports Petitioner's construction. *Hill-Rom Servs., Inc. v. Stryker Corp.*, 755 F.3d 1367, 1373 (Fed. Cir. 2014) (“[T]o deviate from the plain and ordinary meaning of a claim term . . . the patentee must, with some language, indicate a clear intent to do so in the patent.”). In particular, the '614 patent explicitly states that “[a]dsorbent cartridge 206 . . . [is] easily removable [from receptacle 208] to facilitate replacement,” and Figure 7 “shows an exploded view of the oxygen concentrator 100” in which “[a]dsorbent cartridge 206 has been removed from receptacle 208 of cartridge module 116.” Ex. 1001, 11:61–12:3. Figure 7 shows separation cartridge 206 positioned above receptacle 208, which is consistent with separation cartridge 206 having been removed from receptacle 208 by movement of separation cartridge 206 in an upward (first) direction.

Figure 7 and the corresponding description of that figure in the '614 patent are consistent with our interpretation of the removal direction limitation by showing and explaining that separation cartridge 206 can be removed from receptacle 208 by moving separation cartridge 206 upward with reference to or in comparison with receptacle 208, which is opposite the downward direction in which inlet 132a,b,c and outlet 134a,b,c ports are

oriented. Ex. 1001, 3:6–8, 11:67–12:3; *see also id.* at 18:30–34, Fig. 15. Neither Petitioner nor Petitioner’s witness identifies any disclosure in the ’614 patent that supports Petitioner’s position that this limitation allows the separation cartridge to be removed from the receptacle while the separation cartridge remains stationary. Reply 12–15; Ex. 1078 ¶¶ 103–115.

Contrary to Petitioner’s proposed construction, therefore, we interpret the plain language of the removal direction limitation in a manner that is consistent with the Specification of the ’614 patent to require that removal of the separation cartridge from the receptacle is by movement of the separation cartridge in a particular (first) direction with reference to or in comparison to the receptacle. We consequently agree with Patent Owner that “[t]he removal direction limitations specify that the separation cartridge itself must be the structure that is able to be removed from the receptacle by ‘movement relative to’ the receptacle;” and that “the cartridge cannot be stationary.” Sur-Reply 4–5.

C. Analysis of the Patentability Challenges

As set forth above, Petitioner asserts six grounds of unpatentability. Pet. 13. We divide our discussion of the asserted grounds into two parts. In the first part, we address the grounds asserting the unpatentability of the claims that include the removal direction limitation (claims 1–11), and in the second part, we address the grounds asserting the unpatentability of the claims that do not include the removal direction limitation (claims 12–16).

1. Claims 1–11

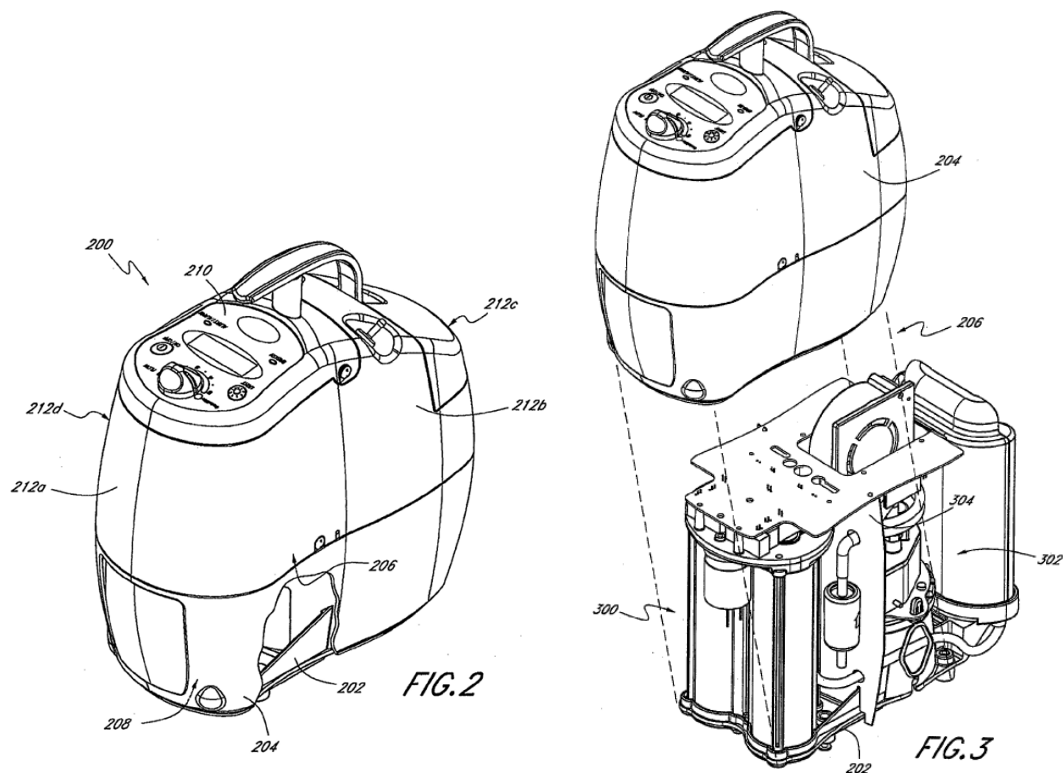
Petitioner asserts that claims 1–5 and 7–11 are unpatentable over Deane alone (Ground 4), or over Deane, Dubois, and Berntson (Ground 1). Pet. 13–14. Petitioner asserts that claims 2 and 3 are unpatentable over

Deane and Hill (Ground 5), or over Deane, Dubois, Berntson, and Hill (Ground 2). *Id.* Petitioner asserts that claim 6 is unpatentable over Deane and Bassett (Ground 6), or over Deane, Dubois, Berntson, and Bassett (Ground 3). *Id.* We begin our analysis with an overview of Deane.

a) Deane (Ex. 1004)

Deane discloses a portable gas fractionalization apparatus having an intake through which ambient air is drawn, a compressor assembly that pressurizes the intake air to produce a feed gas, and a pressure swing adsorption (“PSA”) unit that receives and processes the feed gas to produce product gas having a higher oxygen content than the ambient air. Ex. 1004 ¶¶ 2, 32, Fig. 1.

Figures 2 and 3 illustrate an embodiment of Deane’s portable gas fractionalization apparatus:



Figures 2 and 3 are perspective views of portable gas fractionalization apparatus 200. Ex. 1004 ¶¶ 13–14. The apparatus includes shell 204 and chassis 202, which together form housing 206. *Id.* ¶¶ 57–58. Chassis 202 is removably attached to base 208 of housing 206, and base 208 “has a substantially planar exterior bottom surface adapted to rest against a support surface such as a table or floor.” *Id.* ¶ 57. Chassis 202 “has bottom mounts or vibration isolation feet 407 that are configured to engage with the bottom of the shell.” *Id.* ¶ 60, Fig. 4. “Preferably, screws are inserted through the bottom of the shell and into the bottom of the vibration feet 407.” *Id.* ¶ 60.

Housing 206 is separated into compartments 300, 302 by partition 304. *Id.* ¶ 58. Compartment 300 contains PSA unit 506. *Id.* ¶¶ 58, 61, Fig. 5. Figure 5 of Deane is a perspective view of the components inside compartment 300, including PSA unit 506:

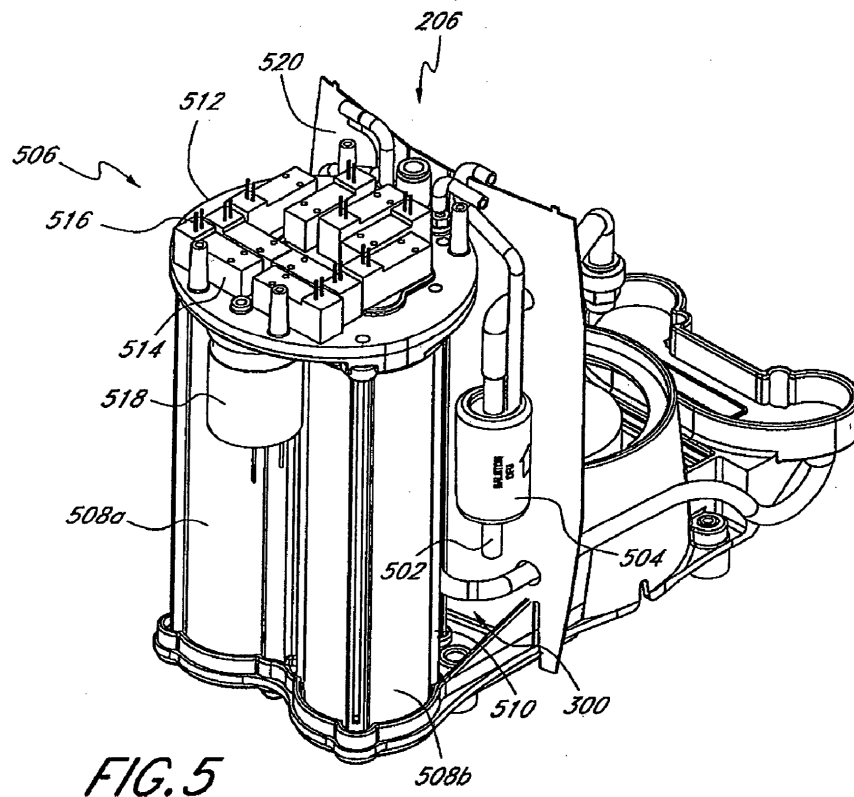


Figure 5 shows PSA unit 506, which includes adsorbent bed columns 508a, 508b, and integrated manifold 512 mounted horizontally on the upper ends of columns 508a, 508b. *Id.* ¶ 62. Integrated manifold 512 contains a plurality of integrated flow passages in fluid communication with openings in the upper end of each column, and a plurality of valves, which control the flow of fluid to and from the columns. *Id.* ¶¶ 7, 63.

Figure 6 of Deane is a “schematic illustration” of adsorbent bed columns 508a, 508b of PSA unit 200, and is reproduced below. *Id.* ¶¶ 17, 66.

