

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

GCE GAS CONTROL EQUIPMENT INC.,

Petitioner,

v.

VBOX, Inc.,

Patent Owner.

Case No. IPR2023-00326

U.S. Patent No. 11,389,614

**PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 11,389,614**

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EXHIBIT LIST

Exhibit No.	Description
1001	U.S. Patent No. 11,389,614 ('614 patent)
1002	File History of U.S. Patent No. 11,389,614 (U.S. Application No. 15/931,716) (<i>'614 patent FH</i>)
1003	Declaration of Kent S. Knaebel, Ph.D. (Knaebel Declaration)
1004	U.S. Patent Application Publication No. 2005/0072306 to Deane, Taylor, Bare, Sargent, and Scherer (<i>Deane</i>)
1005	U.S. Patent No. 6,520,176 to Dubois, Bodelin and Vigor (<i>Dubois</i>)
1006	PCT International Patent Application Publication No. WO 2005/009590 to Berntson (<i>Berntson</i>)
1007	U.S. Patent Application Publication No. 2005/0028868 to Basset, Jean and Schmutz (<i>Basset</i>)
1008	U.S. Patent No. 6,311,719 to Hill, Hill and Hansen (<i>Hill '719</i>)
1009	U.S. Patent Application Publication No. 2003/0167924 to McCombs, Casey, Chimiak and Klimaszewski (<i>McCombs '924</i>)
1010	U.S. Patent Application Publication No. 2006/0117957 to McCombs, Bosinski, Casey and Valvo (<i>McCombs '957</i>)
1011	U.S. Provisional Application No. 60/617,834 to McCombs and Bosinski (<i>McCombs '835 Prov</i>)
1012	U.S. Patent Application Publication No. 2002/0033095 to Warren (<i>Warren '095</i>)
1013	U.S. Patent No. 6,651,658 to Hill, Radtke, Schneider and Bixby (<i>Hill '658</i>)
1014	U.S. Patent Application Publication No. 2006/0283325 to Sugano (<i>Sugano</i>)
1015	U.S. Patent Application Publication No. 2003/0005928 to Appel, Winter, Sward, Sugano, Salter and Bixby (<i>Appel '928</i>)
1016	U.S. Patent No. 4,802,899 to Vrana and Bansal (<i>Vrana</i>)

Exhibit No.	Description
1017	U.S. Patent No. 4,404,005 to Hamlin and Taylor (<i>Hamlin</i>)
1018	U.S. Patent No. 4,065,272 to Armond (<i>Armond</i>)
1019	U.S. Patent No. 7,144,446 to Lessi (<i>Lessi</i>)
1020	U.S. Patent No. 5,578,115 to Cole (<i>Cole</i>)
1021	U.S. Patent No. 4,584,001 to Dechene (<i>Dechene</i>)
1022	U.S. Patent No. 4,094,755 to Mueller (<i>Mueller</i>)
1023	U.S. Patent No. 4,530,706 to Jones (<i>Jones</i>)
1024	U.S. Patent No. 6,149,138 to Birdsell (<i>Birdsell</i>)
1025	U.S. Patent Application Publication No. 2006/0000223 to Dickerson (<i>Dickerson</i>)
1026	U.S. Patent No. 5,275,642 to Bassine (<i>Bassine</i>)
1027	U.S. Patent No. 4,916,630 to Miller (<i>Miller '630</i>)
1028	U.S. Patent Application Publication No. 2006/0137522 to Nishimura, Makari, Motoki and Kobayashi (<i>Nishimura</i>)
1029	U.S. Patent No. 6,471,744 to Hill (<i>Hill '744</i>)
1030	U.S. Patent No. 6,344,069 to Smolarek, Sinicropi and Schaub (<i>Smolarek '069</i>)
1031	U.S. Patent No. 5,429,666 to Agrawal, Kumar, Naheiri and Watson (<i>Agrawal '666</i>)
1032	U.S. Patent No. 5,906,672 to Michaels, Birangi and Polaseck (<i>Michaels '672</i>)
1033	U.S. Patent No. 6,547,851 to Warren (<i>Warren '851</i>)
1034	U.S. Patent Application Publication No. 2002/0144596 to Dee, Chiang, Miller and Whitley (<i>Dee '596</i>)
1035	U.S. Patent No. 5,114,440 to Reiss (<i>Reiss '440</i>)
1036	U.S. Patent No. 4,449,990 to Tedford (<i>Tedford '990</i>)
1037	U.S. Patent No. 6,544,318 to Dee, Chiang, Miller and Whitley (<i>Dee '318</i>)

Exhibit No.	Description
1038	U.S. Patent No. 7,135,059 to Deane, Taylor, Bare, Sargent and Scherer (<i>Deane '059</i>)
1039	U.S. Patent No. 7,438,745 to Deane, Taylor and Li (<i>Deane '745</i>)
1040	U.S. Patent No. 7,250,073 to Keefer, McLean and Babicki (<i>Keefer '073</i>)
1041	U.S. Patent No. 6,585,804 to Kleinberg, Pillarella and Guro (<i>Kleinberg '804</i>)
1042	U.S. Patent No. 6,143,056 to Smolarek and Kun (<i>Smolarek '056</i>)
1043	U.S. Patent No. 5,827,358 to Kulish and Swank (<i>Kulish</i>)
1044	U.S. Patent No. 6,802,889 to Graham, Occhialini and Puri (<i>Graham</i>)
1045	U.S. Patent No. 6,691,702 to Appel, Winter, Sward, Sugano, Salter and Bixby (<i>Appel '702</i>)
1046	U.S. Patent No. 4,687,573 to Miller and Verrando (<i>Miller '573</i>)
1047	U.S. Patent Application Publication No. 2005/0072426 to Deane, Taylor, Bare, March, Merchant and Smith (<i>Deane '426</i>)
1048	U.S. Patent Application Publication No. 2005/0045041 to Hechinger and Zarate (<i>Hechinger</i>)
1049	File History of U.S. Patent No. 7,954,490 (U.S. Application No. 11/054,341) (<i>'490 patent FH</i>)
1050	File History of U.S. Application No. 13/096,362 (<i>'362 application FH</i>)
1051	File History of U.S. Application No. 13/795,977 (<i>'977 application FH</i>)
1052	File History of U.S. Patent No. 10,702,669 (<i>'669 patent FH</i>)
1053	File History of U.S. Patent No. 10,357,628 (<i>'628 patent FH</i>)
1054	U.S. Patent No. 10,357,628 (<i>'628 patent</i>)
1055	U.S. Patent No. 7,954,490 (<i>'490 patent</i>)

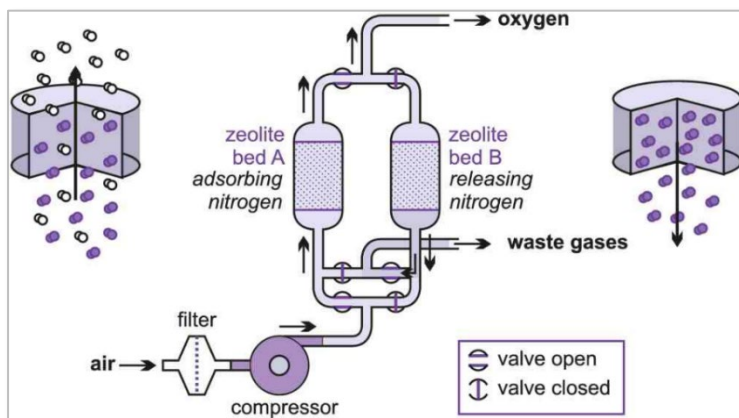
Exhibit No.	Description
1056	U.S. Patent No. 10,702,669 ('669 <i>patent</i>)
1057	Atmosphere National Geographic Society, https://education.nationalgeographic.org/resource/atmosphere Retrieved December 2, 2022 (<i>National Geographic</i>)
1058	U.S. Patent No. 4,859,217 to Chao (<i>Chao</i>)
1059	The American Heritage Dictionary of the English Language, Fourth Edition, Houghton Mifflin Company, 2000, selected pages (<i>American Heritage</i>)
1060	New Oxford American Dictionary, Oxford University Press, 2001, selected pages (<i>New Oxford</i>)
1061	<i>Bloomsbury English Dictionary, Second Edition, Bloomsbury Publishing, 2004, selected pages (Bloomsbury)</i>
1062	<i>Webster's Third New International Dictionary, Merriam-Webster Inc., 2002, selected pages (Webster)</i>
1063	<i>Plaintiff/Counter-Defendant GCE Gas Control Equipment Inc.'s Stipulation of Invalidity Contentions</i> , filed in <i>GCE Gas Control Equip., Inc. v. 3B Medical Mfg., LLC</i> , No. 22-cv-02550 (D. Md.) (Dkt. 28) (<i>D. Ct. Sotera Stipulation</i>)
1064	United States Courts, <i>U.S. D. Ct.—Judicial Caseload Profile: Maryland</i> (reporting period ending June 30, 2022), https://www.uscourts.gov/sites/default/files/fcms_na_distprofil e0630.2022_0.pdf (<i>Judicial Caseload Profile for D. Md.</i>)
1065	<i>Order</i> , filed in <i>In re CTP Innovations, LLC, Patent Litigation</i> , No. 14-cv-2581 (D. Md.) (Dkt. 38)
1066	<i>Order</i> , filed in <i>Paice LLC v. BMW AG</i> , No. 19-cv-03348 (D. Md.) (Dkt. 98)
1067	U.S. Patent Provisional Application No. 60/489,674 to Berntson (<i>Berntson Provisional</i>)
1068	Ruthven et al., <i>Pressure Swing Adsorption</i> (1994)

I. INTRODUCTION

The Challenged Claims of the '614 patent recite features long-known before the '614 patent. They are obvious over *Deane* (and the other Ground references). Indeed, very similar claims in the '614 patent's parent were considered unpatentable in view of *Deane* '426 (having the same relevant teachings as *Deane*) by a different examiner.

II. BACKGROUND

The '614 patent relates to portable oxygen concentrators ("POCs"), which provide supplemental oxygen to elderly or otherwise physically compromised patients. EX1003, ¶¶4-5. The general configuration of POCs using "pressure swing adsorption" ("PSA")¹ is shown here. *Id.*, ¶10. Air (~78% nitrogen, 21% oxygen, 1% argon) is compressed and fed (as "feed gas") alternately into

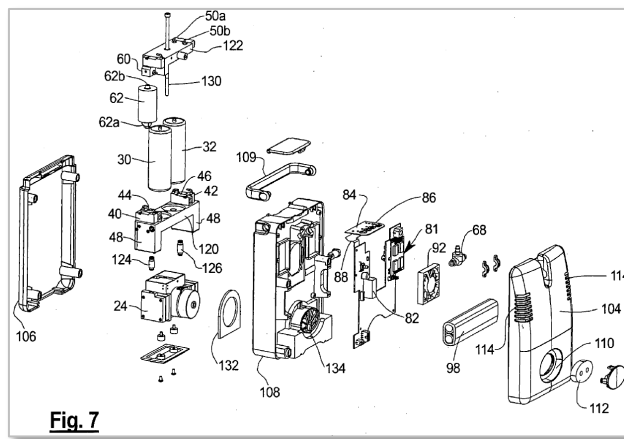


at least two chambers containing adsorbent material (material that holds gas molecules on its surface, *e.g.*, zeolite) that adsorbs nitrogen, leaving concentrated oxygen product gas (~85-95% oxygen) for the patient. *Id.*, ¶¶7, 10. The two beds

¹ A similar well-known process used in POCs is "vacuum swing adsorption" ("VSA"). EX1003, ¶¶7, 12.

A, B provide continuous oxygen flow to the patient. *Id.*, ¶11. When one bed reaches its adsorption capacity limit, air is fed to the second bed while adsorbed nitrogen is removed from the first. *Id.*

POCs of various constructions were well-known before the '614 patent. EX1003, ¶¶4-64. For example, by 2004-2005,² a person of ordinary skill in the art (“POSITA”) would have understood a POC to include housings with compressors, manifolds, valves, batteries, and zeolite adsorbent/adsorber beds with inlets and outlets. *Id.*, ¶¶13-24. *See, e.g.*, EX1009, EX1010, EX1012, EX1013, *passim*. The desire to make POCs highly-portable was also well-known, including by making them battery-powered, light, and small-sized to be patient-carried (including by harness, belt, backpack, or wheeled carrier). EX1003, ¶¶56-64. *See, e.g.*, EX1009, ¶¶[0005], [0025], [0029], FIGS. 1-10; EX1010, ¶¶[0007], [0025], [0036], [0044], FIGS. 1, 7 (reproduced here); EX1012, Abstract, ¶¶[0002], [0025], [0072], FIG. 10; EX1013, 1:7-10, 14:9-37, 8:19-34, 9:66.



² “2004-2005” represents the timeframe before the earliest filing date possibly attributable to the Challenged Claims.

Regarding the adsorber beds, it was well-known to use various types of zeolite, including LiLSX, and internal filters and springs to contain the zeolite.

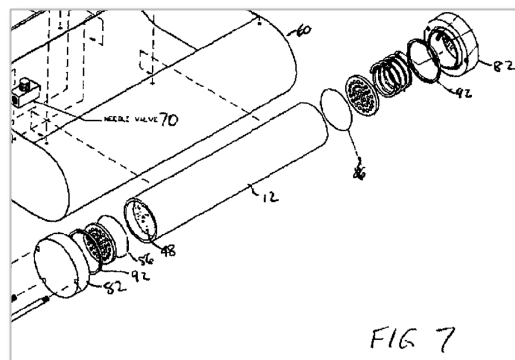
EX1003, ¶¶25-29. *See, e.g.*, EX1009,

¶¶[0019], [0021], [0032]; EX1010,

¶¶[0021]-[0023], [0037]; EX1012, ¶[0061],

[0073], FIG. 7 (reproduced here); EX1013,

7:15-67; EX1014, ¶¶[0057], [0082];



EX1015, ¶¶[0063], [0074], [0105]-[0106]; EX1018, 2:36-39, 4:54-5:2; EX1019,

1:55-57, 2:61-3:5; EX1026, 2:26-28, 3:48-52, 6:17-36, FIG. 6. It was also well-

known that zeolite has a limited useful life, and that zeolite (and beds) needs to be periodically replaced. EX1003, ¶¶30-31. *See, e.g.*, EX1028, ¶[0012]; EX1027,

5:19-34. POSITAs were also well-aware sieve beds (and other

materials/components) could be provided in removable cartridges for serviceability

and/or manufacturability. EX1003, ¶¶49-55. *See, e.g.*, EX1010, ¶[0028]; EX1021,

Abstract, 1:8-34, 2:21-43, 4:12-31 (*see* housing A), FIGS. 1-3; EX1020, Abstract,

3:44-4:22, 4:15-29, FIGS. 2, 3; EX1048, Abstract ¶[0015]; EX1022, 1:27-30,

5:19-6:4; EX1023, 1:11-18, 2:20-26; EX1025, ¶¶[0001]-[0003], [0022], [0053]-

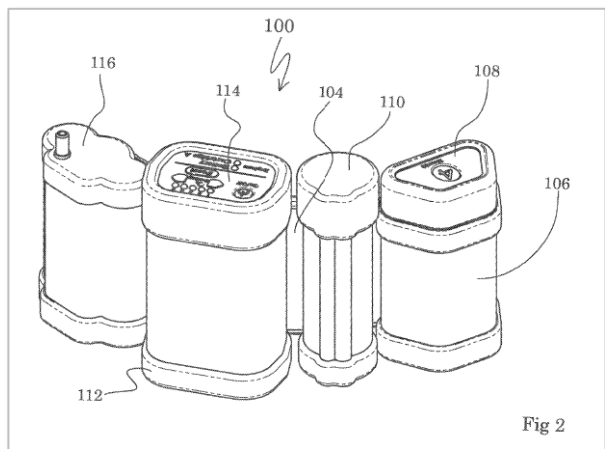
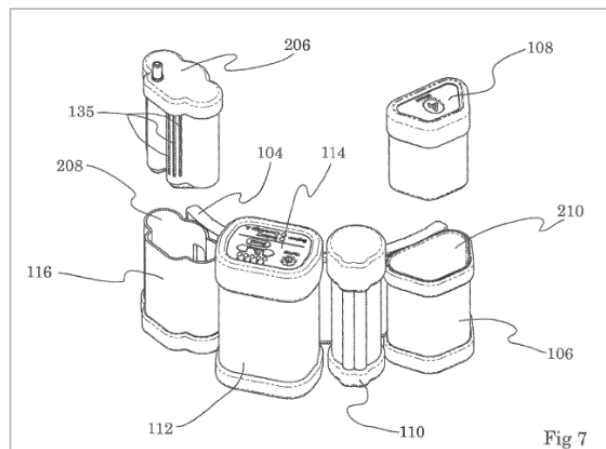
[0062], [0064].