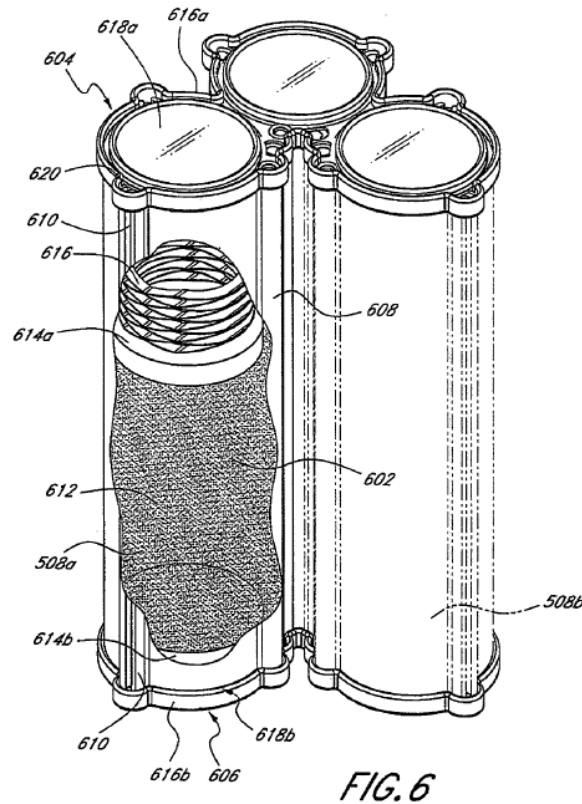


Figure 6 is a schematic illustration of adsorbent bed columns 508a, 508b of PSA unit 200. *Id.* ¶¶ 17, 66. Adsorbent bed column 508a includes housing 602 and integrated feed tube 608 extending from upper end 604 of housing 602 to lower end 606 of housing 602. *Id.* ¶ 66, Fig. 6. “[F]eed tube 608

provides a gas passageway between the manifold and the housing 602 such that gas from the manifold can be routed through the feed tube 608 into the lower end 606 of the housing 602 and vice versa.” *Id.* ¶ 66. Housing 602 contains adsorbent material 612 disposed between upper and lower restraining disks 614a, 614b, which inhibit movement of adsorbent material 612. *Id.* ¶ 68. Spring 616 applies pressure across upper restraining disk 614a to keep disk 614a in position. *Id.* Adsorbent material 612 “selectively removes one or more components” of a feed gas to form a product gas. *Id.* ¶ 70.

Figure 7A of Deane, reproduced below, is a schematic illustration of adsorbent bed column 508a in combination with chassis 202 and manifold 512, and shows “the manner[] in which gas flow is directed in and out of the column 508a.” *Id.* ¶¶ 18, 70.

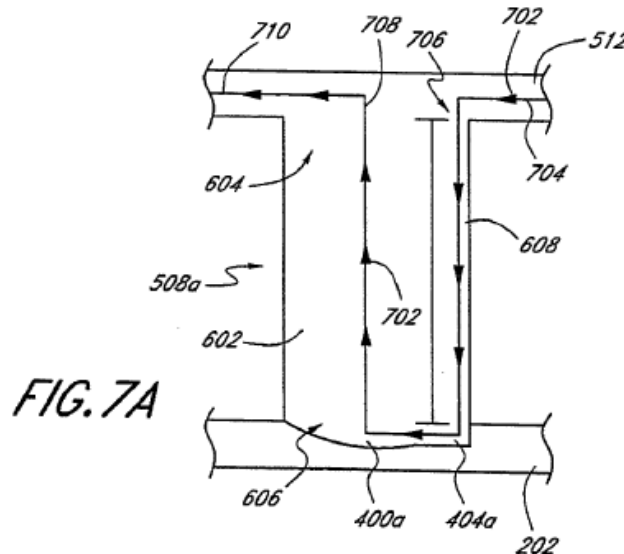


Figure 7A is a schematic diagram of gas flow to and from adsorbent bed column 508a. *Id.* ¶ 18. As indicated by arrows in Figure 7A, feed gas 702 is directed from feed stream 704 in manifold 512 into upper opening 706 (inlet) of feed tube 608, travels downwardly through feed tube 608 and is

diverted by divot 404a in chassis 202 into recess 400a underneath lower end 606 of adsorbent housing 602, flows upwardly from recess 400a through lower end 606 of housing 602, flows upwardly through adsorbent material contained in housing 602, during which the adsorbent material selectively removes one or more components in feed gas 702 to form product gas 708, and product gas 708 flows out of upper end 604 of housing 602 (outlet) into product stream 710 in manifold 512. *Id.* ¶ 70, Fig. 7. Deane discloses that “divot 404a, which is pre-formed in the chassis 202, advantageously serves as a lateral gas flow passageway so as to eliminate the need of any flexible tubing on the lower end of the column, which in turn simplifies assembly and reduces potential leak points.” *Id.* ¶ 70.

b) Ground 4: claim 1 over Deane alone

Our analysis focuses on the removal direction limitation. Petitioner presents three theories for how Deane taught or would have suggested this limitation. Petitioner’s first theory—the axial movement theory—disregards claim 1’s requirement that the separation cartridge is movable in a specified direction.

Petitioner’s second theory—the relative movement theory—rests on an improper construction of the removal direction limitation as encompassing a stationary separation cartridge.

And Petitioner’s third theory—the disassembly theory—relies on an inoperable configuration of Deane’s apparatus. In sum, none of Petitioner’s theories is supported by a preponderance of the evidence on the present record. As a separate matter, we also find that Petitioner’s second and third theories are presented improperly for the first time in the Reply. We address each of Petitioner’s theories below.

(1) The axial movement theory

Petitioner asserts that Deane teaches the removal direction limitation because Deane's adsorbent housing 602/adsorbent bed columns 508a, 508b (separation cartridge) is removable from manifold 512 (receptacle) by movement along the axis of adsorbent housing 602/adsorbent bed columns 508a, 508b. Pet. 42–43. Patent Owner counters that Deane does not teach that housing 602/adsorbent bed columns 508a, 508b (separation cartridge) is removable from manifold 512 (receptacle) by movement in the particular direction specified by the removal direction limitation. Resp. 37–39.

We determine that Petitioner's assertion is not supported by a preponderance of the evidence of record, for reasons that follow.

It is undisputed that a combination of Deane's adsorbent housing 602 and adsorbent bed column 508a corresponds to a separation cartridge as recited in claim 1. *Compare* Pet. 32–35, 44–46, *with* Resp. 33–34, 37. For purposes of this Decision, we consider Deane's manifold 512 to correspond to a “receptacle” as recited in claim 1, as Petitioner asserts. Pet. 35–36.⁸

Patent Owner does not dispute Petitioner's contention that Deane's adsorbent bed column 508a includes an inlet and an outlet oriented in a vertically upward direction, corresponding to the second direction recited in claim 1. *Compare* Pet. 32–35, 44–46, *with* Resp. 33–34, 37–39. It is further undisputed that, in Deane, the first direction recited in claim 1 corresponds to the vertically downward direction, which is opposite the vertically upward

⁸ Taking into consideration the totality of the information on the record before us, we determine that the term “receptacle” does not require express construction to resolve the parties' dispute over the patentability of claims 1–16 of the '614 patent.

direction in which Petitioner contends Deane's inlet and outlet are oriented. *Compare* Pet. 32–35, *with* Resp. 33–34, 37–39.

Petitioner asserts that one of ordinary skill in the art would have understood that Deane's housing 602/adsorbent bed columns 508a, 508b (separation cartridge) is removable from Deane's manifold 512 (receptacle) by movement along the axis of the separation cartridge, which, according to Petitioner, teaches the removal direction limitation. Pet. 42–43.

Patent Owner counters that to establish the obviousness of the removal direction limitation, Petitioner must demonstrate that Deane teaches or would have suggested movement of Deane's housing 602/adsorbent bed columns 508a, 508b (separation cartridge) in the vertically-downward direction relative to Deane's manifold 512 (receptacle), which Petitioner fails to do in the Petition. Resp. 33–34.

We agree with Patent Owner, and determine that Petitioner's assertions do not take into consideration the requirement specifically stated in the removal direction limitation specifying the direction of movement of the separation cartridge for removal from the receptacle.

As discussed above, the removal direction limitation requires that the separation cartridge can be removed from the receptacle by movement of the separation cartridge in comparison to the receptacle in a (first) direction opposite the (second) direction in which the separation cartridge's inlet and outlet are oriented.

Contrary to Petitioner's assertions, the removal direction limitation does not encompass both upward and downward movement of the separation cartridge. Instead, the removal direction limitation requires that the separation cartridge can move in a *particular* direction, the first direction.

Petitioner's reliance on axial movement of Deane's housing 602/adsorbent bed columns 508a, 508b (separation cartridge) as teaching the removal direction limitation, therefore, is contrary to the requirement of the removal direction limitation that the separation cartridge is moveable in a particular direction—the direction opposite the direction of orientation of the inlet and outlet (vertically downward in Deane)—for removal from the receptacle.

Petitioner's axial movement assertions do not establish that Deane discloses or would have suggested that Deane's housing 602/adsorbent bed columns 508a, 508b (separation cartridge) is removable from Deane's manifold by movement of the separation cartridge in a vertically downward direction (the direction opposite the direction of orientation of Deane's inlet and outlet). As Patent Owner and Patent Owner's witness (Dr. Talu) persuasively explain, Deane's disclosures would have suggested otherwise. Resp. 37–38 (citing Ex. 1004 ¶¶ 57, 58, 60, 93 Figs. 3–5; Ex. 2001 ¶¶ 118–131).

In particular, Deane discloses that gas fractionalization apparatus 200 includes shell 204 and chassis 202, which together form housing 206 in which manifold 512 and adsorbent housing 602 are mounted. Ex. 1004 ¶¶ 57, 62, Figs. 2, 3. Deane discloses that base 208 of housing 206 has a substantially planar exterior bottom surface adapted to rest against a support surface such as a table or floor. *Id.* ¶ 60. Deane discloses that chassis 202 has bottom mounts or vibration isolation feet 407 configured to engage with the bottom of the shell, and indicates that screws preferably are inserted through the bottom of the shell and into the bottom of the vibration isolation feet 407 of chassis 202. *Id.*

Deane thus teaches that adsorbent housing 602 and adsorbent bed columns 508a, 508b—the asserted separation cartridge—are part of an apparatus that rests on a support surface such as a table or floor. Based on Deane’s disclosure, we find persuasive Patent Owner’s contention, and Patent Owner’s witness’s opinion, that Deane’s housing 602/adsorbent bed columns 508a, 508b (separation cartridge) cannot be removed from the receptacle by movement of the separation cartridge vertically downward. Resp. 37–38; Ex. 2001 ¶¶ 118–131.