Regarding the manifold and bed inlet/outlet configurations, many different configurations were well-known before the '614 patent, including valves and/or

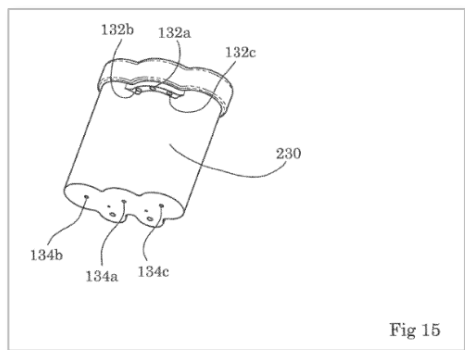
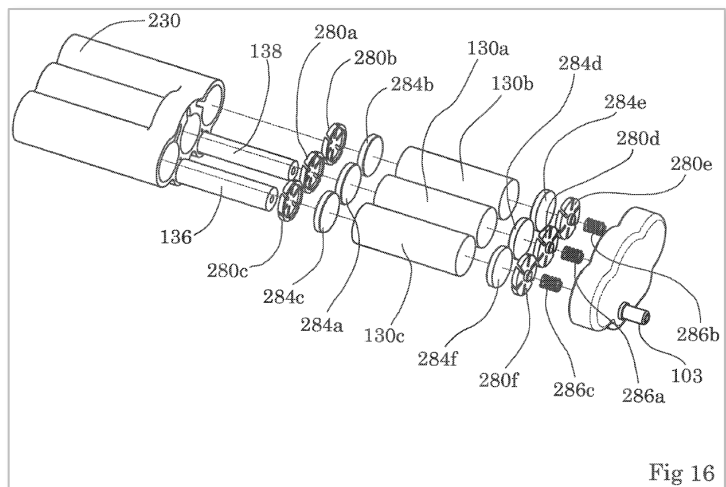
Figure 3A is a cross-sectional view of a medical device, likely a catheter or probe. The device features a main body (300) with a distal tip (380) and a proximal handle (320). A fluid reservoir (350) is located near the distal tip, containing a porous material (800) and a central tube (810). A side tube (360) with a port (420) is connected to the main body. The proximal handle (320) includes a control mechanism (310) with a lever (340) and a trigger (330). A dashed line (114) indicates a specific internal feature or channel. Other labeled components include 450, 500, and 510.

A. Alleged Invention

-4-



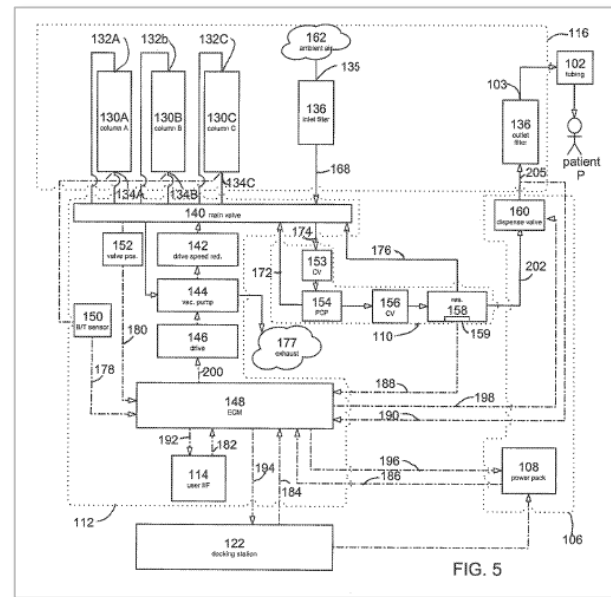
FIGS. 15/16 show separation cartridge 206 with casing 230, adsorption columns 130a-130c (with adsorbent material 282a-282c), inlet (132a-132c) and outlet (134a-134c) ports (one pair for each column 130a-c), filters 284a-284f (preventing adsorbent migration), and springs 286a-286c (holding adsorbent columns 130a-130c in place). EX1001, 18:30-19:14. EX1003, ¶¶73-75.



Importantly to the issues herein, the inlet and outlet ports face the same direction (down in FIG. 15; left in FIG. 16), and respective inlet/outlet pairs for

each column 130 are spaced both axially (*e.g.*, offset) and laterally apart (*e.g.*, at opposite ends) from one another. EX1003, ¶75.

FIG. 5 schematically shows adsorbent columns 130a–130c with “respective inlet ports 132a–132c and outlet ports 134a–134c, air inlet filter 136, and product gas final filter 138.” EX1001, 4:60-63. In use, “[a]mbient air enters air inlet port 135, passes through air inlet filter 136, and enters valve 140 for distribution to adsorbent columns 130a–130c.” *Id.*, 4:63-66. The



adsorbent columns adsorb/retain nitrogen, allowing product gas to pass. *Id.*, 6:47-54. Oxygen then passes through filter 138 and outlet port 103 for delivery to patient P. *Id.*, 4:66-5:1.

B. Prosecution History

The '614 patent is in the following family:

Appl. #	Filing Date	Patent #	Notes
11/054,341	2/9/2005	7,954,490	EX1049 (“’490 patent FH”); EX1055 (“’490 patent”)
13/069,362	4/28/2011	n/a	EX1050 (“’362 application”)

Appl. #	Filing Date	Patent #	Notes
13/795,977	3/12/2013	n/a	EX1051 (“’977 application”)
14/193,504	2/28/2014	10,702,669	EX1052 (“’669 patent FH”); EX1056 (“’669 patent”)
16/006,915	6/13/2018	10,357,628	EX1053 (“’628 patent FH”); EX1054 (“’628 patent”); <i>see</i> IPR2023-00327
15/931,716	5/14/2020	11,389,614	EX1002 (“’614 patent FH”), EX1001 (“’614 patent”)

1. ’490 Patent, ’362 Application, ’977 Application

The first three members of the ’614 patent’s family were directed to overall POC function/structure, not to separation cartridges. EX1003, ¶¶80, 109, 125.

2. ’669 Patent

Nine years after filing the initial application, applicant changed course and filed the application of the ’669 patent, with claims directed to separation cartridge features.³ EX1003, ¶134.

Examiner Vasat handled the ’669 patent prosecution, rather than Examiners Jones (’977 application) or Patel (’490 patent, ’362 application). On January 20, 2020, after an initial round of prosecution, applicant advanced new independent application claims 24/38 requiring a cartridge including multiple adsorbent beds

³ Applicant also added language to the specification (EX1001, 2:54-58) that is not in the ’490 patent (EX1049, 341), ’362 application (EX1050, 465), or ’977 application (EX1051, 477).

(*e.g.*, first and second), each with a port (*e.g.*, first and third) on its axis and another port (*e.g.*, second and fourth) spaced apart from its axis, both facing the same direction. EX1052, 149-53. These claims read on the '669 (and '614) patent's FIG. 15/16 embodiment (EX1003, ¶148) and, as discussed below, are very similar to the Challenged Claims.

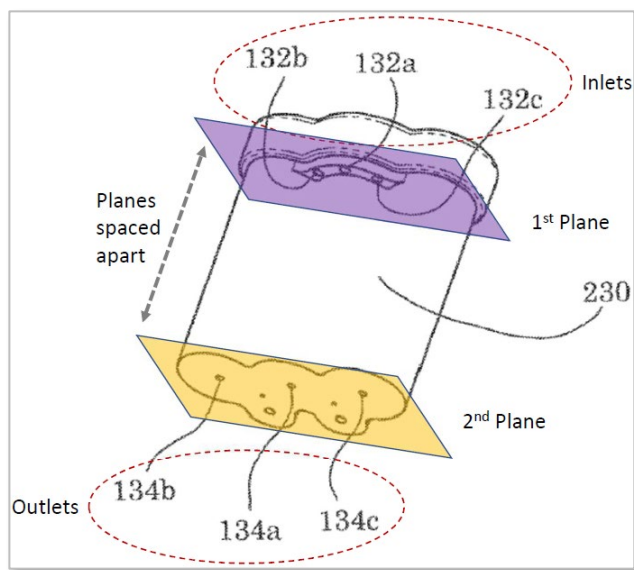
But Examiner Vasat found the January 20, 2020 application claims 24/38 unpatentable over *Deane* '426 (EX1047), which has the same relevant disclosure as *Deane* (EX1004). EX1003, ¶151. To differentiate from *Deane* '426, he required application claim 30's language (reciting a plane including the first/third ports and a plane including the second/fourth ports are spaced apart) be added into claims 24/38. EX1052, 19. EX1003, ¶¶149-151. This is depicted in annotated FIG. 15 of the '669/'614 patent reproduced below with a first (purple) plane spaced apart from a second (orange) plane. EX1003, ¶150.

Applicant agreed, and a notice of allowance issued with an examiner's amendment incorporating the claim 30 language into claims 24/38 (issued claims 1/13). EX1052, 9-17. The notice of allowance indicates:

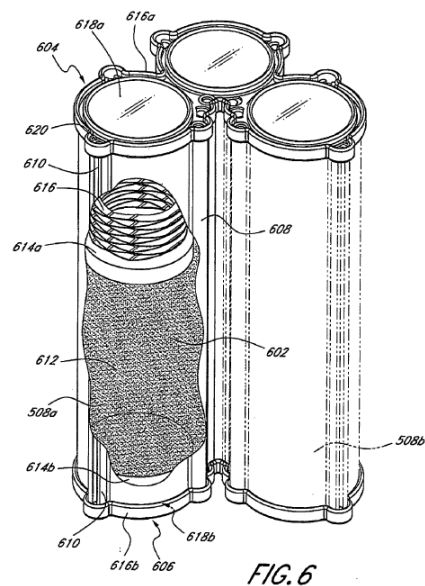
The closest prior art to new claims 24-42 is considered to be prior art to *Deane* (US 20050072426). *Deane* is considered to disclose an oxygen concentrator cartridge, best shown in Figure 6, having a first port corresponding to the filter portion 618a (par. 67) disposed along the first axis defined by the bed of adsorbent material 612 (par. 66) and a second port the upper port of feed tube 608 (par. 68) that lies in the same plane as filter portion 618a and spaced apart from the first port

(fig. 6). The amendment defines over Deane because Deane requires the aforementioned first and second ports to be located in a single plane with the manifold to reduce the number of tubing connections and potential leak points in the unit (par. 64).

EX1052, 16.



'669/'614 patent



Deane '426

Thus, Examiner Vasat considered *Deane* '426 to teach application claims 24/38, but found application claim 30's recited arrangement of ports in/at *different* planes/ends (e.g., purple/orange planes above) was different from *Deane* '426's arrangement (e.g., first port at 618a and second port at the top of 608 in/at the same plane/end). EX1003, ¶¶151, 154.

3. '614 Patent

The '614 patent is a continuation of the '669 patent. EX1001, Cover.

Examiner Jones, not Vasat, handled the '614 patent. EX1003, ¶179. As discussed

below, the features of issued claims 1, 12, and 13 (application claims 21, 32, and 33) of the '614 patent are very similar to the January 20, 2020 application claims 24/38 of the '669 patent found unpatentable over *Deane* '426, and any differences therebetween are clearly obvious in view of *Deane* '426 (or *Deane*). EX1003, ¶¶182-183. But the only office action in the '614 patent's prosecution didn't include a prior art rejection based on *Deane* '426; it rejected claims 21-36 only on non-statutory double patenting grounds. EX1002, 22. Examiner Jones offered no reasons for allowance. EX1002, 7-18.

C. The Examiner Should Have Rejected the '614 Patent's Claims in View of *Deane* '426 During Prosecution

Examiner Jones should not have allowed the '614 patent's Challenged Claims, both for the reasons herein and because they are very similar to the '669 patent's January 20, 2020 application claims 24/38 found unpatentable over *Deane* '426. EX1003, ¶¶191, 194. For example, the following compares the '669 patent's January 20, 2020 claim 38 with the '614 patent's issued claim 1. Similar claim elements are in the same color.

<u>'614 patent</u>	<u>'669 patent</u>
[1a] 1. A portable oxygen concentrator, comprising:	38. A portable oxygen concentrator, comprising:
[1b] a separation cartridge selectively removable from a receptacle by movement relative to the receptacle in a first direction,	a receptacle; a cartridge selectively removable from the receptacle by movement relative to the receptacle in a first direction, the cartridge comprising:
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;	a first bed of adsorbent material disposed along a first axis, wherein the first axis is substantially parallel to the first direction;
[1c] wherein a first line extending parallel to the first and second directions passes through the outlet,	a second bed of adsorbent material disposed along a second axis spaced-apart from the first axis, wherein the second axis is substantially parallel to the first direction;
[1d] wherein a second line spaced-apart from the first line and extending parallel to the first line passes through the inlet, and	a first port disposed along the first axis, the first port configured to receive fluid flowing to the first bed or to expel fluid flowing away from the first bed;
[1e] 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.	a second port spaced-apart from the first axis and configured to receive fluid flowing to the first bed or to expel fluid flowing away from the first bed; a third port disposed along the second axis and configured to receive fluid flowing to the second bed or to expel fluid flowing away from the second bed; and a fourth port spaced-apart from the second axis and configured to receive

	<p>fluid flowing to the second bed or to expel fluid flowing away from the second bed;</p> <p>wherein the first, second, third, and fourth ports are oriented in a second direction opposite the first direction.</p>
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Thus:

- Both claims recite a **POC** with a **cartridge selectively removable** from a **receptacle** in **a first direction**;
- Both recite that the **cartridge** includes inlets and outlets facing a second direction opposite the first;
- Both recite that the cartridge includes **adsorbent**;
- Both recite **inlet ports** disposed on **first axes of the cartridge**;
- Both recite **outlet ports** disposed on **lines spaced apart** from **the first axes**; and
- Both recite **fluid flowing through ports**.

EX1003, ¶192.

The only apparent differences between these claims are: (i) the '669 patent's claim 38 requires two adsorbent beds, while the '614 patent's claim 1 was drafted in an attempt to cover cartridges with at least one adsorbent bed (not shown in the '614 patent); and (ii) the '614 patent's claim 1 specifies which fluid flows contact adsorbent material. EX1003, ¶193. The former is not a patentable difference, and the latter is clearly taught by *Deane '426/Deane*. See FIGS. 7A of each and [1c]-[1e]; EX1003, ¶193. The features Examiner Vasat required be added to the '669

patent's claims to differentiate from *Deane* '426 are not in the '614 patent's claims. EX1003, ¶188. Examiner Jones should have rejected the '614 patent's claims in view of *Deane* '426/*Deane. Id.*, ¶194. In other words, had Examiner Jones properly considered *Deane* '426/*Deane*⁴, along with the remainder of the prior art cited herein (or other similar art), the claims of the '614 patent would not have issued. *Id.* Thus, Examiner Jones erred by allowing the '614 patent's claims. *Id.*

IV. IDENTIFICATION OF CHALLENGE

A. Statutory Grounds

Petitioner requests IPR and cancellation of claims 1-16 ("the Challenged Claims") as follows:

Grounds	Claims	Statutory Basis	Prior Art
1	1-5, 7-16	§103	<i>Deane</i> in view of <i>Dubois</i> and <i>Berntson</i>
2	2, 3, 15	§103	<i>Deane</i> in view of <i>Dubois</i> , <i>Berntson</i> , and <i>Hill</i> '719
3	6	§103	<i>Deane</i> in view of <i>Dubois</i> , <i>Berntson</i> , and <i>Basset</i>
4	1-5, 7-16	§103	<i>Deane</i>

⁴ While applicant filed an IDS identifying *Deane* and *Deane* '426 among ~350 other prior art references (EX1002, 104-518), there is no evidence Examiner Jones properly considered *Deane/Deane* '426 *vis-à-vis* the '614 patent, as he didn't issue prior art rejections or provide reasons for allowance. EX1003, ¶194.

5	2, 3, 15	§103	<i>Deane in view of Hill '719</i>
6	6	§103	<i>Deane in view of Basset</i>

The Grounds render the Challenged Claims obvious because any differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious to a POSITA at the time the invention was made. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007).

B. Relied-Upon Prior Art⁵

1. *Deane* (EX1004)

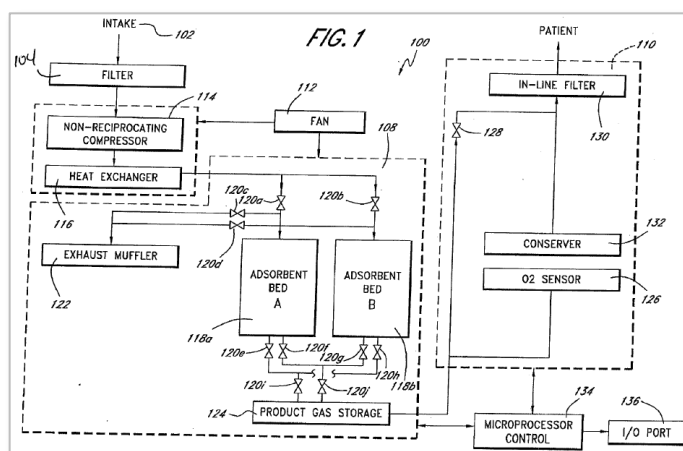
Deane (filed October 7, 2003; published April 7, 2005), is prior art under 35 U.S.C.

§102(e)(1). *Deane* teaches⁶ a POC with PSA unit 108 having two adsorbent beds 118a/118b

and a plurality of valves 120a-j for directing gas in and out of beds 118a, 118b.

EX1004, ¶¶[0002], [0032], [0036]. EX1003, ¶201.

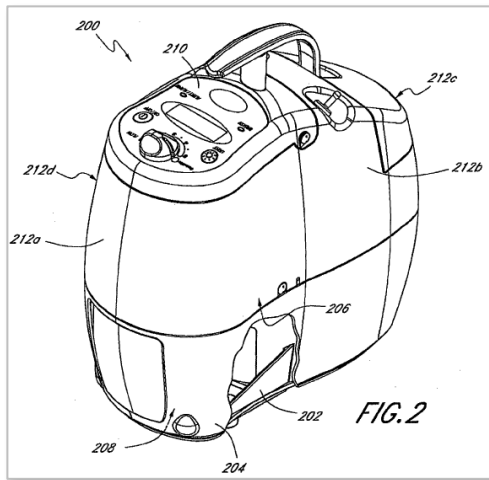
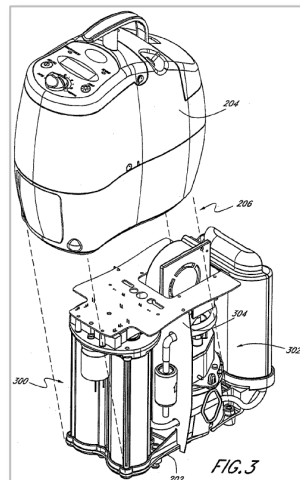
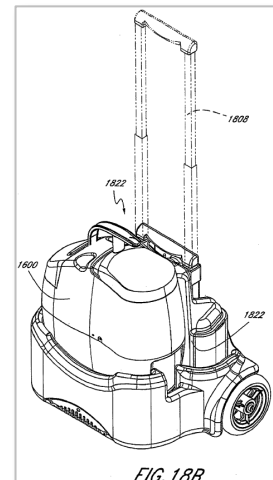
Deane's FIGS. 2/3 show POC 200 includes chassis 202 and shell 204 forming a housing 206 where components are mounted. EX1004, ¶[0057].



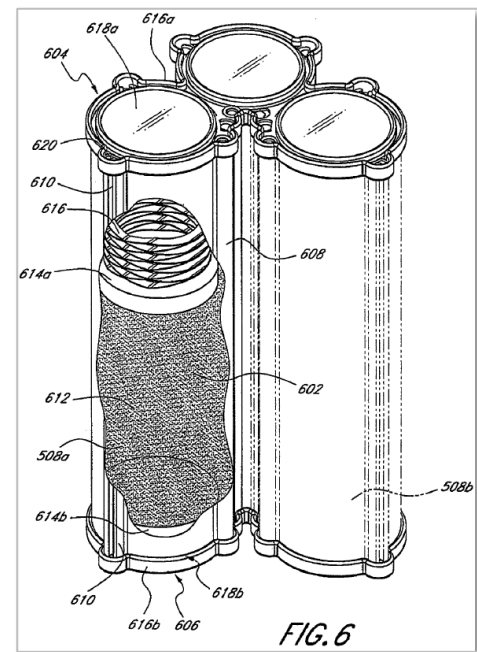
⁵ Pre-AIA 35 U.S.C. §102 applies. MPEP §2159.02.

⁶ “Teaches” is used herein to mean “teaches or suggests.”

EX1003, ¶202. Shell 204 is removable for testing, repair, or maintenance. EX1004, ¶[0058]. EX1003, ¶203. *Deane*'s FIG. 18B shows POC 200 in "mobility cart" 1800. EX1004, ¶¶[0099]-[0101]. EX1003, ¶206.



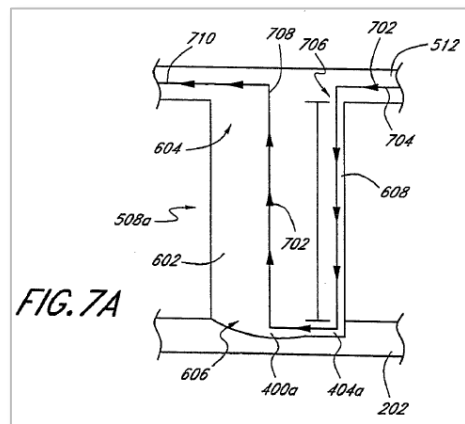
Deane's FIG. 6 shows adsorbent bed columns 508a, 508b with a "single-ended column design" where column 508a includes adsorbent housing 602 with upper and lower ends 604, 606, each defining an opening through which gas can flow in/out of housing 602, and integrated feed tube 608 extending from upper end 604 to lower end 606, allowing gas to be routed to lower end 606. EX1004, ¶[0066]. Housing 602 includes adsorbent material 612 (zeolite), restraining disks 610, 616, 618a, 618b, 614a, 614b, and 610.



614a, 614b (filters), and spring 616 to keep restraining disk 614a in position.

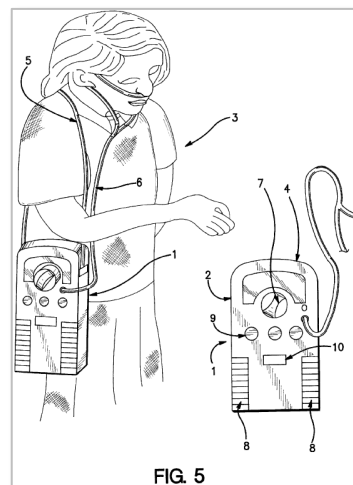
EX1004, ¶[0068]. EX1003, ¶204.

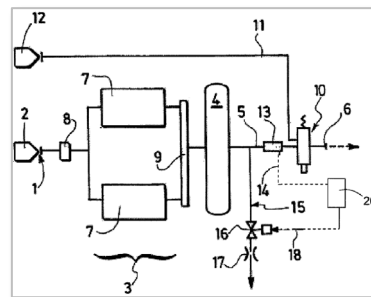
FIG. 7A illustrates gas flow in adsorbent bed columns 508a, 508b. Feed gas 702 is directed into upper opening 706 of feed tube 608, travels downwardly through tube 608 and through recess 400a into lower end 606 of housing 602, then travels upwardly through the adsorbent material in housing 602, which removes nitrogen, and finally flows out of upper end 604 of housing 602. FIG. 7B (not shown here) illustrates purge gas flow. EX1004, ¶[0070]. EX1003, ¶205.



2. *Dubois* (EX1005)

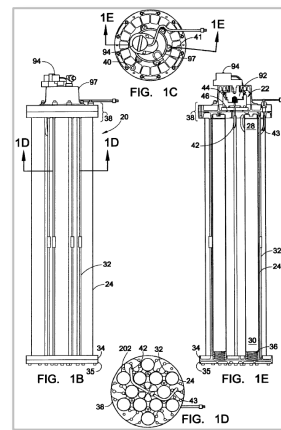
Dubois (filed June 30, 2000; issued February 18, 2003), is prior art under 35 U.S.C. §102(b). *Dubois* teaches portable concentrator 1 with a housing “of a size and weight permitting the patient 3 to carry it while walking,” such as by handle 4 or shoulder strap 5. EX1005, 6:16-25, FIG. 5. EX1003, ¶211.





5. Hill '719 (EX1008)

Hill '719 (filed August 10, 1999; issued November 6, 2001), is prior art under 35 U.S.C. §102(b). *Hill '719* teaches an inlet/outlet structure similar to *Deane*, with adsorption vessels 24 having beds of adsorbent material, manifold 38 where “springs 36 are disposed near the bottoms of the adsorption vessels,” at feed end 30, “to hold the packed beds of adsorbent material firmly in place.” EX1008, 1:5-7, 4:60-5:11, 6:6-18, FIG. 1E. EX1003, ¶¶223-224.

**C. Grounds for Standing**

Petitioner certifies the '614 patent is available for IPR, this Petition is timely filed, and Petitioner is not barred or estopped from requesting IPR on the Grounds presented.

D. Discretionary Analysis for Review

The *General Plastic* and *Fintiv* factors favor institution. This is the first Petition filed against the '614 patent, and its merits are compelling, which “alone demonstrates that the PTAB should not discretionarily deny institution under *Fintiv*.” See USPTO, *Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation* at 3-5 (June 21, 2022) (“Director’s Memo”). Grounds 1-3 present compelling obviousness theories that,

“if unrebutted in trial, would plainly lead to a conclusion that one or more claims are unpatentable by a preponderance of the evidence.” *Id.*, 4. To eliminate potential issue overlap, Petitioner filed a *Sotera*-type stipulation in the district court action. *See id.*. 9; EX1063.

The full *Fintiv* framework also favors institution. The related district court case was filed October 5, 2022 and the average time-to-trial is 43.3 months in the District of Maryland (EX1064), which has granted stays where, as here, an IPR may resolve invalidity (EX1065; EX1066). Petitioner has filed a *Sotera*-type stipulation, and the Petition is compelling. Thus, *Fintiv* factors one (stay likelihood), two (trial date), three (proceeding investment), four (issue overlap) and six (other circumstances) favor institution. For factor five, while Petitioner and PO are the same parties as in district court, this is not unusual in IPR.

Denial of institution under §325(d) would be inappropriate. The Grounds and arguments herein, based on *Deane* combined with *Dubois* and *Berntson* (and *Basset* and *Hill* '719) weren't previously considered by the USPTO. While *Deane*, *Dubois*, and *Hill* '719 were submitted (among ~350 other references) via IDS during prosecution of the '614 patent (EX1002, 104-518), the Examiner didn't apply *Deane*, *Dubois*, or *Hill* '719 in any rejection or otherwise mention them during prosecution. EX1003, ¶¶208, 212, 225. *Berntson* and *Basset* were not of

record. *Id.*, ¶¶216, 220. Indeed, there was no prior art rejection by the Examiner at all. Thus, *Becton* factors (b)-(d) favor of institution.

Moreover, as shown in §§III.C and VII, the Examiner clearly erred by not rejecting the Challenged Claims in view of *Deane '426/Deane*, alone or in combination with the other Ground references. EX1003, ¶194. The Petition presents extensive additional evidence and facts not before the USPTO, including the Knaebel Declaration (EX1003) and supporting references, which demonstrate the Challenged Claims' unpatentability. The Knaebel Declaration explains in detail how the Grounds render the Challenged Claims obvious and sets forth previously-unconsidered obviousness theories, along with additional details about the state of the art and POSITA knowledge. Thus, *Becton* factors (e)-(f) weigh in favor of institution.

Regarding *Becton* factor (a), the PTAB consistently grants institution for petitions presenting obviousness theories not considered during prosecution, even when the prior art overlaps with references cited during examination. *See, e.g., Asetek Danmark A/S v. Coolit Systems, Inc.*, IPR2019-00705, Paper 19 at 7-13 (PTAB Sept. 6, 2019); *Apple Inc. v. MPH Technologies OY*, IPR2019-00820, Paper 10 at 7-18 (PTAB Oct. 7, 2019); *Microsoft Corp. v. IPA Technologies, Inc.*, IPR2019-00814, Paper 12 at 15-22 (PTAB Nov. 6, 2019).

V. LEVEL OF ORDINARY SKILL

A POSITA of the '614 patent would have had at least a bachelor's degree, or the equivalent degree, in mechanical engineering, chemical engineering, or a related field, and 2-3 years of experience in the research, design, or development of portable oxygen concentrators and related hardware, software, and firmware, or equivalent experience. A person with less education but more relevant practical experience, or more education and less experience, may also meet this standard. EX1003, ¶¶226-229.

VI. CLAIM CONSTRUCTION

Petitioner interprets the Challenged Claims according to the *Phillips* standard. 37 C.F.R. §42.100(B); 83 Fed. Reg. 51340, 51340-44 (Oct. 11, 2018); *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312 (Fed. Cir. 2005). Applying *Phillips* here, all terms have their plain and ordinary meaning. Petitioner does not waive any litigation argument as to scope, meaning, or invalidity.

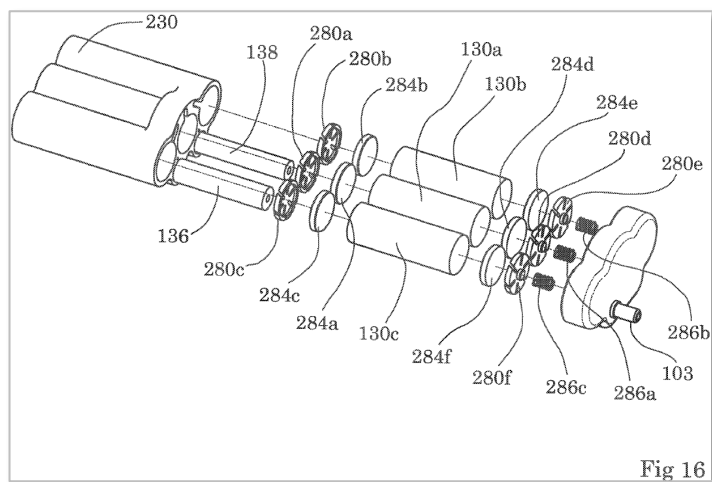
A. “Separation Cartridge”

This term is found throughout the Challenged Claims. It has no specific meaning in the art. EX1003, ¶235. Outside the '614 patent's context, a POSITA would have generally understood “separation cartridge” to be some type of case, housing, or container insertable into a POC with ports and a medium that separates one or more constituents from a fluid flowing through it. *Id.* The claims comport

with this understanding, requiring the “separation cartridge” be “selectively removable from a receptacle,” have an “inlet” and “outlet,” and provide particular fluid flow patterns. *Id.*, ¶236.

While the specification provides no explicit definition for “separation cartridge” (EX1003, ¶237), each and every embodiment describes the separation cartridge as a case with multiple adsorbent columns, each having a dedicated inlet and outlet.

EX1001, 4:7-42, 4:60-5:4, 12:6-14, 18:30-40, 18:57-19:3, FIGS. 5, 7, 15, 16 (reproduced here).



EX1003, ¶¶239-243. In the context of the '614 patent, this makes sense because easy cartridge removability (with all components) is important. *See, e.g.*, EX1001, 11:67-12 (“[a]dsorbent cartridge 206 and power pack 108 are easily removable to facilitate replacement”). EX1003, ¶243. It also allows the use of single inlet/outlet filters (136/138) for the adsorbent columns. EX1003, ¶¶243-244.

The '614 patent's prosecution history does not address the meaning of “separation cartridge,” as the claims were allowed without amendment. EX1003, ¶248. However, during prosecution of other members of the '614 patent's family, the Examiners repeatedly interpreted “cartridge” and/or “separation cartridge” as

reading on modules with more than one adsorbent bed (EX1050, 58-59; EX1051, 27-28; EX1052, 16, 560-61) and applicant didn't disagree (EX1050, 50; EX1051, 15-20, EX1052, 541-547). EX1003, ¶254. By contrast, when an Examiner compared a "separation cartridge" to a single-bed module (EX1052, 297-98), applicant argued the Examiner had not identified a separation cartridge (EX1052, 255-56), which supports "separation cartridge" meaning a module with multiple adsorber beds. EX1003, ¶254.

Accordingly, a POSITA would have understood "separation cartridge" in the context of the '614 patent as "a housing that holds multiple adsorbent columns for gas separation and provides separate inlet and outlet ports for each adsorbent column." EX1003, ¶¶245-247, 257-258.

B. "Receptacle"

This term is found in Challenged Claim 1. It has no specific meaning in the art. EX1003, ¶260. Outside the '614 patent's context, a POSITA would have generally understood a "receptacle" to be a structure that receives and at least partially contains another component, such as an electrical or trash receptacle. *Id.* Claim 1 comports with this understanding, as it describes the separation cartridge as being removable from the "receptacle." *Id.*, ¶261.

The '614 patent's specification provides no explicit definition for "receptacle" and only describes "receptacles" as components from which modules

may be removed and which have connections for the module. EX1001, 17:35-38 (“Adsorbent cartridge 206 has been removed from receptacle 208”; “Cartridge 206 contains a quick-connect attachment (not illustrated)” for various lines “within receptacle 208.”). EX1003, ¶262.

The ’614 patent’s file history does not address the meaning of “receptacle.” EX1003, ¶264. However, during prosecution of the ’614 patent’s other family members, the Examiner compared prior art features to “receptacles” (*e.g.*, *Warren ’095*’s (EX1012) housing 60 and *Dechene*’s (EX1021) housing A). EX1052, 183-84, 301-02; EX1053, 135-39. Applicant didn’t disagree. EX1052, 149; EX1053, 115-22. EX1003, ¶¶265-267.

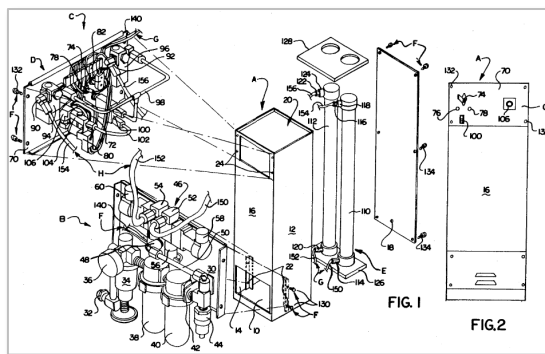
Accordingly, a POSITA would have understood “receptacle” in the context of the ’614 patent as “a structure that releasably interfaces with the inlet(s) and outlet(s) of the separation cartridge and at least partially contains the separation cartridge.” EX1003, ¶¶268-269.

C. “Selectively Removable [From A Receptable]”

This term is found in Challenged Claim 1. It has no specific meaning in the art. EX1003, ¶271. Outside the ’614 patent’s context, a POSITA would have generally understood it to describe a component capable of being chosen for removal. *Id.* Claim 1 does not provide further guidance as to the meaning of this term other than the removal being in a first direction. *Id.*, ¶272.

The '614 patent's specification does not use the phrase “selectively removable” or “selectively,” and uses “select” only twice, neither in the context of cartridges. EX1001, 16:56-60, 20:26-30. EX1003, ¶¶273-274. Regarding “removable,” the specification describes separation cartridges as “removable.” See, e.g., EX1001, 2:54-58, 3:6-8, 11:61-12:3. It also describes other “removable” features. See, e.g., EX1001, 14:48-50 (power pack), 13:25-46 (modules 106, 110, 112, or 116), and 20:9-25 (concentrator from dock).

The '614 patent's file history does not address this term. EX1003, ¶279. However, during prosecution of another '614 patent family member, the Examiner compared *Dechene's* (EX1021) columns 110 to a separation cartridge “selectively removable” from housing A. EX1053, 135-139. Applicant didn't disagree. EX1053, 115-122. EX1003, ¶¶280-281.



A POSITA would not have understood the above to provide any explanation of “removable” beyond the adsorbent cartridge 206 being disconnectable from a receptacle. As for the modifier “selectively,” based on the above, a POSITA would have understood it to specify that, for example, the adsorbent cartridge 206 may be selected for removal (*e.g.*, by a user) as a whole from the receptacle as opposed to part-by-part. EX1003, ¶283.