Neither Petitioner nor Petitioner’s witness, Dr. Knaebel, points to any evidence of record showing that one of ordinary skill in the art would have understood that Deane’s housing 602/adsorbent bed columns 508a, 508b (separation cartridge) could be removed from manifold 512 (receptacle) by moving housing 602/adsorbent bed columns 508a, 508b (separation cartridge) downward when the apparatus is resting on a table or floor, as taught by Deane. Pet. 42–43; Ex. 1078 ¶¶ 121–161.

Petitioner fails to show that Deane’s housing 602/adsorbent bed columns 508a, 508b (separation cartridge) could be removed from the receptacle by movement of the separation cartridge in the downward (second) direction, as required by the removal direction limitation of claim 1. Petitioner, therefore, does not establish unpatentability under its axial movement theory.

In the Institution Decision, we determined that Petitioner did not establish a reasonable likelihood of prevailing based on its axial movement theory for the removal direction limitation. Dec. 34–36 (expressing “concerns about the sufficiency of the Petitioner’s showing for claim 1”). Based on the record now before us, our concerns are not alleviated.

Petitioner does not identify any mistake in our reasoning in the Institution Decision. Instead, Petitioner pivots to a new theory based on relative movement. Reply 16–18. Petitioner’s new theory is procedurally and substantively flawed for the reasons set forth below.

(2) The relative movement theory

Under its relative movement theory, Petitioner asserts that the removal direction limitation is broad enough to encompass moving Deane’s manifold 512 (receptacle) upward while Deane’s housing 602/adsorbent bed columns 508a, 508b (separation cartridge) remains stationary. Reply 16–18 (citing Ex. 1078 ¶¶ 126–135).

Patent Owner contends that Petitioner’s assertion (a) constitutes an improper new theory of unpatentability raised for the first time in the Reply, and (b) is based on an improper claim construction. Sur-Reply 4–5. We address each of these issues in the subsections below.

(a) Untimely new theory of unpatentability

We agree with Patent Owner (Sur-Reply 4) that Petitioner’s relative movement theory is an impermissible new theory of unpatentability improperly presented for the first time in the Reply. *Corephotonics, Ltd. v. Apple Inc.*, 84 F.4th 990, 1008–09 (Fed. Cir. 2023) (A petitioner may not raise in a reply “‘an entirely new theory of *prima facie* obviousness absent from the petition,’ even if the new theory is responsive to the patent owner’s response or the Board’s institution decision.”) (quoting *Wasica Finance GmbH v. Continental Automotive Systems, Inc.*, 853 F.3d 1272, 1286 (Fed. Cir. 2017); see also *Henny Penny Corp. v. Frymaster LLC*, 938 F. 3d 1324, 1330–31 (Fed. Cir. 2019) (“We conclude that the Board did not abuse its

discretion in . . . disregarding its [petitioner's] new theory first raised in reply.”).

Petitioner does not present the relative movement theory in the Petition, and instead presents it for the first time in the Reply. Pet. 42–43. Far from fairly meeting any argument introduced by Patent Owner in the Response, this new theory unfairly changes the thrust of the challenge.

Petitioner bases the relative movement theory on Petitioner's newly introduced interpretation of the removal direction limitation as encompassing “relative movement.” Reply 16–18 (citing Ex. 1078 ¶¶ 126–135). More particularly, Petitioner asserts that (i) moving Deane's housing 602/adsorbent bed columns 508a, 508b (separation cartridge) downward vis-à-vis stationary manifold 512 (receptacle), (ii) moving Deane's manifold 512 (receptacle) upward vis-à-vis stationary housing 602/adsorbent bed columns 508a, 508b (separation cartridge), and (iii) moving Deane's manifold 512 (receptacle) upward while also moving Deane's housing 602/adsorbent bed columns 508a, 508b (separation cartridge) downward, each meet the removal direction limitation. *Id.* According to Petitioner, scenarios (ii) and (iii) result in housing 602 moving relative to manifold 512 in a first direction due to the fact that “in manifold 512's frame of reference while moving, housing 602 moves away from manifold in the first direction.” *Id.* Neither of these scenarios was presented in the Petition or fairly responds to an issue introduced by Petitioner in the Response.

In presenting the relative movement theory, Petitioner not only relies on a newly introduced claim construction, but also relies on new evidence in the form of opinions of Dr. Knaebel provided in a second Declaration submitted with the Reply, which Dr. Knaebel did not present in his first

Declaration submitted with the Petition. *Compare* Ex. 1078 ¶¶ 126–135, *with* Ex. 1003 ¶ 335. That circumstance unfairly denied Patent Owner an opportunity to contest the new theory with counter declaration evidence, which is allowed with a response but not a sur-reply. *See* 37 C.F.R. § 42.23(b) (“A sur-reply may only respond to arguments raised in the corresponding reply and may not be accompanied by new evidence other than deposition transcripts of the cross-examination of any reply witness.”).

In addition, Petitioner’s relative movement theory is meaningfully distinct from the axial movement theory presented in the Petition. In particular, the axial movement theory asserts that movement of Deane’s housing 602/adsorbent bed columns 508a, 508b (separation cartridge) along its axis meets the removal direction limitation, whereas the relative movement theory asserts that movement of the receptacle upward while the separation cartridge remains stationary meets the limitation. *Compare* Pet. 42–43, *with* Reply 16–18.

(b) Based on improper claim construction

Even if Petitioner’s “relative movement” theory had been timely presented, it is not persuasive because it is based on an incorrect claim construction.

Petitioner contends that three types of movement meet the removal direction limitation. Reply 16–17. Specifically, Petitioner asserts that (i) moving Deane’s housing 602/adsorbent bed columns 508a, 508b (separation cartridge) downward vis-à-vis stationary manifold 512 (receptacle), (ii) moving Deane’s manifold 512 (receptacle) upward vis-à-vis stationary housing 602/adsorbent bed columns 508a, 508b (separation cartridge), and (iii) moving Deane’s manifold 512 (receptacle) upward while also moving

Deane's housing 602/adsorbent bed columns 508a, 508b (separation cartridge) downward, each meet the removal direction limitation. *Id.* at 16–18 (citing Ex. 1078 ¶¶ 126–135).

According to Petitioner, scenarios (ii) and (iii) result in housing 602/adsorbent bed columns 508a, 508b (separation cartridge) moving relative to manifold 612 (receptacle) in a first direction because “in manifold 512's frame of reference while moving, housing 602 moves away from manifold in the first direction.” *Id.* at 18 (citing Ex. 1078 ¶¶ 133–135).

Petitioner's scenarios (i) and (iii) both require moving Deane's housing 602/adsorbent bed columns 508a, 508b (separation cartridge) downward relative to manifold 512. For the reasons discussed in subsection III.C.1.b.1 above (“the axial movement theory”), Petitioner fails to show that Deane teaches or would have suggested such movement.

Petitioner's scenario (ii) fails to satisfy the removal direction limitation, as properly construed. As discussed in Section III.B. above, we interpret the removal direction limitation to mean that the separation cartridge must be movable in reference to or in comparison with the receptacle to remove the separation cartridge from the receptacle. Our claim construction does not encompass movement of the receptacle relative to a stationary separation cartridge. For this reason, Petitioner's scenario (ii)—moving Deane's manifold 512 (receptacle) upward vis-à-vis stationary housing 602/adsorbent bed columns 508a, 508b (separation cartridge)—does not teach or suggest the removal direction limitation of claim 1.

(3) The partial disassembly theory

Petitioner asserts that even under a claim construction requiring downward movement of the separation cartridge, Deane teaches downward

removal of housing 602 from manifold 512 after the apparatus is partially disassembled by removing PSA unit 108/506. Reply 17. Patent Owner counters that Petitioner's partial disassembly theory is an improper new theory of unpatentability. Sur-Reply 7–8. Patent Owner further contends that Deane's apparatus would not have a functioning inlet after the partial disassembly process Petitioner proposes, rendering the apparatus inoperable. Sur-Reply 9–11 (citing Ex. 2009, 39:5–15).

(a) Untimely new theory of unpatentability

We agree with Patent Owner that Petitioner's partial disassembly theory is an improper new theory of unpatentability.

Petitioner does not present the partial disassembly theory in the Petition, and instead presents it for the first time in the Reply. In particular, Petitioner's unpatentability challenge of claim 1 in the Petition relies on the axial movement theory, and Petitioner makes no mention of the partial disassembly theory in the Petition. Pet. 42–43.

Petitioner introduces the partial disassembly theory for the first time in the Reply, and bases the theory on Petitioner's newly introduced interpretation of “relative movement.” Reply 2–3. Petitioner asserts that Deane's apparatus could be disassembled by removing shell 204, removing circuit board 1314, and unmounting/removing PSA unit 108/506 from chassis 202. *Id.* Thereafter, according to Petitioner, manifold 512 and housing 602 could be disconnected by holding manifold 512 in one hand, holding housing 602 in the other, and moving one or both of them apart vertically. *Id.* (citing Ex. 1004, Abstr., ¶¶ 7, 62–63, 65, 70; Ex. 1078 ¶¶ 16–24). This exercise changes the thrust of the challenge as presented in the Petition, which does not touch upon this partial disassembly theory.

In presenting the partial disassembly theory in the Reply, moreover, Petitioner not only relies on a newly introduced claim construction, but also relies on new evidence in the form of opinions of Dr. Knaebel provided in a second Declaration submitted with the Reply, which Dr. Knaebel did not present in his first Declaration submitted with the Petition. *Compare* Ex. 1078 ¶¶ 16–24, *with* Ex. 1003 ¶ 335. Here again, Patent Owner was unfairly disadvantaged because it could not supply counter declaration testimony in support of its Sur-reply. *See* 37 C.F.R. § 42.23(b). We are directed to no reason why the partial disassembly theory could not properly have been presented in the Petition.