Accordingly, a POSITA would have understood “selectively removable [from a receptacle]” in the context of the ’614 patent means the separation cartridge is “withdrawable or separable as a whole from a receptable.” EX1003, ¶¶282, 284.

VII. CHALLENGED CLAIMS

A. Ground 1:

A POSITA would have found claims 1-5 and 7-16 obvious based on *Deane*, *Dubois*, and *Berntson*’s teachings. EX1003, ¶286.

1. Combination of *Deane*, *Dubois*, and *Berntson*

Deane teaches the features of at least claims 1-5 and 7-16. *See* §VII.A.2-16. If the Challenged Claims are understood to require more portability than that taught by *Deane* (they shouldn’t be), it would have been obvious to modify *Deane* in view of *Dubois*, which teaches a POC wearable by a patient. *See* §VII.A.2.[1a]. And if the Challenged Claims are understood to require a more distinct cartridge than that taught by *Deane* (they shouldn’t be), it would have been obvious to modify *Deane* in view of *Berntson*, which teaches a distinct cartridge (ORAG). *See* §VII.A.2.[1b].

Regarding the *Deane/Dubois* combination, *Deane* teaches its POC is compact and lightweight for ambulatory use and stresses the importance of providing patients with “greater ease of mobility.” EX1004, Abstract, ¶¶[0002],

[0005]. EX1003, ¶287. *Dubois* teaches its POC is “of a size and weight permitting the patient 3 to carry it while walking.” EX1005, 6:16-20, FIG. 5. Like *Deane*, *Dubois*’s goal is to “produce a really portable concentrator.” EX1005, 3:55-57. Thus, *Dubois* further teaches its lightweight concentrator may be carried by handle 4 or shoulder strap 5, as shown in FIG. 5. EX1005, 6:21-25, FIG. 5. *Dubois* teaches this portability is achieved by optimizing the “mass performances” and other aspects of the concentrator’s components, including the compressor, adsorbent, and battery. EX1005, 4:12-25. EX1003, ¶288. A POSITA would have found it obvious to combine *Deane*’s and *Dubois*’s teachings of optimizing a POC for increased portability, a characteristic recognized as highly desirable by 2004-2005 (as evidenced by *Deane* and *Dubois* themselves, among other references discussed herein). EX1003, ¶289.

Beyond the specific motivations to combine *Deane* and *Dubois* provided by the references themselves, further support for such motivation can be found in a POSITA’s general knowledge at the time of the importance of making POCs highly-portable. EX1003, ¶290. And beyond this, a POSITA would have found it obvious to combine *Deane* and *Dubois*’s teachings, and would have had a reasonable expectation of success in doing so, at least because both references relate to POCs with common processes and components. EX1003, ¶291. Both references teach the portability of POCs and provide similar features and

functionality and have common components. Thus, a POSITA would have been able to utilize *Dubois*'s teachings relating to optimizing POC components common to *Deane*'s and *Dubois*'s systems, including the compressor, adsorbent, and battery, to improve *Deane*'s POC's portability. EX1003, ¶292.

Regarding the *Deane/Berntson* combination, *Deane* teaches its components, including its separation cartridge (*e.g.*, adsorbent housing 602/adsorbent columns 508a, 508b with their inlets, outlets, and adsorbent material) may be accessed for “testing, repair, or maintenance.” EX1004, ¶[0058], FIG. 3. EX1003, ¶296. Similarly, *Berntson* teaches a POC with a “separation cartridge” (its ORAG unit) mountable inside a concentrator's housing or cabinet and removed for maintenance. EX1006, ¶[0019]. EX1003, ¶¶294-295. Thus, it would have been obvious to combine *Deane*'s cartridge teachings (alone or as combined with *Dubois*'s teachings described above) with *Berntson*'s teachings of an easily removable cartridge to improve the ease of maintenance, which both references recognize is important. EX1003, ¶296. In combination, these teachings provide an improved POC with an adsorbent-containing cartridge that is more modular and thus more easily accessed and removed/replaced for maintenance, characteristics a POSITA would have recognized as highly desirable by 2004-2005. *Id.*

Beyond the specific motivations to combine *Deane* (and *Dubois*) and *Berntson* provided by the references themselves, further support for such

motivation can be found in a POSITA's general knowledge of the importance of making adsorbent-containing cartridges in POCs easily removable/accessible to improve serviceability. EX1003, ¶297. And beyond this, a POSITA would have found it obvious to combine *Deane's* (and *Dubois's*) and *Berntson's* teachings, and would have had a reasonable expectation of success in doing so, at least because these references relate to POCs with adsorbent-containing cartridges. *Id.*, ¶298. Both *Deane* and *Berntson* teach the importance of being able to access and repair/replace the adsorbent-containing cartridge and *Berntson* teaches a modular approach was well-known. *Id.*, ¶299.

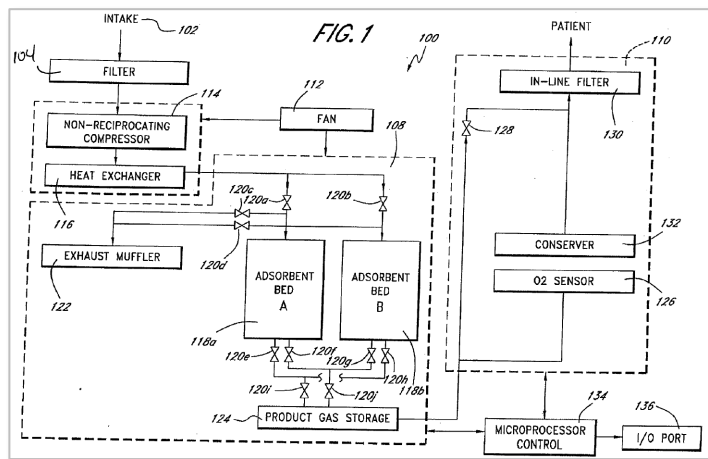
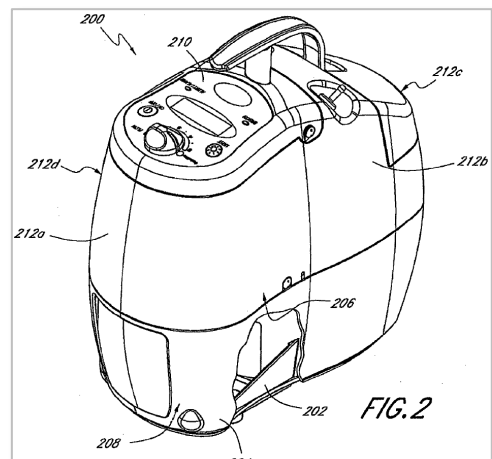
Therefore, at the time of the alleged invention of the Challenged Claims, a POSITA would have been motivated to (and it would have been obvious to a POSITA having the teachings of *Deane*, *Dubois*, and *Berntson* before him/her, along with the other knowledge explained herein) combine the teachings of *Deane*, *Dubois*, and *Berntson* as described herein to provide improved functionality, with a reasonable expectation such modifications would have been successful. EX1003, ¶¶293-300.

2. Claim 1

The combination of *Deane*, *Dubois*, and *Berntson* renders Claim 1 obvious. EX1003, ¶301.

[1a] 1. A portable oxygen concentrator, comprising:

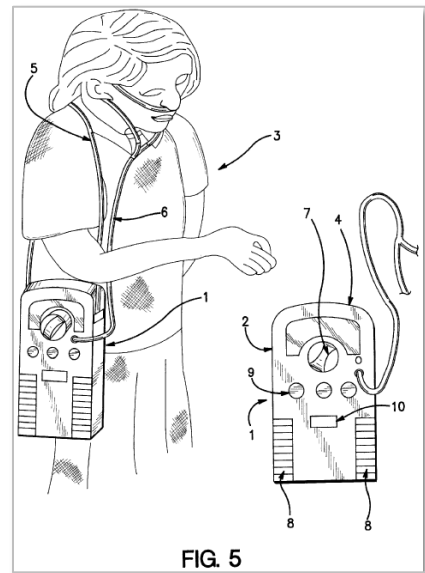
If a limitation (it is not), *Deane* combined with *Dubois* and *Berntson* renders [1a] obvious because *Deane* teaches “a portable gas fractionalization system” or “compact oxygen concentrator that is suitable for both in-home and ambulatory use so as to provide users greater ease of mobility” (EX1004, ¶[0002]) and “FIG. 2 illustrates a gas fractionalization apparatus 200 of the preferred embodiment, which is shown in the form of a portable oxygen concentrator” (EX1004, ¶[0057]). See also *id.*, ¶[0012] (FIG. 1 depicts a “portable gas fractionalization system”), [0013] (FIG. 2 depicts a “portable gas fractionalization apparatus”), [0093] (*Deane*’s device is a “portable oxygen concentrator unit 1600”); elements [1b]-[1e] below (discussing particular features of *Deane*’s portable oxygen concentrator). EX1003, ¶¶302-306, 312.



Deane also teaches throughout its disclosure the portable nature of its POC, including in the above-cited portions and in view of, for example, its handle (*see* FIGS. 2 and 16A) and wheeled mobility cart 1800 (*see* FIGS. 18A, 18B). EX1004, FIGS. 2, 16A, 18A, 18B, ¶¶[0099]-[0101]. EX1003, ¶307. Should PO argue

Deane's teachings are deficient regarding portability, it would also have been obvious to make *Deane*'s POC even more portable, including by sizing it to be provided on a patient-wearable belt or strap in the manner depicted in *Dubois*'s figures.

EX1005, 3:25-30, 6:21-25, FIG. 5 (reproduced here). EX1003, ¶308. As discussed above, a



POSITA would have been motivated to modify *Deane* in view of *Dubois* to improve *Deane*'s POC's portability. EX1003, ¶309. Moreover, highly portable and wearable POCs were generally known by POSITAs by 2004-2005, and it would have been obvious to a POSITA to configure *Deane*'s POC to make it patient-wearable in view of this general knowledge. EX1003, ¶310.

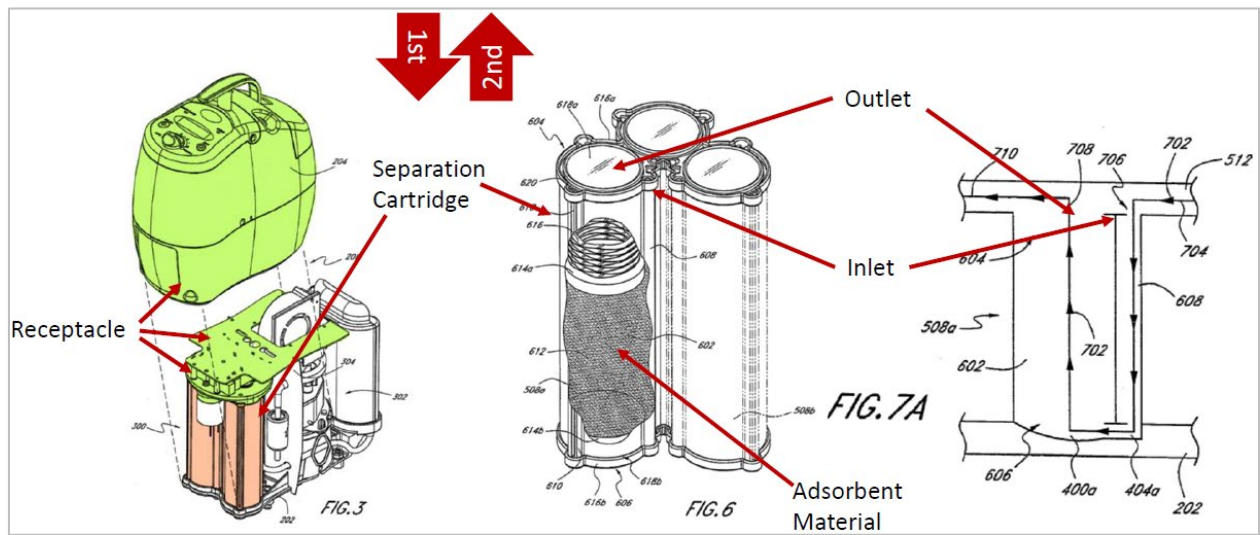
Lastly, during prosecution of a member of the '614 patent's family, applicant confirmed *Deane* '059, which is similar to *Deane*, teaches a POC. EX1049, 40, 178-179. EX1003, ¶311.

<p>[1b]</p>	<p>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;</p>
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Deane combined with *Dubois* and *Berntson* renders [1b] obvious because *Deane* teaches a separation cartridge (*e.g.*, adsorbent housing 602 / adsorbent bed columns 508a, 508b, shaded in orange in the annotated drawings below) selectively removable from a receptacle (*e.g.*, adsorbent housing 602 / adsorbent bed columns 508a, 508b is removable from manifold 512 or a combination of manifold 512 and shell 204, shaded green in the annotated drawings below, along with circuit board 1314) by movement relative to the receptacle in a first direction (*e.g.*, the direction labeled “1st” in the figures below), the separation cartridge (*e.g.*, adsorbent housing 602 / adsorbent bed columns 508a, 508b) comprising an inlet oriented in a second direction opposite the first direction (*e.g.*, openings 706 of feed tubes 608 of adsorber housing 602 / adsorbent bed columns 508a, 508b are oriented in the direction labeled “2nd” in the figures below), an outlet oriented in the second direction (*e.g.*, upper ends 604 of adsorber housing 602 / adsorbent bed columns 508a, 508b are oriented in the direction labeled “2nd” in the annotated figures below), and a bed of adsorbent material configured to preferentially adsorb nitrogen (*e.g.*, adsorbent material 612 in adsorbent bed columns 508a, 508b). *E.g.*, EX1004, ¶¶[0007]-[0008], [0010]-[0011], [0014], [0017]-[0018], [0035]-[0036],

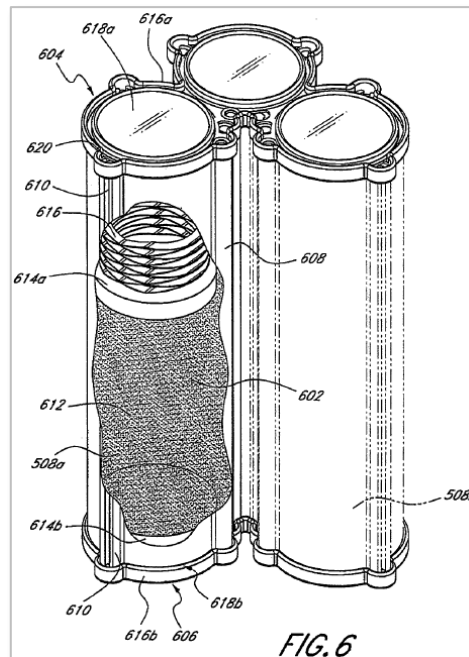
[0057]-[0059], [0062]-[0063], [0065]-[0070], [0086], [0092], FIGS. 3, 6, 7.

Berntson also teaches a “separation cartridge selectively removable from a receptacle”—an oxygen-rich air generator (ORAG) unit mountable inside a housing or cabinet of an oxygen concentrator and “removably fastened” to the housing within what a POSITA would have understood is a “receptacle” of the housing/cabinet. EX1006, ¶¶[0011]-[0012]. EX1003, ¶¶313-314. The annotated versions of *Deane*’s FIGS. 3, 6, and 7A below provide further explanation and examples of how *Deane* teaches each of the features of [1b] in the manner described below. EX1003, ¶¶315, 347.



“a separation cartridge...”: As discussed in §VI.A, a “separation cartridge” is a housing that holds multiple adsorbent columns for gas separation and provides separate inlet and outlet ports for each adsorbent column. *Deane*

renders this feature of [1b] obvious because (in addition to the above), it teaches an adsorbent housing 602 / adsorbent bed columns 508a, 508b component (as shown in FIG. 6)⁷, where each column 508a, 508b contains adsorbent material 612 (e.g., zeolite) through which feed gas flows for separation (e.g., nitrogen is removed from the feed gas to produce oxygen rich product gas). EX1004, ¶¶[0007] (“plural adsorbent bed columns mounted side by side”), [0014], [0017], [0018], [0062] (“[e]ach adsorbent bed column 508 a-b



comprises an elongated housing containing a nitrogen-selective adsorbent material such as zeolite...adapted to remove nitrogen from intake air in a known manner in accordance with a PSA cycle so as to produce an oxygen rich product gas.... As shown in FIG. 5, all three columns 508 a-b, 510 are mounted side by side in the

⁷ “Housing 602 / adsorbent bed columns 508a, 508b” is used herein to refer to *Dean*’s entire structure discussed for this element, such as the entire structure shown in FIG. 6. If one of these components is identified singly herein for brevity, it is intended to mean the entire structure. A POSITA would have understood *Deane* to teach that housing 602 extends around each of the adsorbent bed columns (e.g., 508a, 508b) and/or each adsorbent bed column (e.g., 508a, 508b) to have individual housings 602 that are interconnected, such as along their diameters or by ends 604, 606, as shown in FIG. 6. EX1003, ¶316.

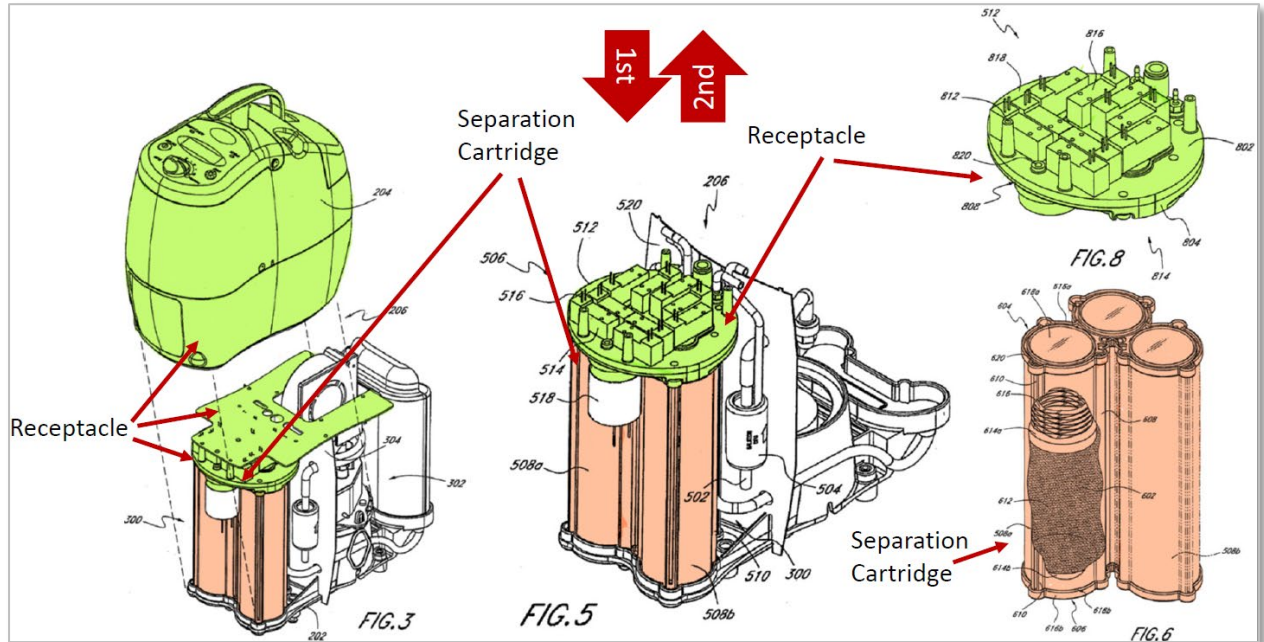
housing 206.”), [0066]-[0070], [0092], FIGS. 3, 6, 7. Columns 508a, 508b also each have a separate inlet and outlet, as discussed below. EX1003, ¶316.

If “separation cartridge” is defined more broadly as requiring a housing with at least one adsorber column, inlet, and outlet (which is not supported by the ’614 patent), *Deane* also teaches such a configuration, for at least the reasons above, as (for example) a housing with multiple adsorber columns would also be a housing with at least one adsorber column. EX1003, ¶317.

“...*selectively removable from a receptacle*...”: As discussed in §VI.B, “receptacle” means a structure that releasably interfaces with the separation cartridge’s inlet(s) and outlet(s) and at least partially contains the separation cartridge; and, as discussed in §VI.C, “selectively removable [from a receptacle]” means that the separation cartridge is “withdrawable or separable as a whole from a receptacle.” EX1003, ¶318.

More specifically (and in addition to the above), *Deane* renders this feature of element [1b] obvious because it teaches that adsorbent housing 602 / adsorbent bed columns 508a, 508b (the “separation cartridge” discussed above and highlighted in **orange** in the annotated figures below) is withdrawable or separable as a whole (*e.g.*, “selectively removable”) from manifold 512, or a combination of manifold 512 and shell 204 (*e.g.*, the “receptacle,” highlighted in **green** in the

figures). For example, a POSITA would have considered manifold 512 to teach a “receptacle” because its structure both: (i) releasably interfaces with the separation

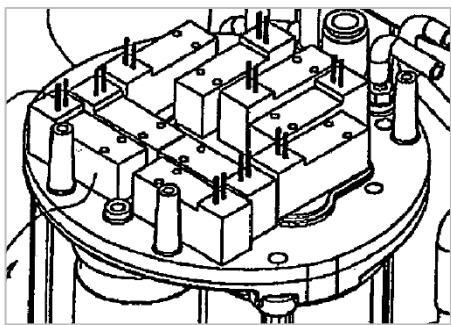


cartridge’s inlet(s) and outlet(s) (*via* the gas passage interfaces of manifold 512); and (ii) at least partially contains the separation cartridge (*via* the connective structure of manifold 512 which at least partially contains the end of adsorbent housing 602 / adsorbent bed columns 508a, 508b around its periphery, as shown by comparing FIGS. 5 and 6). Alternatively, a POSITA would have considered the combination of manifold 512 and shell 204 to provide both requirements, as shell 204 completely laterally surrounds adsorbent housing 602 in addition to the lateral containment offered by manifold. A POSITA would also have considered circuit board 1314 (also highlighted in **green** in the figures above), and/or other intervening structure, part of the receptacle. EX1003, ¶319.

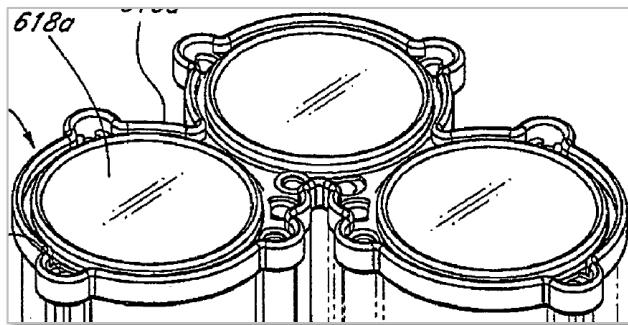
More specifically, *Deane* teaches a “receptacle” formed of manifold 512 or the combination of manifold 512 and shell 204, for several reasons. EX1003, ¶320.

First, *Deane* teaches its separation cartridge (*e.g.*, adsorbent housing 602 / adsorbent bed columns 508a, 508b) may be connected to integrated manifold 512, which releasably interfaces with the inlet(s) and outlet(s) on the upper end of adsorbent housing 602 / adsorbent bed columns 508a, 508b to provide gas flow therewithin. EX1004, Abstract, ¶¶[0007] (teaching an “integral fluid flow manifold mounted on one end of the columns”), [0014], [0017]-[0018], [0059], [0062] (“PSA unit 506 generally includes...an integrated manifold 512 for controlling fluid flow to and from the columns 508 a-b, 510.”), [0063] (“integrated manifold 512 contains a plurality of integrated flow passages formed in a single plane that permit fluid to flow to and from the columns 508 a-b, 510.... [T]he integrated manifold 512 is mounted on the upper end of the columns 508 a-b, 510 in a manner such that the integrated flow passages in the manifold are in fluid communication with openings in the upper end of each column.”), [0065]-[0067], [0070] (“FIGS. 7A and 7B provide schematic illustrations of the adsorbent bed column 508 a in combination with the chassis 202 and the manifold 512, showing the manners in which gas flow is directed in and out of the column 508 a in accordance with the single-ended column design.”), [0086], FIGS. 3, 5, 6, 7. EX1003, ¶321.

Second, *Deane* teaches integrated manifold 512 also at least partially contains adsorbent housing 602 / adsorbent bed columns 508a, 508b *via* the connective structure of manifold 512 which at least partially contains the end of adsorbent housing 602 / adsorbent bed columns 508a, 508b around its periphery, as shown by comparing FIGS. 5 and 6 and by the partial reproductions that follow. *See also, e.g.,* EX1004, Abstract, ¶¶[0007] (“integral fluid flow manifold mounted on one end of the columns”), [0014], [0017]-[0018], [0059], [0062] (“integrated manifold 512 can be mounted horizontally on the upper end of the columns 508 a-b, 510”), [0063], [0065] (“integrated manifold mounted horizontally on one end of the columns”), [0066]-[0067], [0070], [0086], FIGS. 3, 5, 6, 7. As shown below, when housing 602 / adsorbent bed columns 508a, 508b is mated with manifold 512, manifold 512 couples to and partially surrounds/contains housing 602 / adsorbent bed columns 508a, 508b. EX1003, ¶322.



Deane FIG. 5



Deane FIG. 6

Third, *Deane* teaches its shell 204 also at least partially contains adsorbent housing 602 / adsorbent bed columns 508a, 508b (e.g., “separation cartridge”). EX1004, ¶[0057] (shell 204, together with chassis 202, “form[s] a housing 206 in which various components are mounted”), FIGS. 3, 14, 15, 16C. EX1003, ¶323.

Thus, a POSITA would have understood *Deane*’s: (i) manifold 512; or (ii) manifold 512 and shell 204 together, to teach a “receptacle” as properly construed (see §VI.B) because manifold 512 interfaces with the gas connections on adsorbent housing 602 / adsorbent bed columns 508a, 508b, and either manifold 512 or manifold 512 and shell 204 together at least partially contain adsorbent housing 602 / adsorbent bed columns 508a, 508b. EX1003, ¶¶324.-325.

Deane also teaches adsorbent housing 602 / adsorbent bed columns 508a, 508b is “selectively removable” from the above-identified receptacle (either manifold 512 or manifold 512 and shell 204) because *Deane* teaches adsorbent housing 602 / adsorbent bed columns 508a, 508b is withdrawable or separable as a whole from these components. For example, *Deane* repeatedly illustrates these components as separate pieces or assemblies. *See, e.g.*, EX1004, FIGS. 3-6, 8, 11, 13. *Deane* also teaches, in the above passages, integrated manifold 512 is “mounted” to adsorbent housing 602 / adsorbent bed columns 508a, 508b. Based at least on these teachings, a POSITA would have understood that adsorbent housing 602 / adsorbent bed columns 508a, 508b and manifold 512 (or manifold 512 and

shell 204) would have been disconnectable from each other as a matter of basic engineering, and therefore that adsorbent housing 602 / adsorbent bed columns 508a, 508b is “selectively removable” from manifold 512 (or manifold 512 and shell 204). EX1003, ¶¶326, 329. Indeed, a POSITA would have recognized that these components are disconnectable, or would have considered it obvious to make such disconnection possible, because adsorption beds must periodically be replaced. EX1003, ¶327. Still further, *Deane* specifically teaches that its individual components can be connected and disconnected for repair or maintenance. EX1004, ¶¶[0057]-[0058]. EX1003, ¶328.

Should PO argue “selectively removable from a receptable” also/alternatively means adsorbent housing 602 / adsorbent bed columns 508a, 508b must be removable from *Deane*’s system 100 independently from other removable components, such as battery 1104, *Deane* also teaches such a configuration as its battery is also removable from battery slot 412. EX1004, ¶¶[0059], [0080]-[0081], [0099], [0100]. EX1003, ¶330. And should PO argue manifold 512 and shell 204 cannot satisfy “receptacle” because they are not a *single* component, PO would be incorrect. Making individual components separate or integral is simply a matter of preference since no functionality is gained or lost via that choice and is therefore obvious. EX1003, ¶331. Arranging manifold 512,

circuit board 1314, and shell 204 to cooperatively form a “receptacle” would have been an obvious variation of *Deane*’s structure. EX1003, ¶331.

Further, should PO argue *Deane* fails to teach a separation cartridge “selectively removable from a receptacle,” *Berntson* teaches such a feature because it teaches an oxygen-rich air generator (ORAG) unit removable as a whole from the receptacle of a concentrator, *e.g.*, for maintenance purposes. EX1006, ¶[0019]. EX1003, ¶333. ORAG 32 contains adsorbent containers 42, among other components, and includes inlet filtration 44 and oxygen-rich air outlet 56. EX1006, ¶[0012]. EX1003, ¶333. ORAG 32 is “removably fastened” in the concentrator housing in what a POSITA would have understood to be a “receptacle.” EX1006, ¶¶[0011]-[0012], [0019]. Thus, a POSITA would have understood *Berntson* to teach a structure (the inside of the housing/cabinet) that releasably interfaces with the inlet(s) and outlet(s) of *Berntson*’s separation cartridge and at least partially contains the separation cartridge, which is a claimed receptacle. EX1003, ¶333. As explained above, a POSITA 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, *e.g.*, for maintenance purposes. EX1006, ¶[0019]. EX1003, ¶332.

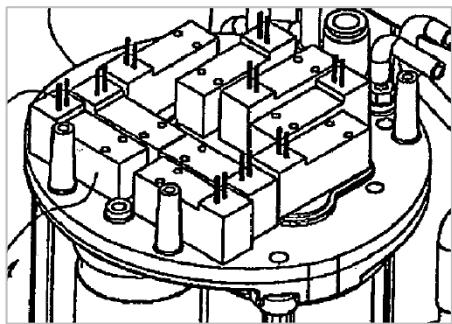
Lastly, selectively removable components, including batteries and separation cartridges, were generally known by POSITAs by 2004-2005. EX1003, ¶334.

Thus, should PO argues *Deane* (and/or *Berntson*) is somehow deficient as to teaching this feature of [1b], it would have been obvious to a POSITA based on the POSITA's general knowledge to configure *Deane*'s adsorbent housing 602 / adsorbent bed columns 508a, 508b to utilize such teachings to improve the speed of replacement of adsorbent material 612 in adsorbent housing 602 / adsorbent bed columns 508a, 508b. EX1003, ¶334.

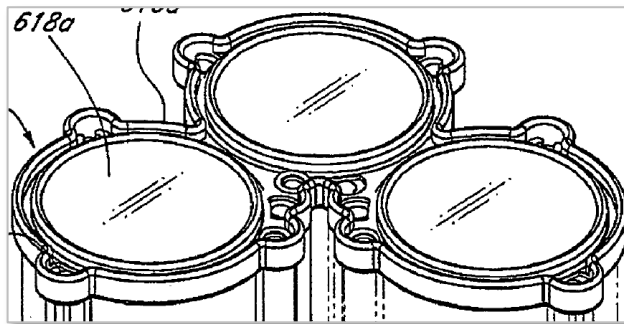
“...by movement relative to the receptacle in a first direction...”: More specifically (and in addition to the above), *Deane* renders this feature of [1b] obvious because, as shown in the annotated figures, a POSITA would have understood that adsorbent housing 602 / adsorbent bed columns 508a, 508b is selectively removable from manifold 512 “by movement relative to the receptacle in a first direction,” which is a direction along the axis of adsorbent housing 602 / adsorbent bed columns 508a, 508b (identified in the annotated drawings herein with a red arrow labeled “1st”), for several reasons. *First*, a POSITA would have recognized this to be the intended removal direction simply by reviewing *Deane*'s Figures, which illustrate an assembly direction along the axis of adsorbent housing 602 / adsorbent bed columns 508a, 508b. EX1004, FIGS. 3, 4, 5, 8, 11, 13, 14, 15.

Second, the particular mounting configuration described above and shown in, e.g., FIGS. 5 and 6 teaches a removal direction along the axis of adsorbent housing 602 / adsorbent bed columns 508a, 508b at least because the outer

periphery of manifold 512 laterally surrounds the uppermost lateral surfaces of adsorbent housing 602 / adsorbent bed columns 508a, 508b such that disconnection in other directions (such as laterally) would be difficult (see portions of FIGS. 5 and 6 reproduced below). EX1003, ¶335.



Deane FIG. 5



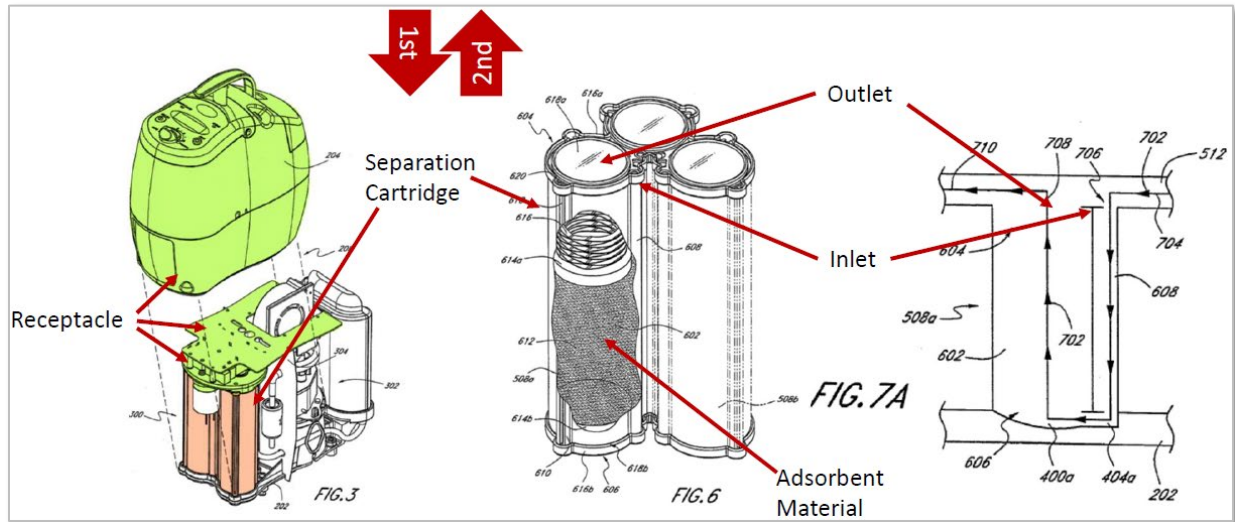
Deane FIG. 6

Third, if removal in a direction other than the 1st direction would even have been possible, a POSITA would have considered it obvious to separate manifold 512 and adsorbent housing 602 / adsorbent bed columns 508a, 508b in the 1st direction labeled in the annotated figures to maintain the airtightness of the various connections to the adsorbent housing 602's / adsorbent bed columns 508a, 508b inlet(s) and outlet(s), as a POSITA would have considered other directions, such as lateral removal, to result in more wear on the connecting surfaces. For example, if possible, lateral removal would result in the top end of housing 602 / adsorbent bed columns 508a, 508b, including the inlet(s) and outlet(s), scraping against manifold 512.