In that regard, we find Petitioner’s partial disassembly theory is meaningfully distinct from Petitioner’s axial movement theory. The axial movement theory asserts that movement of Deane’s housing 602/adsorbent bed columns 508a, 508b (separation cartridge) along its axis meets the removal direction limitation. In contrast, the partial disassembly theory proposes first partially disassembling Deane’s apparatus, and asserts that in this disassembled state, downward removal of housing 602/adsorbent bed columns 508a, 508b from manifold 512 meets the removal direction limitation. *Compare* Pet. 42–43, *with* Reply 17.

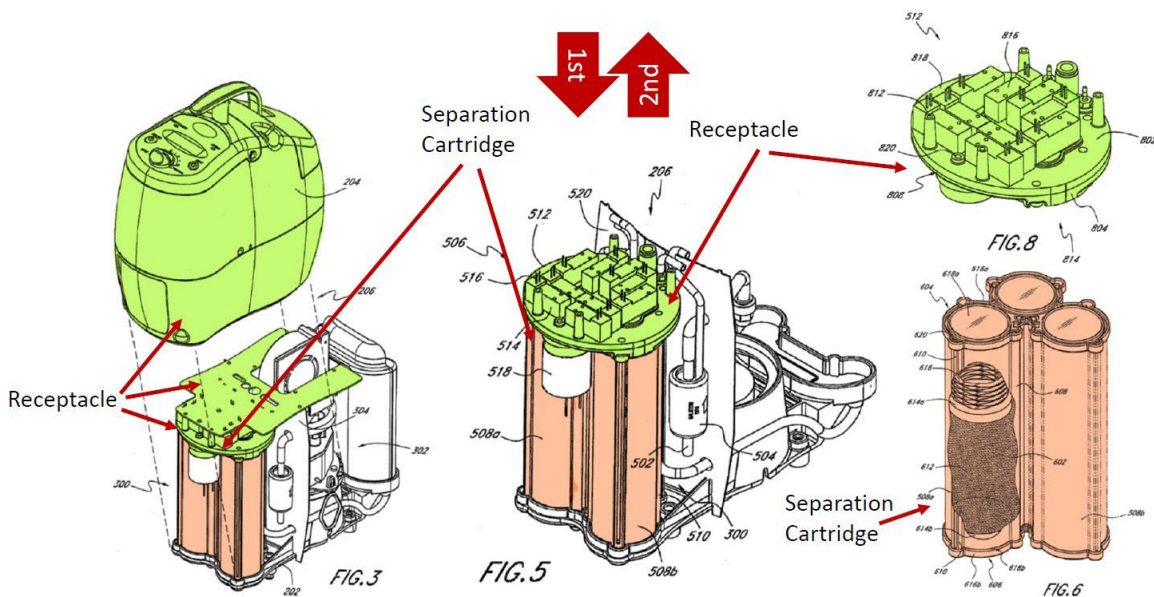
As Patent Owner indicates (Sur-Reply 7–8), Petitioner’s relative movement theory, therefore, constitutes an impermissible new theory of unpatentability improperly presented for the first time in the Reply.

(b) Does not teach or suggest claim 1

Even if Petitioner’s “partial disassembly” theory is not an impermissible new theory of unpatentability, Petitioner does not meet its burden of demonstrating that, if Deane’s gas fractionalization apparatus

were partially disassembled as Petitioner proposes, the apparatus in this state would teach or suggest the limitations of claim 1.

Petitioner contends that Deane's portable gas fractionalization apparatus could be disassembled by removing shell 204, removing circuit board 1314, and unmounting/removing PSA unit 108/506⁹ from chassis 202, as shown in the following annotated versions of Deane's Figures 3, 5, and 6. Reply 2–3 (citing Ex. 1004, Abstr., ¶¶ 7, 62–63, 65, 70; Ex. 1078 ¶¶ 16–24).

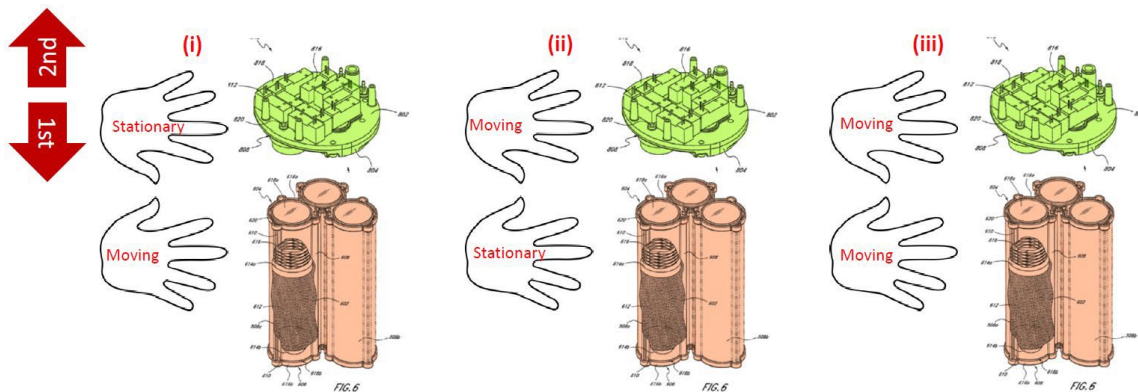


Deane's annotated Figures 3, 5, and 6, reproduced above, show elements of Deane's portable gas fractionalization apparatus.

Petitioner contends that following this disassembly process, manifold 512 (receptacle) could be separated from housing 602 housing 602/adsorbent bed columns 508a, 508b (separation cartridge) by holding manifold in one

⁹ Deane discloses that, “[a]s FIG. 5 further shows, the PSA unit 506 generally includes a pair of adsorbent bed columns 508a, 508b, a product gas storage column 510, and an integrated manifold 512 for controlling fluid flow to and from the columns 508a-b, 510.” Ex. 1004 ¶ 62. Deane's PSA unit thus includes the adsorbent columns and the manifold.

hand, holding housing 602 in the other, and moving one or both of them apart from each other vertically, as shown in the following annotated version of Deane's Figure 6 (Reply 16–17 (citing Ex. 1078 ¶¶ 126–127)):



Deane's annotated Figure 6 shows elements of Deane's portable gas fractionalization apparatus.

Petitioner asserts that scenarios (i) and (iii) both meet the removal direction limitation under an interpretation of the limitation restricted to downward movement of the separation cartridge for removal from the receptacle. Reply 17 (citing Ex. 1078 ¶¶ 129–132).

The evidence of record shows that when Deane's gas fractionalization apparatus is partially disassembled as Petitioner proposes, the apparatus does not teach or suggest claim 1.

First, Petitioner's counsel confirmed at the oral hearing that following partial disassembly of Deane's apparatus, the apparatus is no longer operable. In particular, Petitioner's counsel indicated that following removal of PSA unit 108/506 from chassis 202, Deane's apparatus is "no longer operating because that chassis, the cartridge forms into the chassis, it directs the airflow back up, and that's not going to happen in this situation." Tr. 13:6–14:11. Petitioner's counsel stated later at the hearing that "[t]he claim

isn't talking about separated units or components. It's talking about an assembled configuration of these components when it's operating. That's what the claim is directed to. And what I think I said earlier was that *when you remove the PSA unit [of Deane's apparatus], it doesn't operate.*" *Id.*, 37:8–12 (emphasis added).

Second, the evidence of record supports Patent Owner's assertion that, following Petitioner's partial disassembly process, Deane's feed tube no longer functions as an inlet because it is not able to direct fluid to the adsorbent bed in this state. Sur-Reply 9. In particular, Petitioner's witness (Dr. Knaebel) testified that when Deane's manifold and housing are in the disassembled state, "gas would flow downwards, out and not contact the absorbent [*sic*, adsorbent]." *Id.* (citing and quoting Ex. 2009, 39:5–15). Elaborating, Dr. Knaebel further stated that gas would flow out of the bottom of the feed tube and into the atmosphere when the manifold and housing are in the disassembled state. Ex. 2009, 39:5–15.

Third, Dr. Knaebel's testimony on this point is consistent with, and reflects, Deane's description of the flow path of feed gas through Deane's apparatus. In particular, Figure 7A of Deane (reproduced below) illustrates the feed gas flow path through Deane's apparatus:

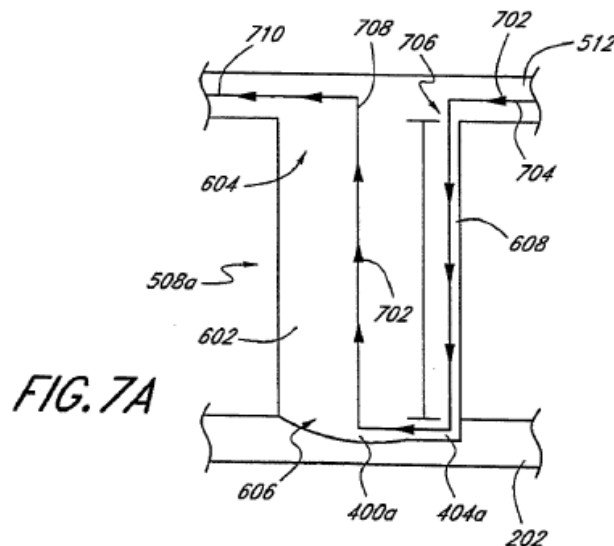


Figure 7A is a schematic diagram of gas flow to and from adsorbent bed column 508a. Ex. 1004 ¶ 18.

As shown in Figure 7A, manifold 512 directs feed gas 702 into upper opening 706 (inlet) of feed tube 608, feed gas then travels downwardly through feed tube 608, and divot 404a in chassis 202 diverts the feed gas into recess 400a underneath lower end 606 of adsorbent housing 602. *Id.* ¶ 70. The feed gas then flows upwardly from recess 400a through lower end 606 of housing 602, and flows upwardly through adsorbent material contained in housing 602, during which the adsorbent material selectively removes one or more components in feed gas 702 to form product gas 708. *Id.* Deane discloses that “divot 404a, which is pre-formed in the chassis 202, advantageously serves as a lateral gas flow passageway so as to eliminate the need of any flexible tubing on the lower end of the column, which in turn simplifies assembly and reduces potential leak points.” *Id.*

Deane thus discloses that chassis 202, and in particular divot 404a in chassis 202, functions as a lateral gas flow passageway through which feed gas 702 flows from feed tube 608 into lower end 606 of adsorbent housing

602 via recess 400a. *Id.* As Dr. Knaebel indicates, if chassis 202 were disconnected and removed from housing 602, feed gas 702 flowing from manifold 512 into upper opening 706 (inlet) of feed tube 608 and through feed tube 608 would not flow into lower end 606 of adsorbent housing 602. Instead, the feed gas would flow out of the bottom of feed tube 608 into the surrounding atmosphere, due to the absence of a lateral passageway formed by divot 404a in chassis 202 for directing the feed gas into lower end 606 of adsorbent housing 602.