“...the separation cartridge comprising an inlet oriented in a second direction opposite the first direction, an outlet oriented in the second direction...”: More specifically (and in addition to the above), *Deane* renders this feature of [1b] obvious because it teaches that adsorbent housing 602 / adsorbent bed columns 508a, 508b (the “separation cartridge” as discussed above and highlighted in orange in the annotated figures) has inlets (opening 706 of feed tube 608 connected to lower end 606 of each column 508a, 508b) oriented in a second direction opposite the first direction (*e.g.*, the direction labeled “2nd” in the figures below), and outlets (upper ends 604 of each column 508a, 508b) oriented in the second direction.⁸ EX1004, ¶¶[0066], [0070]; *see also id.*, Abstract, ¶¶[0007]-[0008], [0014], [0017]-[0018], [0036], [0059], [0062]-[0067], [0092], FIG. 3, 5, 6,

⁸ Based at least on the passages cited herein for element [1b], a POSITA would have understood *Deane* as teaching both columns 508a, 508b are of the same construction (*i.e.*, each has the same inlet, outlet, filters, springs, *etc.*). Thus, a description of one of columns 508a, 508b related to a claim element herein is intended to describe either or both.

7. EX1003, ¶¶336, 339.



More specifically as to the claimed “inlet,” as shown in FIG. 7A, *Deane* teaches that opening 706 of feed tube 608 at upper end 604 of each column 508a, 508b is an inlet into which feed gas 702 (ambient air) flows. EX1004, FIG. 7, ¶¶[0066], [0070] (“[F]eed gas 702 is directed from a feed stream 704 in the manifold 512 into an upper opening 706 of the feed tube 608.”). The opening of feed tube 608 (upper opening 706) is oriented in a second direction opposite the direction in which the housing 602 / adsorbent bed columns 508a, 508b is removed from manifold 512 (as described above). EX1004, FIGS. 5. 6. EX1003, ¶337.

And more specifically as to the claimed “outlet,” *Deane*’s FIG. 7A also shows that product gas 708 flows out of upper ends 604 of each column 508a, 508b into a product stream. EX1004, FIG. 7, ¶[0070]. The product gas flows out of housing 602 / adsorbent bed columns 508a, 508b and into manifold 512 *via* filter

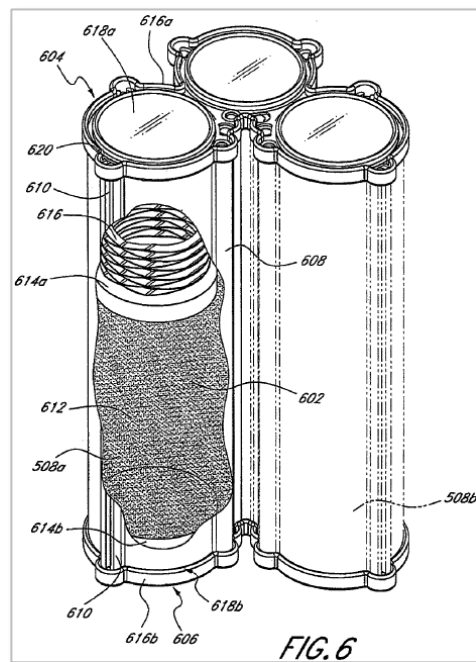
portion 618a at upper end 604 of housing 602 / adsorbent bed columns 508a, 508b, as shown in *Deane*'s FIGS. 5/6. Thus, *Deane* discloses an outlet oriented in the same direction as *Deane*'s inlet—in the direction opposite from the direction in which the housing 602 / adsorbent bed columns 508a, 508b is removed from manifold 512. EX1003, ¶338.

Should PO argue *Deane* is somehow deficient as to teaching this feature of [1b], providing inlet and outlet ports on the same end of an adsorption cartridge was generally known by POSITAs by 2004-2005, and it would have been obvious to a POSITA based on the POSITA's general knowledge to configure *Deane*'s adsorbent housing 602 / adsorbent bed columns 508a, 508b to utilize such inlet/outlet teachings to improve the speed of replacing adsorbent housing 602 / adsorbent bed columns 508a, 508b and/or simplify the manifold arrangement such that it would be arranged on one end of adsorbent housing 602 / adsorbent bed columns 508a, 508b. EX1003, ¶340.

Lastly, both the applicant and Examiner in various related applications confirmed *Deane*'s teachings, as provided in *Deane* '059 (EX1038) and *Deane* '426 (EX1047), render this portion of [1b] obvious. EX1049, 40; EX1052, 16. EX1003, ¶¶341-342.

“[the separation cartridge comprising]...a bed of adsorbent material configured to preferentially adsorb nitrogen”: More specifically (and as

discussed above), *Deane* renders this feature of [1b] obvious because it teaches that adsorbent housing 602 / adsorbent bed columns 508a, 508b (the “separation cartridge” as discussed above and highlighted in orange in the figures above) has beds of adsorbent material 612 configured to preferentially adsorb nitrogen. EX1004, Abstract, ¶¶[0007]-[0008], [0010]-[0011], [0014], [0017]-[0018], [0035]-[0036], [0062], [0066], [0068]-[0070], [0092], FIG. 3, 6, 7. EX1003, ¶¶343-344.



Should PO argue *Deane* is somehow deficient as to teaching this feature of [1b], providing an adsorbent material in a cartridge was generally known by POSITAs by 2004-2005, and it would have been obvious to a POSITA based on the POSITA’s general knowledge to configure *Deane*’s adsorbent housing 602 / adsorbent bed columns 508a, 508b to include adsorbent material to allow operation of *Deane*’s POC. EX1003, ¶345.

Lastly, as mentioned above, the Examiner of the related ’669 patent found *Deane* ’426 (EX1047) discloses a “bed of adsorbent material 612,” and this bed is contained in adsorbent housing 602 / adsorbent bed columns 508a, 508b, which,

similar to in *Deane* discussed above, is a separation cartridge. EX1047, FIG. 6.

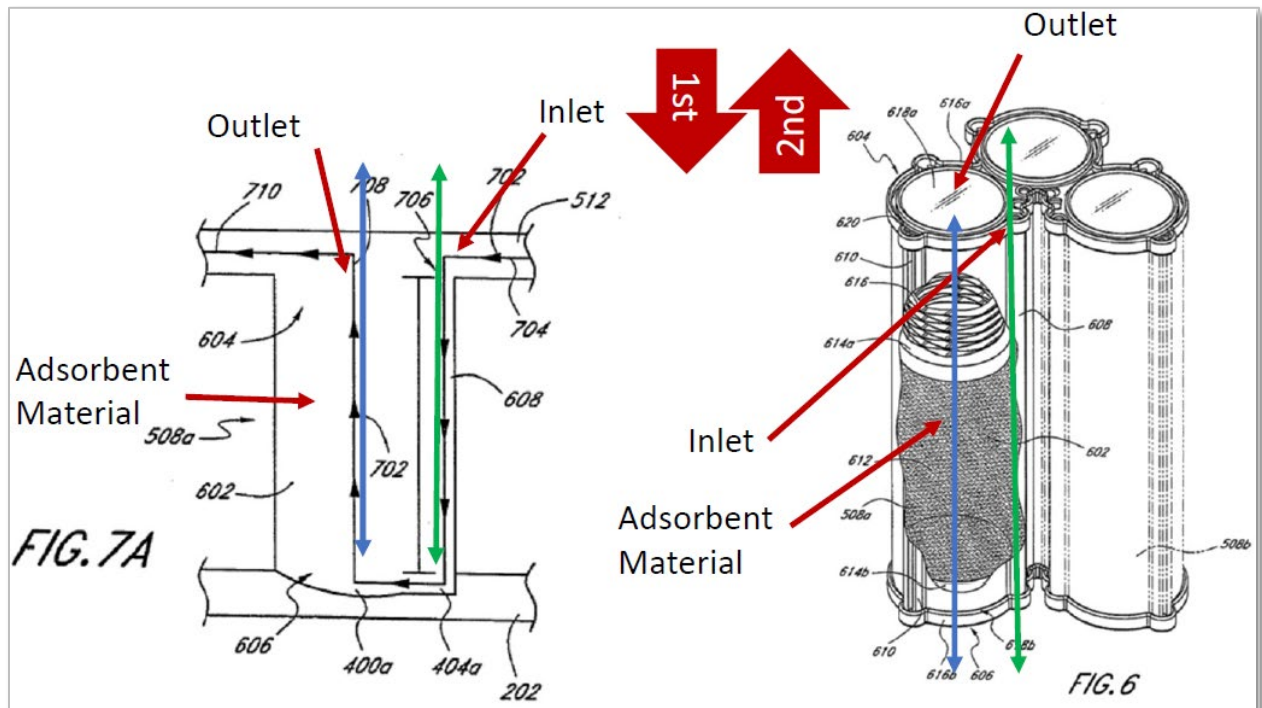
EX1003, ¶346.

- [1c] wherein a first line extending parallel to the first and second directions passes through the outlet,
- [1d] wherein a second line spaced-apart from the first line and extending parallel to the first line passes through the inlet, and
- [1e] 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.

Deane combined with *Dubois* and *Berntson* renders [1c]-[1e] obvious because *Deane* teaches that a first line extending parallel to the first and second directions passes through the outlet (e.g., the **blue line** in the annotated figures below is parallel to the first and second directions and passes through outlet 604 of adsorbent housing 602 / adsorbent bed columns 508a, 508b), wherein a second line spaced-apart from the first line and extending parallel to the first line passes through the inlet (e.g., the **green line** in the figures below is parallel to the first line and passes through inlet 706/608 of adsorbent housing 602 / adsorbent bed columns 508a, 508b), wherein the separation cartridge (e.g., adsorbent housing 602 / adsorbent bed columns 508a, 508b) is configured such that, when fluid flows through the separation cartridge, fluid flowing along the first line contacts the adsorbent material of the bed (e.g., fluid flowing along the **blue line** in the figures below passes through adsorbent material 612) and fluid flowing along the second

line does not contact the adsorbent material of the bed (*e.g.*, fluid flowing along the green line in the figures below flows through feed tube 608 that does not contain adsorbent material 612).⁹ EX1004 at, *e.g.*, ¶¶[0059], [0062], [0066], [0068], [0070], FIGS. 6, 7A. EX1003, ¶¶348-349, 354.

The annotated versions of *Deane's* FIGS. 6 and 7A reproduced here provide further explanation and examples of how *Deane* teaches [1c]-[1e] described in more detail below. EX1003, ¶350.



⁹ As discussed above, a POSITA would have understood *Deane* as teaching both columns 508a, 508b are of the same construction (*i.e.*, each has the same inlet, outlet, filters, springs, *etc.*).

Specifically, *Deane* teaches the claimed fluid flow defined by elements [1c]-[1e] as shown in the annotated version of FIG. 7A above and in ¶[0070], which states:

FIGS. 7A and 7B provide schematic illustrations of the adsorbent bed column 508a..., showing the manners in which gas flow is directed in and out of the column 508a in accordance with the single-ended column design. As shown in FIG. 7A, feed gas 702 is directed from a feed stream 704 in the manifold 512 into an upper opening 706 of the feed tube 608. The feed gas 702 travels downwardly through the tube 608 and is diverted by a divot 404a in the chassis 202 into a recess 400 a underneath the lower end 606 of the adsorbent housing 602.... The feed gas 702 flows upwardly from the recess 400a through the lower end 606 of the housing 602 and upwardly through the adsorbent material contained in the housing 602. The adsorbent material selectively removes one or more components in the feed gas 702 in a known manner to form a product gas 708. The product gas 708 flows out of an upper end 604 of the housing 602 into a product stream 710....

EX1004, ¶[0070]. *See also id.*, Abstract, ¶¶[0059], [0062], [0066], [0068].

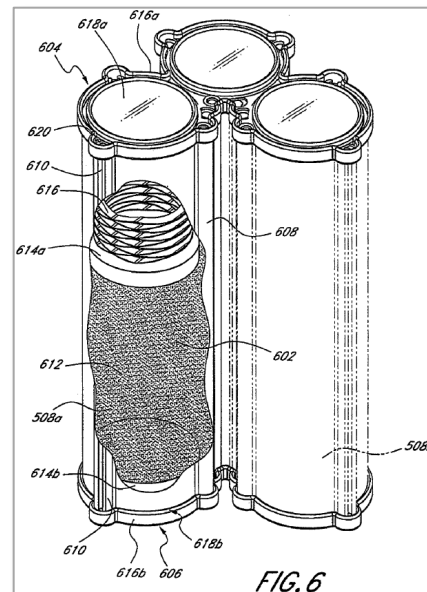
EX1003, ¶351. Additionally, should PO argue *Deane* is somehow deficient as to teaching these elements, various arrangements of inlets and outlets to provide appropriate connectivity were generally known by POSITAs by 2004-2005, and it would have been obvious to a POSITA based on POSITA's general knowledge to configure *Deane*'s inlets and outlets as claimed to provide appropriate connectivity. EX1003, ¶352.

Lastly, the Examiner in a related application confirmed *Deane*'s teachings, as provided in *Deane* '426 (EX1047), render these elements obvious. EX1052, 16. EX1003, ¶353.

3. Claim 2

- | | |
|------|--|
| [2a] | The portable oxygen concentrator as recited in claim 1, wherein: |
| [2b] | the outlet is arranged adjacent a first end of the bed, and |
| [2c] | adjacent a second end of the bed opposite the first end, the separation cartridge includes a spring configured to hold the bed in place. |

Deane combined with *Dubois* and *Berntson* renders Claim 2 obvious for several reasons. EX1003, ¶355. Element [2a] is obvious per Claim 1. EX1003, ¶356. *Deane* teaches [2b] because *Deane* teaches outlets (e.g., upper ends 604 of adsorber housing 602 / adsorbent bed columns 508a, 508b) arranged adjacent a first end of an adsorbent bed (e.g., adsorbent material 612 in adsorbent bed columns 508a, 508b) as explained above in connection with [1b]. EX1003, ¶357. A POSITA would have understood “adjacent” to mean closer to the first end of the bed than the opposite end, at least because the '614 patent does not indicate just how close two



elements have to be to be “adjacent.” *Id.* Moreover, a POSITA would have recognized “adjacent” must include arrangements like *Deane*'s where the

elements, such as spring 616 and upper restraining disk 614a, are provided between adsorbent material 612 and upper end 604 (*see* EX1004, FIG. 6) as the '614 patent similarly includes such interposed elements in its embodiments (*see* EX1001, FIG. 16). EX1003, ¶357. Still further, as described as to [2c], it would also have been obvious to move *Deane*'s spring 616 to the opposite side of housing 602 to bias adsorbent material 612 closer and even more adjacent to the outlet. *Id.*

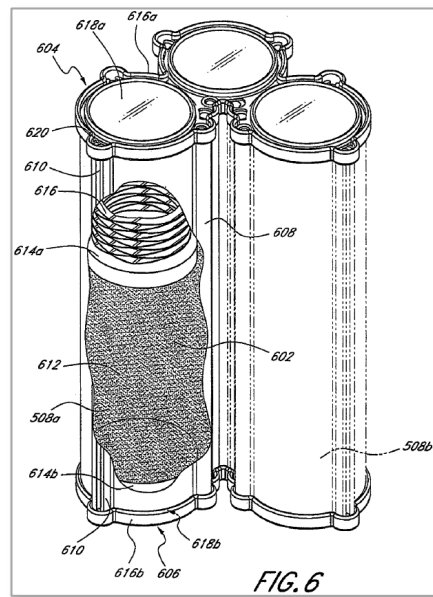
Deane also teaches [2c]. As shown in FIG. 6, *Deane* teaches: (i) upper restraining disk 614a “pressed against the adsorbent material 612 by [a] spring 616;” and (ii) lower restraining disk 614b on the opposite side of adsorbent material 612. EX1004, ¶[0068], FIG. 6. While *Deane*'s spring is adjacent the first (top) end of the column/bed, it would have been obvious to also/alternatively provide a spring on the opposite side of the adsorbent material (the claimed “second end of the bed opposite the first end”) so the spring would hold lower restraining disk 614b—instead of upper restraining disk 614a—in position to compress the adsorbent material. EX1003, ¶358. This is because *Deane* teaches spring 616 is provided to apply pressure to keep restraining disk 614a in position, a teaching a POSITA would have recognized as applicable to either end of *Deane*'s adsorbent columns. EX1004, ¶[0068], FIG. 6. EX1003, ¶358. It would have been a simple design choice to arrange a spring at either end, or both ends, of adsorbent columns 508a-b. *Id.* It would have been obvious to provide a spring on either or

both ends of *Deane*'s adsorbent columns based on the common knowledge of a POSITA, as such configurations were well-known by 2004-2005. *See* §II. EX1003, ¶359.

4. Claim 3

- | | |
|------|--|
| [3a] | The portable oxygen concentrator as recited in claim 2, wherein: |
| [3b] | adjacent the second end of the bed, the separation cartridge includes a porous filter, and |
| [3c] | the spring contacts the second end of the bed via the porous filter. |

Deane combined with *Dubois* and *Berntson* renders Claim 3 obvious for several reasons. EX1003, ¶360. Element [3a] is obvious per Claim 2. EX1003, ¶361. *Deane* teaches [3b] because, as shown in FIG. 6, *Deane* teaches restraining disk 614b is a “porous filter” at the second (lower) end of adsorbent housing 602. EX1004, ¶[0068] (“restraining disks 614a-b are preferably comprised of a frit material that can also serve as a filter for gross particulate...”), FIG. 6. EX1003, ¶362.



Deane also teaches [3c]. As explained above for Claim 2, it would have been obvious to provide a spring on either or both ends of adsorbent material 612. In a configuration with the spring at the bottom of *Deane*'s bed (“second end”), the

spring would have been arranged to contact restraining disk 614b just as it contacts restraining disk 614a as shown in FIG. 6. EX1003, ¶¶363-364.