As a consequence, even if housing 602/adsorbent bed columns 508a, 508b (separation cartridge) could be removed from manifold 512 (receptacle) by moving housing 602/adsorbent bed columns 508a, 508b (separation cartridge) downward (in the first direction) when Deane's apparatus is partially disassembled as Petitioner proposes, the apparatus in this state would not contain a separation cartridge configured such that when fluid flows through the separation cartridge, the fluid contacts the cartridge's bed of adsorbent material. Instead, fluid flowing through the cartridge's inlet and feed tube would flow out of the bottom of the feed tube into the surrounding atmosphere without contacting the bed of adsorbent material.

The evidence of record thus shows that following partial disassembly of Deane's apparatus according to Petitioner's proposed process, the apparatus would not be in the operable state Petitioner admits is required by claim 1 (Tr. 37:8–12), even if in such state the separation cartridge could be moved downward.

Against that backdrop, we find that Petitioner does not establish unpatentability based on its partial disassembly theory.

(4) Conclusion for Claim 1

The preponderance of the evidence on the record before us, therefore, does not support Petitioner's contention that Deane teaches or would have suggested the removal direction limitation of claim 1. Accordingly, on this record, Petitioner does not establish that the POC of claim 1 is unpatentable as obvious over Deane (Ground 4).

c) Ground 4: claims 2–5 and 7–11 over Deane alone

Because claims 2–5 and 7–11 depend from claim 1, our analysis for claim 1 for Ground 4 also applies to these claims. As a consequence, Petitioner does not establish that the POC of claims 2–5 and 7–11 is unpatentable as obvious over Deane.

d) Ground 5: claims 2 and 3 over Deane and Hill; and Ground 6: claim 6 over Deane and Basset

Claims 2, 3, and 6 depend from claim 1. Petitioner challenges the patentability of claims 2 and 3 in Ground 5 over Deane and Hill, and the patentability of claim 6 in Ground 6 over Deane and Basset. Pet. 66–72; Reply 30–31. Petitioner does not rely on any disclosure in Hill or Bassett, or provide any other argument or evidence, that remedies the deficiencies of the Petitioner's showing with respect to claim 1 in Ground 4. *Id.* Petitioner, therefore, does not establish by a preponderance of the evidence that claims 2 and 3 are unpatentable as obvious over Deane and Hill and claim 6 is unpatentable as obvious over Deane and Basset.

e) Ground 1: claim 1 over Deane, Dubois, and Berntson

Petitioner does not show by a preponderance of the evidence that claim 1 would have been obvious over Deane, Dubois, and Berntson. Petitioner's showing is insufficient for two reasons. First, Petitioner does not provide a persuasive rationale for combining the teachings of Berntson

with those of Deane. Second, even if the references' teachings were combined, Petitioner does not establish that the combined teachings would suggest the removal direction limitation. We begin our analysis with an overview of Berntson (Ex. 1006).

Berntson discloses medical oxygen concentrator 10 “for delivering a flow of oxygen enriched air to a patient.” Ex. 1006 ¶ 3; Fig. 1. Oxygen concentrator 10 includes housing or cabinet 12 having power cord 16 “for plugging into a wall outlet,” and patient delivery system 24 including a hose and mask. *Id.* ¶ 11; Fig. 1. Cabinet/housing 12 includes service access port 30 and contains oxygen-rich air generator unit (ORAG) 32. *Id.* ¶¶ 6, 11; Fig. 1. ORAG 32 includes chassis 34 “mounted inside of the cabinet 12, for example by being bolted, screwed, clamped, banded or otherwise removably fastened to the cabinet 12.” *Id.* ¶ 12; Fig. 2. The components of ORAG 32 are mounted on chassis 34, and include pump 36, valve system 46, and “adsorbent containers 42 in which sieve beds are contained.” *Id.* “[A]dsorbent containers 42 are in selective fluid communication with the inlet and/or outlet of the pump 36 via tubing or other connections with the valve system 46.” *Id.* Cooling fan 48 “is preferably provided to cool the components of the ORAG 32.” *Id.*

Petitioner asserts that Berntson teaches an oxygen-rich air generator (ORAG) unit containing adsorbent containers, an inlet, and an outlet, which is removable as a whole from a housing for maintenance purposes. Pet. 41 (citing Ex. 1006 ¶¶ 11, 12, 19; Ex. 1003 ¶ 333). Petitioner contends that one of ordinary skill in the art “would have been motivated to incorporate Berntson’s teachings into Dean’s POC to provide a cartridge with an adsorbent bed and other components removable as a whole from the POC’s

receptacle” to provide “an adsorbent-containing cartridge that is more modular and thus more easily accessed and removed/replaced for maintenance.” *Id.* at 28 (citing Ex. 1003 ¶ 293); *id.* at 41 (citing Ex. 1006 ¶ 19, Ex. 1003 ¶ 332).

Petitioner’s rational for combining Berntson’s teachings with those of Deane is not supported by the evidence of record.

First, Petitioner’s rationale is inconsistent with Deane’s disclosures. As Petitioner and Petitioner’s witness themselves point out, Deane teaches that components of Deane’s apparatus, including the separation cartridge, may be conveniently accessed for testing, repair, or maintenance, by simply removing the apparatus’ shell. *Id.* at 28 (citing Ex. 1004 ¶ 58, Fig. 3); Ex. 1003 ¶¶ 294–296.

Deane’s apparatus is thus designed to allow easy access to the separation cartridge for testing, repair, and maintenance. Petitioner’s rationale does not explain why modifying Deane’s apparatus in view of Berntson would allow the separation cartridge to be more easily accessed or removed/replaced for maintenance. Nor does Petitioner establish that modifying Deane’s apparatus in view of Berntson would address any problem with Deane’s apparatus, or provide any benefit to the apparatus, when Deane discloses that the separation cartridge is already conveniently accessible for maintenance and repair. Ex. 1004 ¶ 58.

Second, as Patent Owner correctly indicates, Petitioner does not describe with any degree of specificity how Berntson’s teachings actually would be used to modify Deane’s apparatus, or describe with particularity the resulting modified apparatus, including its separation cartridge. Resp. 45–46 (citing Pet. 26–29, 41–42).

Petitioner’s conclusory rationale lacks the detail necessary to persuasively establish how—and thus why—one of ordinary skill in the art would have modified Deane’s apparatus in view of Berntson. We are persuaded by Patent Owner’s argument that “Petitioner’s vague attempt to set forth a combination in view of Berntson in the alternative to Deane” “is insufficient to establish obviousness” because “Petitioner does not make clear how the alleged teachings of Berntson would be incorporated into Deane, or even explain what the alleged “separation cartridge” would be in the resulting combination.” *Id.*

Furthermore, even if Berntson’s teachings were combined with those of Deane, Petitioner does not establish that modifying Deane’s apparatus in view of Berntson’s disclosures would have resulted in a modified apparatus that suggests the removal direction limitation.

As Patent Owner and Patent Owner’s witness explain, Berntson does not disclose movement of its ORAG unit in a particular direction relative to a receptacle, much less disclose that the ORAG unit could be moved in a first direction, i.e., downward, relative to a receptacle, as required by the removal direction limitation in the context of Deane. Resp. 46; Ex. 2001 ¶ 133.

Instead, Berntson discloses that its ORAG unit includes a chassis to which the components of the ORAG unit (including adsorbent containers) are mounted, and Berntson discloses that the chassis is removably fastened to the inside of a cabinet/housing. Ex. 1006 ¶¶ 11, 12; Fig. 2. Petitioner does not identify any disclosure in Berntson that teaches or would have suggested that the ORAG unit could be removed from the cabinet/housing by moving the ORAG unit vertically downward. Nor does Petitioner

explain how modifying Deane's apparatus in view of Berntson's disclosures would have resulted in Deane's housing 602/adsorbent bed columns 508a, 508b (separation cartridge) being removable from Deane's manifold 512 (receptacle) by movement of the separation cartridge vertically downward.

Thus, even if one of ordinary skill in the art would have been led by Berntson's teachings to modify Deane's gas fractionalization apparatus, Petitioner does not provide objective evidence sufficient to establish that Deane's modified apparatus would teach or suggest the removal direction limitation of claim 1.

Petitioner's reliance on Berntson, therefore, does not cure the deficiencies of Petitioner's showing for claim 1 based on Deane alone. Nor does Petitioner rely on Dubois for any disclosure that cures the deficiencies of Petitioner's showing for claim 1 based on Deane alone. Pet. 26–29, 31. Petitioner, therefore, does not establish by a preponderance of the evidence that claim 1 is unpatentable as obvious over Deane, Dubois, and Berntson.

f) Ground 1: claims 2–5 and 7–11 over Deane, Dubois, and Berntson

Because claims 2–5 and 7–11 depend from claim 1, our analysis for claim 1 for Ground 1 also applies to these claims. As a consequence, Petitioner does not establish that the POC of claims 2–5 and 7–11 is unpatentable as obvious over Deane, Dubois, and Berntson.

*g) Ground 2: claims 2 and 3 over Deane, Dubois, Berntson, and Hill; and
Ground 3: claim 6 over Deane, Dubois, Berntson, and Basset*

Claims 2, 3, and 6 depend from claim 1. Petitioner challenges the patentability of claims 2 and 3 in Ground 2 over Deane, Dubois, Berntson, and Hill, and the patentability of claim 6 in Ground 3 over Deane, Dubois, Berntson, and Basset. Pet. 66–72; Reply 30–31.

Petitioner does not rely on any disclosure in Hill or Bassett, or provide any other argument or evidence, that remedies the deficiencies of the Petitioner's showing with respect to claim 1 in Ground 1. *Id.* Petitioner, therefore, does not establish by a preponderance of the evidence that claims 2 and 3 are unpatentable as obvious over Deane, Dubois, Berntson, and Hill and claim 6 is unpatentable as obvious over Deane, Dubois, Berntson and Basset.

2. Claims 12–16

Petitioner asserts that claims 12–16 are unpatentable over Deane alone (Ground 4), or over Deane, Dubois, and Berntson (Ground 1). Pet. 13–14. We first discuss the parties' dispute about a limitation common to claims 12–16—the “non-contact limitation”—and then address the parties' dispute about the spring arrangement of dependent claim 15.

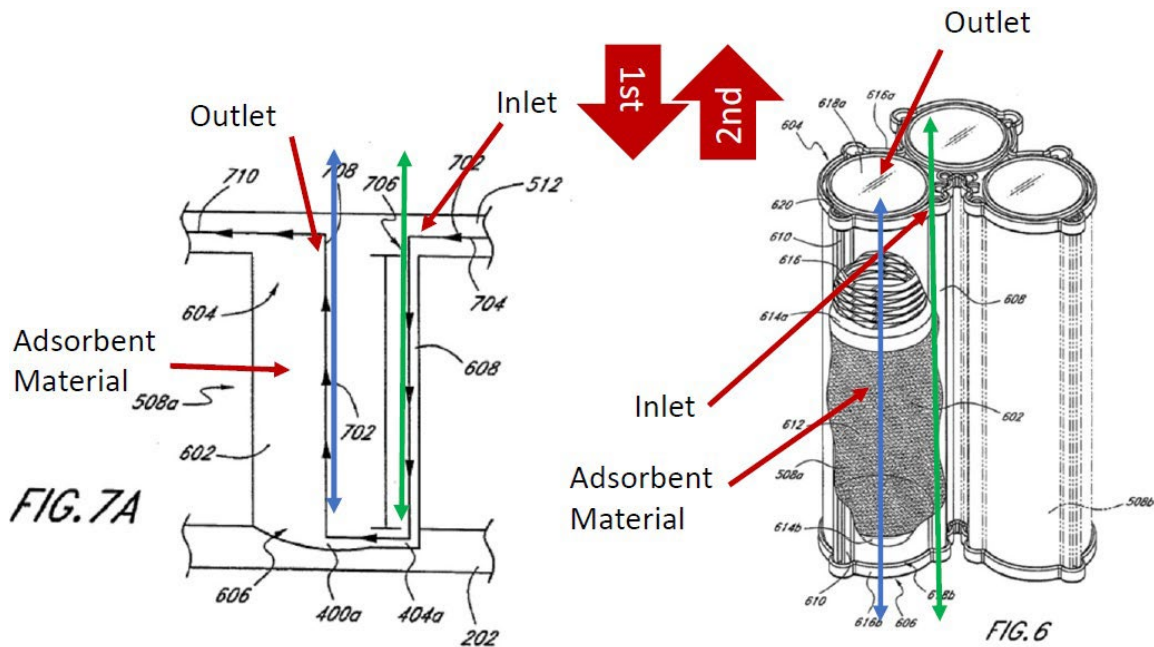
a) Non-Contact Limitation of Claims 12–16

Independent claims 12 and 13 both require a first line extending parallel to the direction of orientation of the inlet and the outlet to pass through the outlet. Claims 12 and 13 also require a second line spaced-apart from the first line and extending parallel to the first line to pass through the inlet. Claims 12 and 13 further require the separation cartridge to be configured such that, when fluid flows through the separation cartridge, fluid flowing along the first line contacts the adsorbent material of the bed, and fluid flowing along the second line does not contact the adsorbent material of the bed. We refer to these claim elements as “the non-contact limitation.” Claims 14–16 include the non-contact limitation because they depend, directly or indirectly, from claim 13.

To reiterate for clarity, the non-contact limitation requires that fluid flowing along a line passing through the inlet does not contact the adsorbent material of the bed, while fluid flowing along a parallel line passing through the outlet does contact the adsorbent material of the same bed.

Petitioner establishes by a preponderance of the evidence that Deane discloses the non-contact limitation. Petitioner persuasively shows that Figures 6 and 7A of Deane and the corresponding disclosure teach this limitation. Patent Owner's assertions to the contrary are based on an incorrect interpretation of Deane's Figure 6 and Petitioner's annotations of that figure, and are inconsistent with the record evidence.

Petitioner provides the following annotated versions of Deane's Figures 6 and 7A (Pet. 49):



Deane's Figure 7A is a schematic diagram of gas flow to and from the adsorbent bed column illustrated in Deane's Figure 6. Ex. 1004 ¶ 18.

We are persuaded by Petitioner's contention that Deane discloses that a first line (the blue line in Petitioner's annotated drawing, above) extends parallel to the direction of orientation of filter portion 618a (outlet) of adsorbent housing 602/adsorbent bed column 508a (separation cartridge) and extends parallel to opening 706 of feed tube 608 of adsorbent housing 602/adsorbent bed column 508a (inlet) (illustrated by arrow labeled "2nd" in the Petitioner's annotated drawing, above) and passes through filter portion 618a/top portion 604 of adsorbent housing 602/adsorbent bed column 508a (outlet). Pet. 48–49 (citing Ex. 1004 ¶¶ 59, 62, 66, 68, 70, Figs. 6, 7A; Ex. 1003 ¶¶ 348–349, 354); *see also* Pet. 32–33 (discussing the orientation of the inlet and outlet in Deane's apparatus).

Petitioner shows persuasively that a second line spaced-apart from the first line (the green line in the Petitioner's annotated drawing, above) extends parallel to the first (blue) line and passes through opening 706 of feed tube 608 of adsorbent housing 602/adsorbent bed column 508a (inlet). *Id.*

We are also persuaded by Petitioner contention that Deane discloses that adsorbent housing 602/adsorbent bed column 508a (separation cartridge) is configured such that, when fluid flows through adsorbent housing 602/adsorbent bed column 508a (separation cartridge), fluid flowing along the blue (first) line passes through (contacts) adsorbent material 612, and fluid flowing through feed tube 608 flows along the green (second) line, and does not contact adsorbent material 612. *Id.* Based on Petitioner's contentions, we find that Deane thus teaches the fluid flow defined by the non-contact limitation. *Id.* at 50.

Patent owner contends that Petitioner does not establish that Deane teaches the non-contact limitation and illustrates its contention with the following annotated version of Deane's Figure 6. Resp. 52, 54.

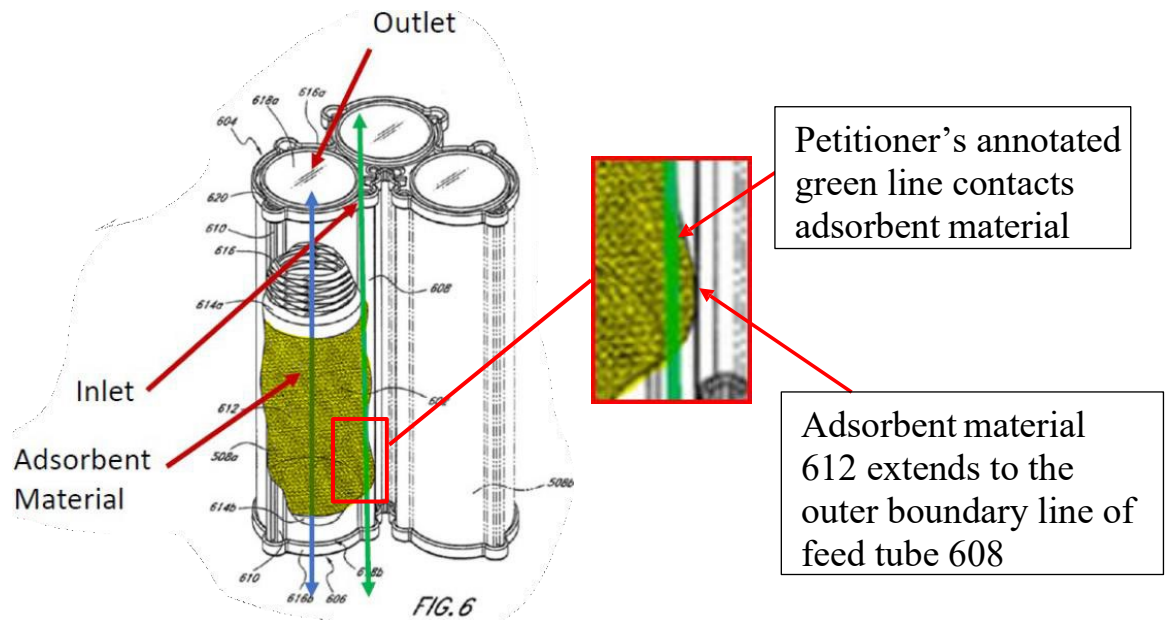


Figure 6 of Deane illustrates the adsorbent bed column of the PSA unit of Deane's gas fractionalization apparatus. Ex. 1004 ¶ 17.

Patent Owner contends that the above figure shows adsorbent material 612 (highlighted in yellow) extending to the outer boundary line of feed tube 608, demonstrating that adsorbent material 612 is in feed tube 608.

Resp. 54. Patent Owner contends that Petitioner's annotated green line illustrates that fluid flowing along the green line would contact adsorbent. *Id.* Patent Owner asserts that Petitioner's witness, Dr. Knaebel, admitted during a deposition that the green line in the above figure is touching adsorbent. *Id.* at 55 (citing Ex. 2003, 47:17–48:8).

We credit Dr. Knaebel's testimony on this issue, which, when considered in full, is contrary to Patent Owner's contentions. In particular, Dr. Knaebel opines that Figure 6 of Deane is a two-dimensional "artist's

rendition” of a three-dimensional object in which part of housing 602 is cut away to show the components inside the housing. Ex. 2003, 45:6–13, 45:21–46:2, 49:1–2. Dr. Knaebel opines that although Petitioner’s annotated version of Figure 6 shows in two dimensions the green line touching adsorbent material, “it would not in the three-dimensional reality.” *Id.* at 49:8–9. Dr. Knaebel indicates that one of ordinary skill in the art, therefore, would not have understood the drawing to show that the green line passes through adsorbent. *Id.* at 47:3–7.