5. Claim 4

- [4a] 4. The portable oxygen concentrator as recited in claim 1, further comprising:**
- [4b] a power pack removable from the portable oxygen concentrator;**
- [4c] a pump electrically coupled to the power pack, the pump operable to cause a flow of fluid to move relative to the bed of adsorbent material;**
- [4d] a user interface configured to allow a patient to adjust and monitor operation of the portable oxygen concentrator; and**
- [4e] a carrying device for transporting the portable oxygen concentrator.**

Deane combined with *Dubois* and *Berntson* renders Claim 4 obvious for several reasons. EX1003, ¶366. Element [1a] is obvious per Claim 1. EX1003, ¶367. *Deane* teaches [4b] because it teaches removable battery 1104 powering all its major systems. EX1004, ¶¶[0068], [0081], [0099], [0100], FIG. 11. EX1003, ¶368. *Deane* teaches [4c] because it teaches battery-powered compressor 1108 (“a pump”) pressurizing and delivering air to supply a feed gas to both adsorbent columns to produce a product gas (thereby causing fluid flow relative to the adsorbent beds). EX1004, ¶[0092]. EX1003, ¶368. *Deane* teaches [4d] because it teaches “user interface panel 1602 containing a plurality of system controls 1604 such as flow rate and on-off switches[,]” where the user interface is “integrally formed in the shell 204” of *Deane*’s POC. EX1004, ¶[0094]. EX1003, ¶369. *Deane*

teaches [4e] because it teaches its POC has a handle and mobility cart 1800.

EX1004, ¶[0099]; EX1003, ¶370.

Should PO argue *Deane*'s POC's handle and/or mobility cart is not a "carrying device," *Dubois* discloses such a device as explained above in [1a].

EX1005, 3:25-30, 6:21-25, FIG. 5. EX1003, ¶371.

In addition, the Examiner in a related application asserted *Deane* '745 (having a common disclosure with *Deane*) teaches all the elements of Claim 4.

EX1050, 58-59. EX1003, ¶372.

6. Claim 5

<p>[5] The portable oxygen concentrator as recited in claim 1, wherein the bed comprises a bed of zeolite which provides preferential adsorption of nitrogen.</p>
--

Deane combined with *Dubois* and *Berntson* renders Claim 5 obvious because, for example, *Deane* teaches adsorbent bed columns 508a-b include "a nitrogen-selective adsorbent material such as zeolite" and "remove nitrogen from intake air in a known manner...so as to produce an oxygen rich product gas."

EX1004, ¶[0062]. EX1003, ¶373.

7. Claim 7

[7] The portable oxygen concentrator as recited in claim 1, wherein the first and second lines are straight lines.

Deane combined with *Dubois* and *Berntson* renders Claim 7 obvious because the blue and green lines shown in annotated FIGS. 6 and 7A in [1c]-[1e] above are straight. EX1003, ¶¶374-375.

8. Claim 8

[8] The portable oxygen concentrator as recited in claim 1, wherein the separation cartridge is configured such that, when fluid flows through the separation cartridge, fluid flows along the first line in the second direction and fluid flows along the second line in the first direction.
--

Deane combined with *Dubois* and *Berntson* renders Claim 8 obvious because, as shown in annotated FIGS. 6 and 7A in [1c]-[1e] above, fluid flows along: (i) the first (blue) line in the second direction toward the top of the cartridge and the outlet; and (ii) the second (green) line in the first direction toward the bottom of the cartridge. EX1004, ¶¶[0066], [0070]. EX1003, ¶¶376-377.

9. Claim 9

[9] The portable oxygen concentrator as recited in claim 1, wherein the separation cartridge includes at least one additional outlet oriented in the second direction and spaced-apart from the second line.

Deane combined with *Dubois* and *Berntson* renders Claim 9 obvious because, as explained in [1b]-[1e] above, *Deane* teaches a separation cartridge (e.g., adsorbent housing 602 / adsorbent bed columns 508a, 508b) with an inlet and

outlet for each adsorbent bed columns 508a, b. EX1003, ¶378. By nature of the separation cartridge construction discussed above, the outlets of each column 508a, b will be oriented in the second direction and spaced apart from a second line passing through inlets for the columns 508a, b, as shown in the annotated FIGS. 6/7A above. EX1003, ¶379. The separation cartridge also includes a product gas storage column 510, which also includes an outlet spaced apart from the second line. EX1004, ¶[0062]. EX1003, ¶379.

10. Claim 10

[10] The portable oxygen concentrator as recited in claim 1, wherein the first line intersects adsorbent material of the bed and the second line does not intersect adsorbent material of the bed.

Deane combined with *Dubois* and *Berntson* renders Claim 10 obvious because, as shown in the annotated version of *Deane's* FIGS. 6/7A, a first (blue) line passes through and intersects adsorbent material 612 in the column and the second (green) line passes through feed tube 608 without intersecting adsorbent material 612. EX1003, ¶¶380-381.

11. Claim 11

[11] The portable oxygen concentrator as recited in claim 1, wherein the inlet is configured to receive ambient air and the outlet is configured to expel product gas.

Deane combined with *Dubois* and *Berntson* renders Claim 11 obvious because *Deane* teaches drawing ambient air into its system to use as a “feed gas”

(EX1004, ¶¶[0032]-[0033]) which flows into *Deane*'s separation cartridge through an inlet (opening 706 of feed tube 608) (EX1004, ¶[0070], FIG. 7A). EX1003, ¶383. *Deane* further teaches the feed gas flows down feed tube 608 and upward through adsorbent housing 602 and adsorbent material 612 to therefore form "product gas" which is expelled through outlet (upper end 604 and/or filter portion 618a). EX1003, ¶383.

Should PO argue "ambient air" is not received at the separation cartridge's inlet due to it first passing through a compressor in *Deane*'s PSA process, PO would be wrong because *Deane* also teaches a VSA system may be used, which a POSITA would have understood to introduce ambient air more directly to the inlets. EX1004, ¶[0055]. EX1003, ¶384.

12. Claim 12

Claim 12 is obvious in view of the combination of *Deane*, *Dubois*, and *Berntson*. EX1003, ¶385.

[12a] 12. A separation cartridge for a portable oxygen concentrator, comprising:

If a limitation (it is not), *Deane* combined with *Dubois* and *Berntson* renders [12a] obvious for at least the reasons described above in [1a]-[1b]. EX1003, ¶¶386-387.

- [12b] an inlet oriented in a direction;**
- [12c] an outlet oriented in the direction;**
- [12d] a bed of adsorbent material configured to preferentially adsorb nitrogen; and**

Deane combined with *Dubois* and *Berntson* renders [12b]-[12d] obvious for at least the reasons described above in [1b], where “the direction” is equivalent to the “second direction” of [1b]. EX1003, ¶¶388-389.

- [12e] wherein a first line extending parallel to the direction passes through the outlet,**
- [12f] wherein a second line spaced-apart from the first line and extending parallel to the first line passes through the inlet, and**
- [12g] 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.**

Deane combined with *Dubois* and *Berntson* renders [12e]-[12g] obvious for at least the reasons described above in [1c]-[1e], where “the direction” is equivalent to the “second direction” of [1c]-[1e]. EX1003, ¶¶390-391.

13. Claim 13

Claim 13 is obvious in view of the combination of *Deane*, *Dubois*, and *Berntson*. EX1003, ¶392.

[13a] 13. A portable oxygen concentrator, comprising:

If a limitation (it is not), *Deane* combined with *Dubois* and *Berntson* renders [13a] obvious for at least the reasons described above in [1a]. EX1003, ¶393.

- [13b] a first bed of adsorbent material configured to preferentially adsorb nitrogen;**
- [13c] a first inlet oriented in a direction, wherein the first inlet is configured to direct a flow of ambient air to the first bed;**
- [13d] a first outlet oriented in the direction, wherein the first outlet is configured to expel product gas flowing downstream of the first bed;**
- [13e] a second bed of adsorbent material configured to preferentially adsorb nitrogen;**
- [13f] a second inlet oriented in the direction, wherein the second inlet is configured to direct a flow of ambient air to the second bed;**
- [13g] a second outlet oriented in the direction, wherein the second outlet is configured to expel product gas flowing downstream of the second bed;**

Deane combined with *Dubois* and *Berntson* renders [13b]-[13g] obvious for at least the reasons described above in [1b]-[1e], which describe how the separation cartridge in *Deane*'s POC includes two beds of adsorbent material (*e.g.*, adsorbent material 612 in adsorbent bed columns 508a, 508b), each having an inlet and outlet, and describe the flow of ambient air and product gas in *Deane*'s system, "the direction" here being equivalent to the "second direction" of [1c]-[1e]. EX1004, ¶[0070], FIG. 7A. EX1003, ¶¶394-402.

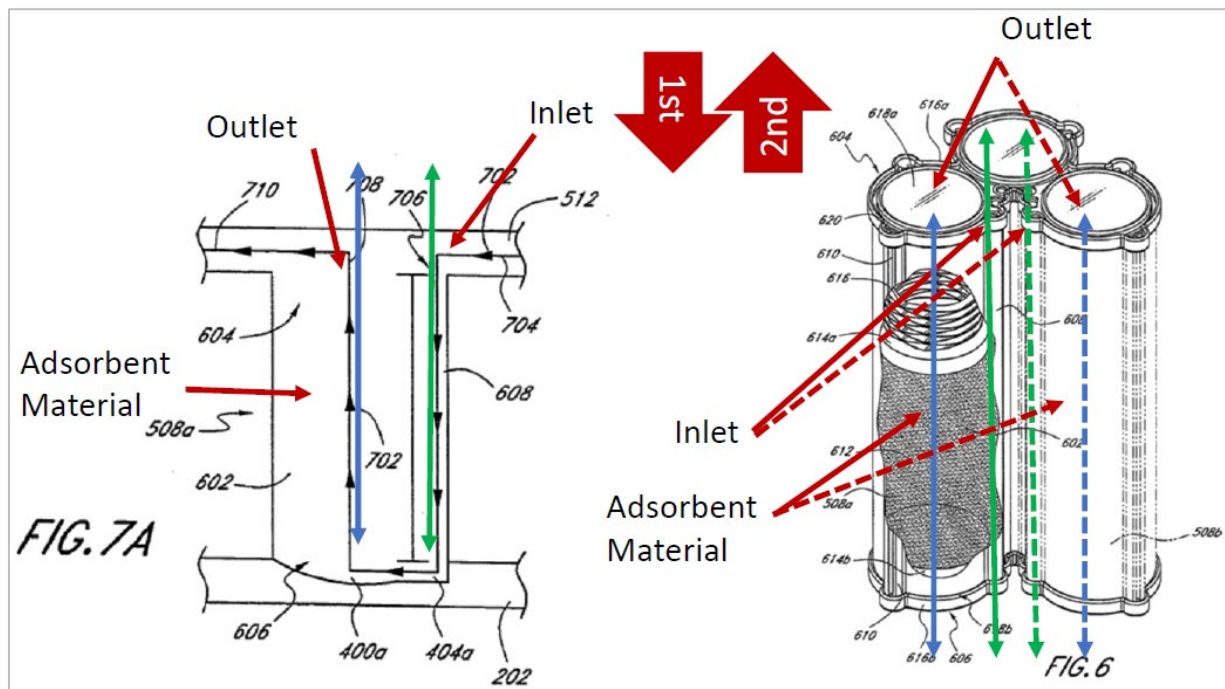
- [13h] a power pack removable from the portable oxygen concentrator;**
- [13i] a pump electrically coupled to the power pack, the pump operable to cause a flow of fluid to move relative to the first and second beds of adsorbent material;**
- [13j] a user interface configured to allow a patient to adjust and monitor operation of the portable oxygen concentrator;**
- [13k] a carrying device for transporting the portable oxygen concentrator;**

Deane combined with *Dubois* and *Berntson* renders [13h]-[13k] obvious for at least the reasons described in Claim 4. EX1003, ¶403.

- [13l] wherein a first line extending parallel to the direction passes through the first outlet,**
- [13m] wherein a second line spaced-apart from the first line and extending parallel to the first line passes through the first inlet,**
- [13n] wherein the portable oxygen concentrator is configured such that, during use, fluid flowing along the first line contacts the adsorbent material of the first bed and fluid flowing along the second line does not contact the adsorbent material of the first bed,**
- [13o] wherein a third line extending parallel to the direction passes through the second outlet,**
- [13p] wherein a fourth line spaced-apart from the third line and extending parallel to the third line passes through the second inlet, and**
- [13q] wherein the portable oxygen concentrator is configured such that, during use, fluid flowing along the third line contacts the adsorbent material of the second bed and fluid flowing along the fourth line does not contact the adsorbent material of the second bed.**

Deane combined with *Dubois* and *Berntson* renders [13l]-[13q] obvious for at least the reasons described above in elements [1c]-[1e] and [12e]-[12g] and the

following. EX1003, ¶408. *Deane* teaches [13l]/[13o] because it teaches first/third lines extend parallel to the direction and pass through first/second outlets (e.g., the **solid blue line** and **dashed blue line** in the annotated figures below). EX1003, ¶409.



Deane teaches [13m]/[13p] because it teaches a second/fourth line spaced-apart from and extending parallel to the first/third line passes through the first/second inlet (e.g., the **solid green line** and **dashed green line** in the figures). EX1003, ¶500.

Deane teaches [13n]/[13q] because it teaches a POC (e.g., the POC of [1a]), including a separation cartridge with first/second beds (e.g., adsorbent housing 602 / adsorbent bed columns 508a, 508b with adsorbent material 612 of [1b]-[1e])

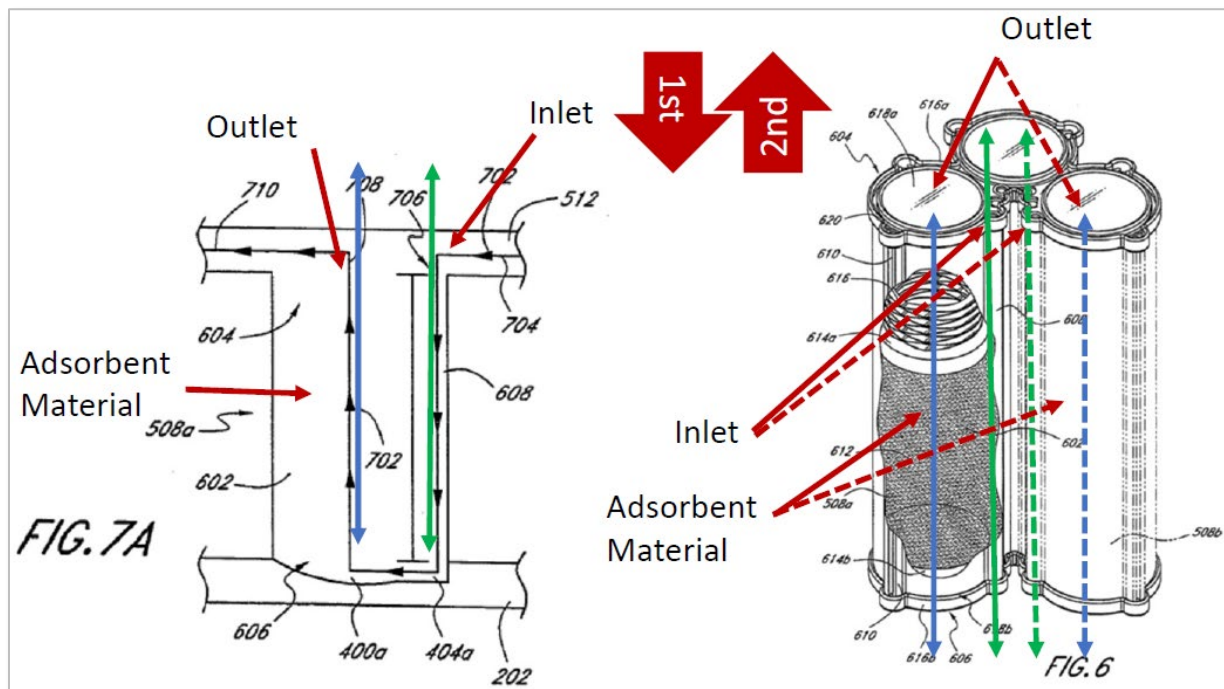
configured such that, during use, fluid flowing along a first/third line contacts the adsorbent material of the first/second bed (*e.g.*, fluid flowing along the **solid blue line** and **dashed blue line** passes through adsorbent material 612 for at least the reasons in [1c]-[1e]) and fluid flowing along the second/fourth line does not contact the adsorbent material of the first/second bed (*e.g.*, fluid flowing along the **solid green line** and **dashed green line** flows through feed tubes 608 that do not contact adsorbent material 612 for at least the reasons in [1c]-[1e]). EX1003, ¶501.

14. Claim 14

- [14a] **14. The portable oxygen concentrator as recited in claim 13, wherein the portable oxygen concentrator is configured such that, during use:**
- [14b] **fluid flows along the first line in the direction,**
- [14c] **fluid flows along the second line opposite the direction,**
- [14d] **fluid flows along the third line in the direction, and**
- [14e] **fluid flows along the fourth line opposite the direction.**

Deane combined with *Dubois*, and *Berntson* renders [14a]-[14e] obvious for at least the reasons of [1c]-[1e], Claim 8, Claim 13 ([13l]-[13q]), and the following, where “the direction” and “the opposite direction” are equivalent to the “second direction” and “the first direction” of [1b], respectively. EX1003, ¶¶412-416. Regarding [14b]/[14d], annotated FIGS. 6/7A show that fluid flows through *Dean’s* POC/separation cartridge upwards along the first (**solid blue**) and third (**dashed blue**) line in the direction in which the inlets/outlets are oriented (the

“direction” or “second direction” of [1b]-[1e]). EX1003, ¶417. Regarding [14c]/[14e], annotated FIGS. 6/7A show fluid flows downwards along the second (**solid green**) and fourth (**dashed green**) line opposite the direction in which the inlets/outlets are oriented. EX1004, ¶[0070], FIGS. 6, 7A; EX1003, ¶417.