Dr. Knaebel further points out that Deane discloses that the feed tube has an inner diameter of only about 0.125 inches, and if the feed tube were filled or even partially filled with adsorbent beads “the flow through that tube would be seriously impacted, such that the unit would not operate.” *Id.* at 50:2–10; *see also* Ex. 1004 ¶ 67. Dr. Knaebel opines that it “would be obvious to one skilled in the art that you don’t want something . . . to obstruct the flow through that tube.” Ex. 2003, 51:4–12. We find that Dr. Knaebel’s explanation of Deane’s feed tube is credible and consistent with Deane’s Figure 6.

Patent Owner counters that nothing in Deane “contradicts the clear showing of Figure 6 of adsorbent extending into feed tube 608.” Resp. 60. Patent Owner contends that, for example, Deane’s Figure 7A does not establish that Deane’s feed tube lacks adsorbent because adsorbent material is not shown in the figure, and the figure does not show any structural details or arrangement of components. *Id.* at 57 (citing Ex. 2001 ¶ 146). Patent Owner contends that Deane’s disclosure also does not state at any point that adsorbent is not present in the feed tube, which Dr. Knaebel admitted. *Id.* at 58 (citing Ex. 2003, 51:17–22).

As discussed above, however, Petitioner provides persuasive evidence demonstrating that Figures 6 and 7A of Deane taken together disclose the non-contact limitation, contrary to Patent Owner's assertions. Pet. 48–50.

First, although Deane's written description does not explicitly indicate whether adsorbent extends into the feed tube, Dr. Knaebel provides persuasive testimony that the presence of adsorbent in the feed tube would negatively impact flow through the tube “such that the unit would not operate,” and, therefore one skilled in the art would not have so obstructed flow through the feed tube. Ex. 1078, 50:2–10, 51:4–12.

Second, Petitioner asserts, and we find, that although Figure 7A's schematic illustration of gas flow does not show structural details of manifold 512, adsorbent housing 602, and feed tube 608, the Figure illustrates a vertical, partition-like line extending between the housing and the feed tube. Reply 29 (citing Ex. 1078 ¶¶ 181, 183). We agree with Petitioner that this vertical line shows that the housing is separated from the feed tube, and adsorbent present in the housing, therefore, does not extend into the feed tube. *Id.*

Third, we credit Dr. Knaebel's testimony that the vertical, partition-like line shown in Figure 7A is a “wall” that separates the main portion of the housing containing adsorbent from the feed tube. Ex. 1078 ¶ 181. Dr. Knaebel indicates that due to the presence of this wall, if Deane's Figure 6 were illustrating adsorbent in the feed tube, it would have to portray two separate masses of adsorbent: one in the main portion of the housing and the other in the feed tube. *Id.* ¶ 182. According to Dr. Knaebel, Figure 6 instead shows only one mass of adsorbent. *Id.* Dr. Knaebel indicates that “a POSITA would have understood by viewing FIGS. 6 and 7A in tandem that

the main portion of housing 602 and feed tube 608 are separate volumes and that adsorbent in the main portion of housing 602 does not extend into feed tube 608.” *Id.* ¶ 183.

Patent Owner’s witness (Dr. Talu) counters that Figure 7A does not demonstrate that adsorbent is not present in the feed tube because the Figure “does not show any adsorbent at all,” and does not provide an accurate depiction of the structures that guide movement of fluid relative to the feed tube. Ex. 2001 ¶ 146. Dr. Talu, however, does not address the presence of the vertical, partition-like line shown in Figure 7A extending between the housing and the feed tube. Dr. Talu thus does not provide a plausible interpretation of the Figure that explains how and why the vertical line does not separate the housing from the feed tube. Dr. Talu’s testimony, therefore, is less persuasive than Dr. Knaebel’s testimony that the vertical, partition-like line is a wall that prevents adsorbent from extending from the housing into the feed tube.

Patent Owner contends that providing adsorbent in Deane’s feed tube could serve the function of a pre-bed, relying on two references that teach an initial bed of adsorbent in series with a main bed of adsorbent. Resp. 56. (citing Ex. 1037, 4:48–50; Ex. 1068, 126–129). Patent Owner asserts that “[t]hese teachings support a reason why Deane shows adsorbent in the identified feed tube 608.” *Id.*

As discussed above, however, as Dr. Knaebel testifies Deane’s Figure 6 shows that the adsorbent material is formed as a single, unitary bed. Ex. 1078 ¶ 182. Patent Owner’s references indicate that pre-beds have a different structure and a different function than a single, unitary bed of adsorbent material as disclosed in Deane. Ex. 1068, 126–128; Ex. 1037

4:48–53 (disclosing that a pre-bed is a separate, distinct bed disposed in series with (upstream from) a main bed that functions to remove different components from a feed stream than the main bed removes). Accordingly, if adsorbent material of Deane’s unitary bed extended into the feed tube as Patent Owner contends, the adsorbent material present in the feed tube would not have the same structure and function as the pre-beds described in Patent Owner’s references. Patent Owner’s references, therefore, do not support Patent Owner’s assertion that adsorbent material extending into the feed tube could serve the function of a pre-bed.

Petitioner establishes by a preponderance of the evidence on the record before us that Deane teaches or would have suggested the non-contact limitation of independent claims 12 and 13.

b) Spring Arrangement of Claim 15

Petitioner asserts that claim 15 is unpatentable over Deane and Hill (Ground 5), or over Deane, Dubois, Berntson, and Hill (Ground 2). Pet. 13–14.

Claim 15 depends from independent claim 13, which recites a POC comprising first and second beds of adsorbent material. Claim 15 recites that an outlet is arranged adjacent to a first end of each bed, and a spring is arranged adjacent to the (second) opposite end of each bed. Petitioner contends that Hill teaches the spring arrangement of claim 15. Pet. 66–68, 70, 72.

Hill discloses a pressure swing adsorption system for separating gases that includes multiple adsorption vessels that each contain a bed of adsorbent material. Ex. 1008, 1:5–6, 4:48–49, 4:60–62. Springs are disposed near the

bottom (feed end) of each adsorption vessel and function to hold the adsorbent material firmly in place. *Id.* at 5:7–9.

Petitioner presents two theories for why the combined disclosures of Deane and Hill would have suggested the spring configuration recited in claim 15, neither of which is supported by a preponderance of the evidence on the present record. In particular, both theories are contrary to Deane’s disclosures, and also are not supported by a persuasive rationale for modifying the placement of Deane’s springs.

Petitioner and Dr. Knaebel first assert that it would have been obvious to reposition Deane’s springs from the upper/product end of Deane’s adsorbent columns to the bottom (feed) ends of the columns as disclosed in Hill because Deane and Hill’s springs both have the same function of holding adsorbent material in place. Pet. 66–67; Ex. 1003 ¶ 429. Petitioner further asserts that such repositioning would have been obvious because it was known in the art that springs could be positioned at either end of an adsorbent column, rendering spring placement a matter of design choice. Pet. 66–67 (citing Ex. 1003 ¶ 427). Dr. Knaebel echoes Petitioner’s assertions, and further opines that Warren¹⁰ and Bassine¹¹ evidence that it was known in the art that a spring could be placed on either side of an adsorbent bed, rendering spring placement a design choice. Ex. 1003 ¶ 430 (citing Ex. 1012 ¶ 73, Ex. 1026, Fig. 6).

Petitioner’s assertions and Dr. Knaebel’s opinions are contrary to Deane’s explicit disclosures, however.

¹⁰ Ex. 1012.

¹¹ Ex. 1026.

It is undisputed—and Petitioner explicitly acknowledges—that each adsorbent column of Deane’s apparatus includes upper and lower restraining disks that inhibit movement of adsorbent material present in the column’s housing. *Compare* Pet. 66–67, *with* Resp. 63–64; *see also* Ex. 1004 ¶ 68 (“As also shown in FIG. 6, the adsorbent bed housing 602 contains an adsorbent material 612, an upper and a lower restraining disk 614a, 614b for inhibiting movement of the adsorbent material 612.”).

It is also undisputed—and Petitioner explicitly acknowledges—that Deane discloses a spring adjacent to the upper restraining disk, and the spring applies uniform pressure across the upper restraining disk to keep it in place and prevent it from tilting. *Compare* Pet. 66–67, *with* Resp. 63–64; *see also* Ex. 1004 (“[T]he upper restraining disk 614a is pressed against the adsorbent material 612 by the spring 616. The spring 616 is preferably a wave spring configured to apply substantially uniform pressure across the surface of the upper restraining disk 614a, so as to substantially inhibit the disk from tilting.”).

Deane thus explicitly discloses that the restraining disks—rather than the springs—function to inhibit movement of adsorbent material present in the housings of Deane’s adsorbent columns, while the springs function to keep the upper restraining disks in place. Deane’s disclosures, therefore, contradict Petitioner’s and Dr. Knaebel’s assertions that Deane’s and Hill’s springs both function to hold adsorbent material in place.

Neither Petitioner nor Dr. Knaebel addresses the purpose and functional significance of placing Deane’s springs adjacent to the upper restraining disks at the top of Deane’s adsorbent beds, and the effect that repositioning the springs would have on the springs’ function and purpose.

In particular, neither Petitioner nor Dr. Knaebel explains how and why the upper restraining disks would be held in place if the springs were moved to the bottom of Deane's columns, contradicting their assertion that placement of Deane's springs would be a matter of design choice. We, therefore, are not persuaded that Hill's spring position was a known alternative to the spring position disclosed in Deane.

Although Petitioner argues it was known in the art that springs could be positioned at either end of an adsorbent column, that argument does not provide a sufficient rationale for repositioning Deane's springs. *Virtek Vision Int'l ULC v. Assembly Guidance Systems, Inc.*, 97 F.4th 882, 886 (Fed. Cir. 2024) ("It does not suffice to meet the motivation to combine requirement to recognize that two alternative arrangements . . . were both known in the art. . . . [Such] disclosures, however, do not provide any reason why a skilled artisan would use [one] instead of [the other]."). Petitioner proposes to substitute Hill's spring position for Deane's. Pet. 66–67. As in *Virtek*, however, Petitioner provides "no argument in the petition regarding why a skilled artisan would make this substitution—other than that the two different [spring positions] were 'known to be used.'" See *Virtek Vision*, 97 F.4th at 887. Under the particular facts at hand, we detect the unmistakable taint of impermissible hindsight reconstruction in Petitioner's conclusory proposition.

As Patent Owner's witness (Dr. Talu) correctly points out, the spring positioned at the top end of Deane's adsorbent column "works perfectly fine." Ex. 2001 ¶ 165. Petitioner does not establish that repositioning Deane's springs to place them at the bottom of the adsorbent columns would address any problem with Deane's apparatus, or provide any benefit to the

apparatus. Petitioner, for example, does not provide any evidence of a design need that would have been met by the proposed repositioning of Deane's springs. Nor does Petitioner provide any evidence to establish that the proposed repositioning would have had a predictable effect. Petitioner, therefore, does not provide a persuasive rationale for repositioning Deane's springs to the bottom of Deane's adsorbent columns.

Second, Petitioner asserts that it would have been obvious to place springs at both ends of Deane's adsorbent columns because it was known in the art to do so. Pet. 67–68 (citing Ex. 1003 ¶ 430). Petitioner's assertion is not supported by a persuasive rationale for the proposed modification, and is also contrary to Deane's disclosures.

As discussed above, Petitioner's known alternatives argument, even if it were supported by the evidence, does not provide a sufficient rationale for adopting one configuration over the other. *Virtek Vision*, 97 F.4th at 886. Petitioner does not provide any evidence showing that Deane's apparatus would benefit in any way by adding a second spring to the bottom of each adsorbent column. As Patent Owner and Dr. Talu persuasively point out, adding a second spring to each adsorbent column of Deane's apparatus would unnecessarily increase the apparatus' complexity, without providing any benefit. Resp. 62–63; Ex. 2001 ¶ 165.

Furthermore, as Patent Owner and Dr. Talu also point out, adding a second spring to each of Deane's adsorbent columns would actually be detrimental to Deane's apparatus. As Patent Owner indicates, Deane discloses that the presence of "head space" or dead volume in the adsorbent column's housing is undesirable because it penalizes system performance. Ex. 1004 ¶ 67. As Patent Owner further indicates, Dr. Knaebel testified that

adding a second spring to the bottom of Deane's adsorbent column would increase the dead volume in the housing containing the adsorbent column. Ex. 2009, 86:22–87:5.

Petitioner, therefore, does not provide a persuasive rationale for adding a second spring to the bottom of each of Deane's adsorbent columns.

In sum, Petitioner does not establish by a preponderance of the evidence on the record before us that Deane in view of Hill teaches or would have suggested the spring configuration recited in claim 15.

c) Objective Indicia of Nonobviousness: Licensing

As discussed above, Petitioner shows that the prior art teaches or would have suggested the limitations of claims 12–14 and 16. We therefore consider all objective indicia of nonobviousness presented on the trial record. Patent Owner contends that licensing activity suggests that the claims of the '614 patent would not have been obvious. Resp. 65. Petitioner counters that Patent Owner does not establish a nexus between the licensing activity and the challenged claims. Reply 31. We agree with Petitioner for reasons that follow.

At the outset, we take account of our reviewing court's instruction that, “[i]n order to accord substantial weight to secondary considerations in an obviousness analysis, ‘the evidence of secondary considerations must have a ‘nexus’ to the claims, i.e., there must be ‘a legally and factually sufficient connection’ between the evidence and the patented invention.”

Fox Factory, Inc. v. SRAM, LLC, 944 F.3d 1366, 1373 (Fed. Cir. 2019) (quoting *Henny Penny Corp. v. Frymaster LLC*, 938 F.3d 1324, 1332 (Fed. Cir. 2019)); see also *Lectrosonics, Inc. v. Zaxcom, Inc.*, Case IPR2018-01129, Paper 33 at 32 (PTAB Jan. 24, 2020) (precedential) (“For objective

indicia of nonobviousness to be accorded substantial weight, its proponent must establish a nexus between the evidence and the merits of the claimed invention.”).

The patent owner bears the burden of showing this nexus. *Fox Factory*, 944 F.3d at 1373. A patent owner, however, is entitled to a presumption of nexus where it shows that the evidence supporting secondary considerations “is tied to a specific product and the product ‘is the invention disclosed and claimed’” or, put another way, the “product ‘embodies the claimed features, and is coextensive with them.’” *Id.*

“A [patent owner] may establish nexus absent the presumption by showing that the objective indicia are the ‘direct result of the unique characteristics of the claimed invention,’ rather than a feature that was ‘known in the prior art.’” *Campbell Soup Co. v. Gamon Plus, Inc.*, 10 F.4th 1268, 1277 (Fed. Cir. 2021) (citation omitted).

Here, Patent Owner asserts that a third party, Inogen, has taken a license from another third party (3B), who is an exclusive licensee of Patent Owner. Resp. 65. Patent Owner represents that the license is “for Inogen’s POC products regarding patent families including U.S. Patent Nos. 10,357,628 and 7,604,005 (which includes the ’614 Patent).” *Id.* According to Patent Owner, the parties are permitted to disclose the existence of the Inogen license, but its terms are confidential. *Id.*

Patent Owner asserts that Petitioner’s witness, Dr. Knaebel, “testified that he believes Inogen to be a market leader in the portable oxygen concentrator [POC] space,” and “Inogen would not have taken a license to a patent it believed to be invalid.” *Id.* (citing Ex. 2003, 22:4–23:8). Patent Owner further explains that its witness, Dr. Talu, “testifies that Inogen has a

good reputation in the industry and their taking of a license speaks to the inventiveness of the '614 Patent.” *Id.* (citing Ex. 2001 ¶¶ 170, 171).

Petitioner contends that Patent Owner does not establish a nexus between the licensing activity and the challenged claims, rendering the licensing activity “irrelevant.” Reply 31.

We determine that Patent Owner’s arguments and evidence fall short of establishing the required nexus.

Patent Owner’s assertion that the license is “for Inogen’s POC products regarding patent families including U.S. Patent Nos. 10,357,628 and 7,604,005 (which includes the '614 Patent)” (Resp. 65) is not sufficient to establish that the licensed products embody the features claimed in the '614 patent, and are coextensive with the claimed features.

In particular, the 7,604,005 patent is not in the same patent family as the '614 patent, and, critically, Patent Owner does not explain the relevance of this patent to the invention claimed in the '614 patent. Although the 10,357,628 patent and the '614 patent are both continuations of the same parent application, Patent Owner does not explain why and how this patent is relevant to the invention claimed in the '614 patent.

Nor does Patent Owner provide any evidence demonstrating that the licensing activity is tied to a specific product that corresponds to the invention disclosed and claimed in the '614 patent. Patent Owner similarly provides no evidence establishing that the relied-upon licensing activity is tied to a specific product that embodies the features claimed in the '614 patent, and is coextensive with the claimed features.

Patent Owner, therefore, is not entitled to a presumption of nexus.

Although Patent Owner may still establish a nexus between the challenged claims and the licensing activity in the absence of a presumed nexus, Patent Owner does not provide a sufficient showing to do so on the record before us.

Patent Owner indicates that the licensing activity relates to numerous patents, but does not provide any evidence linking the Inogen license specifically to the '614 patent, as opposed to the other licensed patents. It is unclear on the present record, therefore, whether the license arose out of recognition and acceptance of the subject matter claimed in the '614 patent, or for some other reason. Even if we were to accept that the licensee may be a market leader in POCs and may have a good reputation in the industry, those facts alone do not show sufficiently that the licensing activity was due to the merits of the POC claimed in the '614 patent.

The mere existence of a license, without more specific information about the circumstances surrounding the license, does not establish a nexus. *See EWP Corp. v Reliance Universal Inc.*, 755 F.2d 898, 907–08 (Fed. Cir. 1985). Because Patent Owner does not provide any evidence to show that the licensing activity is the direct result of the unique characteristics of the POC claimed in the '614 patent, Patent Owner does not establish a nexus between the licensing activity and the invention claimed in the '614 patent.

The licensing activity, therefore, carries little weight towards establishing the nonobviousness of the challenged claims.

d) Conclusion for Claims 12–16

Petitioner establishes that claims 12–14 and 16 are unpatentable over Deane (Ground 4), claims 12–14 and 16 are unpatentable over Deane, Dubois, and Berntson (Ground 1). Petitioner, however, does not establish

that claim 15 is unpatentable over Deane and Hill (Ground 5), or over Deane, Dubois, Berntson, and Hill (Ground 2).

IV. CONCLUSION¹²

Petitioner does not establish by a preponderance of the evidence that claims 1–11 and 15 of the '614 patent are unpatentable, but does establish by a preponderance of the evidence that claims 12–14 and 16 of the '614 patent are unpatentable. The following table summarizes our decision.

Claim(s)	35 U.S.C. §	Reference(s)/ Basis	Claim(s) Shown Unpatentable	Claim(s) Not shown Unpatentable
1–5, 7–16	103(a)	Deane, Dubois, Berntson	12–14, 16	1–5, 7–11, 15
2, 3, 15	103(a)	Deane, Dubois, Berntson, Hill		2, 3, 15
6	103(a)	Deane, Dubois, Berntson, Basset		6
1–5, 7–16	103(a)	Deane	12–14, 16	1–5, 7–11, 15
2, 3, 15	103(a)	Deane, Hill		2, 3, 15
6	103(a)	Deane, Basset		6

¹² Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner's attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. See 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. See 37 C.F.R. § 42.8(a)(3), (b)(2).

Overall Outcome			12–14, 16	1–11, 15
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V. ORDER

It is

ORDERED that Petitioner has not proved by a preponderance of the evidence that claims 1–11 and 15 of the '614 patent are unpatentable;

FURTHER ORDERED that Petitioner has proved by a preponderance of the evidence that claims 12–14 and 16 of the '614 patent are unpatentable; and

FURTHER ORDERED that, because this is a Final Written Decision, any party to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

IPR2023-00326
Patent 11,389,614 B2

FOR PETITIONER:

Robert Masters
Timothy Cremen
Eric Gill
Roy Jung
SHEPPARD, MULLIN, RICHTER & HAMPTON LLP
rmasters@sheppardmullin.com
tcremen@sheppardmullin.com
egill@sheppardmullin.com
rjung@sheppardmullin.com

FOR PATENT OWNER:

Timothy Murphy
David Atallah
Jessica Fleetham
CARLSON, GASKEY & OLDS, P.C.
tmurphy@cgolaw.com
datallah@cgolaw.com
jfleetham@cgolaw.com