15. Claim 15

- [15a] 15. The portable oxygen concentrator as recited in claim 14, wherein:**
- [15b] the first outlet is arranged adjacent a first end of the first bed,**
- [15c] a first spring is arranged adjacent a second end of the first bed opposite the first end,**
- [15d] the first spring is configured to hold the first bed in place,**
- [15e] the second outlet is arranged adjacent a first end of the second bed,**
- [15f] a second spring is arranged adjacent a second end of the second bed opposite the first end, and**
- [15g] the second spring is configured to hold the second bed in place.**

Deane combined with *Dubois* and *Berntson* renders Claim 15 obvious for at least the reasons of [1b]-[1e]/[13b]-[13g] (*Deane*'s teaching that its POC's separation cartridge (*e.g.*, adsorbent material 612 in adsorbent bed columns 508a, 508b) includes two beds of adsorbent material, each having an inlet and outlet) and Claim 2 (*Deane*'s explicit teachings of springs arranged adjacent first ends of the beds and of the springs' function (alone or in combination with a POSITA's general knowledge) would have made it obvious to a POSITA to arrange the springs adjacent the second ends of the beds). EX1003, ¶¶418-422.

16. Claim 16

[16] The portable oxygen concentrator as recited in claim 13, wherein the first and second beds are contained within a common separation cartridge.

Deane combined with *Dubois* and *Berntson* renders Claim 16 obvious for at least the reasons of [1b]/[13b]/[13e] (*Deane*'s teaching that adsorbent material 612 in adsorbent bed columns 508a, 508b is in a common separation cartridge (e.g., adsorbent housing 602 / adsorbent bed columns 508a, 508b)). EX1003, ¶423-424. Should PO argue *Deane* fails to teach the claimed "separation cartridge," *Berntson* teaches it as explained in [1b]. EX1003, ¶425.

B. Ground 2

A POSITA would have found Claims 2, 3, and 15 obvious based on the combination of *Deane*, *Dubois*, *Berntson*, and *Hill* '719. EX1003, ¶426.

1. Combination of *Deane*, *Dubois*, *Berntson*, and *Hill* '719

As discussed in detail herein, *Deane* (alone and in combination with *Dubois* and *Berntson*) teaches the features of Claims 2, 3, and 15. See §§VII.A.3, 4, 15. Should PO argue *Deane* does not teach the spring locations recited in Claims 2, 3, and 15, this would have been obvious in view of *Hill* '719.

Specifically, *Deane* teaches a POC with a separation cartridge having adsorbent columns with adsorbent material held in place by upper/lower restraining disks and a spring holding the upper restraining disk in place (at the

upper/product end). EX1004, ¶[0068], FIGS. 6. EX1003, ¶427. *Hill '719* teaches a concentrator with columns (adsorption vessels 24) including adsorbent material and that “[s]prings 36 are disposed near the bottoms of the adsorption vessels,” at feed end 30, “to hold the packed beds of adsorbent material firmly in place.” EX1008, Abstract, 4:60-5:9, FIG. 1E. That is, *Hill '719*’s springs serve the same function as *Deane*’s—holding adsorbent material in place—but are at the opposite (feed) end. EX1003, ¶428.

A POSITA would have found it obvious to combine *Deane*’s teachings (alone and in combination with *Dubois* and *Berntson*) of a spring at a product end of an adsorbent column with *Hill '719*’s teachings of the spring being at the feed end to provide a spring at the feed end and/or a spring at both ends. EX1003, ¶429. A POSITA would have recognized these constructions as alternatives that would be used to retain the adsorbent material and that would be applied to different cartridge constructions, providing flexibility in design that would have been recognized as highly desirable by 2004-2005 (as evidenced by *Deane* and *Hill '719* themselves, among other references discussed herein). *Id.*

Beyond the specific motivations to combine *Deane* (alone and in combination with *Dubois* and *Berntson*) and *Hill '719* provided by the references themselves, further support for such motivation can be found in a POSITA’s general knowledge at the time that springs were provided at either or both ends of

adsorbent columns, and that it was a simple design choice to do so. EX1003, ¶430.

And beyond this, a POSITA would have found it obvious to combine these teachings, and would have had a reasonable expectation of success in doing so, at least because both references relate to POCs with common processes and components, including springs used to hold adsorbent beds in place. *Id.*, ¶431.

Both *Deane* (alone and in combination with *Dubois* and *Berntson*) and *Hill '719* teach using a spring to hold adsorbent material in place but teach placing the spring on opposite sides of the bed. Thus, a POSITA would have had a reasonable expectation of success in utilizing *Hill '719*'s teachings to provide alternative implementations of *Deane*'s cartridge using simple design choices. *Id.*, ¶432.

Therefore, at the time of the alleged invention of the '614 patent, a POSITA would have been motivated to (and it would have been obvious to a POSITA having the teachings of *Deane* (alone and in combination with *Dubois* and *Berntson*) and *Hill '719* before him or her, along with the other knowledge explained above to) combine their teachings as described above (and below) to provide improved functionality, with a reasonable expectation that such modifications would have been successful. EX1003, ¶433.

2. Claim 2

Deane combined with *Dubois*, *Berntson*, and *Hill* '719 renders Claim 2

obvious for at least the reasons provided for Claim 2,

Ground 1. EX1003, ¶¶434-436. Should PO argue

Deane does not teach [2c], *Hill* '719 teaches spring

36 at the bottom end of an adsorbent column, where

feed gas enters, opposite the top end of the column,

where product gas exits. EX1008, 5:7-11, FIG. 1E.

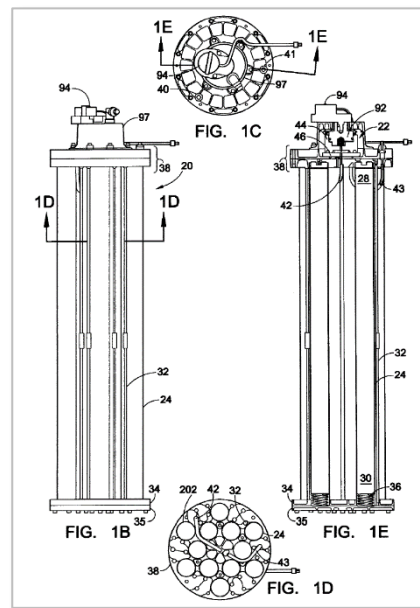
EX1003, ¶437. As discussed above, it would have

been obvious to provide a spring at the bottom (or

both bottom and top) of *Dean*'s adsorbent column in view of *Hill* '719, such that

there would be a spring adjacent a second end of the bed (bottom end where feed

gas enters) opposite the first end (where the product gas exits). EX1003, ¶438.

**3. Claim 3**

Deane combined with *Dubois*, *Berntson*, and *Hill* '719 renders Claim 3

obvious for at least the reasons provided for Claim 3, Ground 1. EX1003, ¶¶439-

441. Should PO argue *Deane* does not teach [3c], *Deane* combined with *Hill* '719

does. EX1003, ¶442. As described in Claim 2, according to the combined

teachings of *Deane* and *Hill* '719, a POSITA would have arranged a spring

adjacent the second end of the adsorbent bed and, in such a position, the spring

would contact the lower filter (e.g., *Deane*'s lower restraining disk 614b) as it does with respect to *Deane*'s teaching of a spring contacting its upper restraining disk 614a. EX1003, ¶442.

4. Claim 15

Deane combined with *Dubois*, *Berntson*, and *Hill* '719 renders Claim 15 obvious for at least the reasons provided for Claim 15, Ground 1 and Claim 2, Ground 2. EX1003, ¶¶443-447.

C. Ground 3

A POSITA would have found Claim 6 obvious based on the combination of *Deane*, *Dubois*, *Berntson*, and *Basset*. EX1003, ¶448.

1. Combination of *Deane*, *Dubois*, *Berntson*, and *Basset*

As discussed in detail herein, *Deane* (alone and in combination with *Dubois* and *Berntson*) teaches the use of zeolite adsorbent beds. See §VII.A.2.[1b]. EX1003, ¶449. *Basset* teaches a POC with two adsorbers 7 containing “Zeolite, advantageously a lithium zeolite of the LiX type, preferably an LiLSX Zeolite.” EX1007, 1:10-14, 2:13-29. EX1003, ¶450.

A POSITA would have found it obvious to combine *Deane*'s teachings of zeolite adsorbent with *Basset*'s teaching of a particular zeolite “of the LiLSX type” because such a combination would have provided improved adsorbent performance. EX1003, ¶451. POSITAs were well aware that LiLSX provided

performance improvements as compared to other zeolites, which a POSITA would have recognized as highly desirable by 2004-2005. *Id.*

Beyond the specific motivations to combine *Deane* (alone and in combination with *Dubois* and *Berntson*) and *Basset* provided by the references themselves, further support for such motivation can be found in a POSITA's general knowledge at the time that both zeolite and LiLSX zeolite were used as adsorbents. EX1003, ¶452. And beyond this, a POSITA would have found it obvious to combine these teachings, and would have had a reasonable expectation of success in doing so, at least because both references relate to oxygen concentration using types of zeolite as an adsorbent. *Id.*, ¶453.

Therefore, at the time of the alleged invention of the '614 patent, a POSITA would have been motivated to (and it would have been obvious to a POSITA having the teachings of *Deane* (alone and in combination with *Dubois* and *Berntson*) and *Basset* before him or her, along with the other knowledge explained above) combine the these teachings as described above (and below) to provide improved functionality and a specific implementation of what *Deane* already teaches, with a reasonable expectation that such modifications, to the extent there even are any, would have been successful. EX1003, ¶454.

2. Claim 6

[6] The portable oxygen concentrator as recited in claim 5, wherein the zeolite is an LiLSX adsorbent.

Deane combined with *Dubois*, *Berntson*, and *Basset* renders Claim 6 obvious because *Deane* teaches an adsorbent bed of zeolite (see Ground 1, [1b]) and *Basset* teaches use of a “Zeolite, advantageously a lithium zeolite of the LiX type, preferably an LiLSX Zeolite.” EX1007, 2:21-22. EX1003, ¶¶456-456.

D. Grounds 4-6

If PO does not contest, or the Board finds, *Deane* teaches [1a]-[1b], a POSITA would have found: (i) Claims 1-5 and 7-16 obvious based on *Deane* (Ground 4); (ii) Claims 2, 3, and 15 obvious based on *Deane* combined with *Hill* '719 (Ground 5); and (iii) Claim 6 obvious based *Deane* combined with *Basset* (Ground 6) for at least the reasons in Grounds 1, 2, and 3 above, respectively, because *Deane*, *Deane* combined with *Hill* '719, and *Deane* combined with *Basset* teach all the features of the Challenged Claims (*i.e.*, *Dubois* and/or *Berntson*'s teachings would be unnecessary). EX1003, ¶457.

VIII. NO OBJECTIVE INDICIA OF NON-OBVIOUSNESS

Petitioner is unaware of any secondary considerations of non-obviousness.

IX. CONCLUSION

For the foregoing reasons, Petitioner requests *inter partes* review and cancellation of the Challenged Claims.

X. MANDATORY NOTICES AND FEES

Real Party In Interest: The real party-in-interest is GCE Gas Control Equipment Inc. (“GCE”). To the extent identification of GCE’s ownership is necessary, GCE is a Delaware corporation and is a wholly-owned indirect subsidiary of ESAB Corp. (“ESAB”), also a Delaware corporation, which is a publicly-held company traded on the New York Stock Exchange. No other parties directed, controlled, or funded this IPR proceeding.

Related Matters: Petitioner sought a declaratory judgement of non-infringement of the ’614 patent in an action filed in the United States District Court for the District of Maryland styled *GCE Gas Control Equip. Inc. v. 3B Medical Mfg., LLC*, No. 8:22-cv-02550-TDC. Patent Owner has counterclaimed for infringement.

The ’614 patent is in the same family as U.S. Patent No 10,357,628. An IPR challenging the ’628 patent will soon be filed as IPR2023-00327. To Petitioner’s best knowledge, the ’614 patent was not previously challenged in an IPR.

Lead and Backup Counsel: Pursuant to 37 C.F.R. §42.8(b)(3) and 42.10(a), Petitioner designates Robert M. Masters (Reg. No. 35,603) as Lead Counsel, and Timothy Cremen (Reg. No. 50,855), Eric K. Gill (Reg. No. 71,709), and Roy D. Jung (Reg. No. 80,281) as Back-Up Counsel, each of Sheppard, Mullin, Richter & Hampton LLP.

Service Information: Petitioner consents to service by e-mail at: legaltm-gce-ipr@sheppardmullin.com. Petitioner's counsel may also be served by mail or hand delivery at Sheppard, Mullin, Richter & Hampton LLP, 2099 Pennsylvania Avenue, NW, Suite 100, Washington, DC 20006-6801. Petitioner's counsel may be reached by telephone at 202.747.1900 and by facsimile at 202.747.1901.

Fees: Petitioner paid the required fees. The Office is authorized to charge any fee deficiency, or credit any overpayment, to Deposit Account No. 50-4561.

Dated: December 23, 2022

Respectfully submitted,

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Control Equipment Inc.*

CLAIM APPENDIX

[1a] 1. A portable oxygen concentrator, comprising:

[1b] 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;

[1c] wherein a first line extending parallel to the first and second directions passes through the outlet,

[1d] wherein a second line spaced-apart from the first line and extending parallel to the first line passes through the inlet, and

[1e] 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.

[2a] 2. The portable oxygen concentrator as recited in claim 1, wherein:

[2b] the outlet is arranged adjacent a first end of the bed, and

[2c] adjacent a second end of the bed opposite the first end, the separation cartridge includes a spring configured to hold the bed in place.

[3a] 3. The portable oxygen concentrator as recited in claim 2, wherein:

[3b] adjacent the second end of the bed, the separation cartridge includes a porous filter, and

[3c] the spring contacts the second end of the bed via the porous filter.

[4a] 4. The portable oxygen concentrator as recited in claim 1, further comprising:

[4b] a power pack removable from the portable oxygen concentrator;

[4c] a pump electrically coupled to the power pack, the pump operable to cause a flow of fluid to move relative to the bed of adsorbent material;

[4d] a user interface configured to allow a patient to adjust and monitor operation of the portable oxygen concentrator; and

[4e] a carrying device for transporting the portable oxygen concentrator.

5. The portable oxygen concentrator as recited in claim 1, wherein the bed comprises a bed of zeolite which provides preferential adsorption of nitrogen.

6. The portable oxygen concentrator as recited in claim 5, wherein the zeolite is an LiLSX adsorbent.

7. The portable oxygen concentrator as recited in claim 1, wherein the first and second lines are straight lines.

8. The portable oxygen concentrator as recited in claim 1, wherein the separation cartridge is configured such that, when fluid flows through the separation cartridge, fluid flows along the first line in the second direction and fluid flows along the second line in the first direction.

9. The portable oxygen concentrator as recited in claim 1, wherein the separation cartridge includes at least one additional outlet oriented in the second direction and spaced-apart from the second line.

10. The portable oxygen concentrator as recited in claim 1, wherein the first line intersects adsorbent material of the bed and the second line does not intersect adsorbent material of the bed.

11. The portable oxygen concentrator as recited in claim 1, wherein the inlet is configured to receive ambient air and the outlet is configured to expel product gas.

[12a] 12. A separation cartridge for a portable oxygen concentrator, comprising:

[12b] an inlet oriented in a direction;

[12c] an outlet oriented in the direction;
[12d] a bed of adsorbent material configured to preferentially adsorb nitrogen;
and

[12e] wherein a first line extending parallel to the direction passes through the outlet,

[12f] wherein a second line spaced-apart from the first line and extending parallel to the first line passes through the inlet, and

[12g] 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.

[13a] 13. A portable oxygen concentrator, comprising:

[13b] a first bed of adsorbent material configured to preferentially adsorb nitrogen;

[13c] a first inlet oriented in a direction, wherein the first inlet is configured to direct a flow of ambient air to the first bed;

[13d] a first outlet oriented in the direction, wherein the first outlet is configured to expel product gas flowing downstream of the first bed;

[13e] a second bed of adsorbent material configured to preferentially adsorb nitrogen;

[13f] a second inlet oriented in the direction, wherein the second inlet is configured to direct a flow of ambient air to the second bed;

[13g] a second outlet oriented in the direction, wherein the second outlet is configured to expel product gas flowing downstream of the second bed;

[13h] a power pack removable from the portable oxygen concentrator;

[13i] a pump electrically coupled to the power pack, the pump operable to cause a flow of fluid to move relative to the first and second beds of adsorbent material;

[13j] a user interface configured to allow a patient to adjust and monitor operation of the portable oxygen concentrator;

[13k] a carrying device for transporting the portable oxygen concentrator;

[13l] wherein a first line extending parallel to the direction passes through the first outlet,

[13m] wherein a second line spaced-apart from the first line and extending parallel to the first line passes through the first inlet,

[13n] wherein the portable oxygen concentrator is configured such that, during use, fluid flowing along the first line contacts the adsorbent material of the first bed and fluid flowing along the second line does not contact the adsorbent material of the first bed,

[13o] wherein a third line extending parallel to the direction passes through the second outlet,

[13p] wherein a fourth line spaced-apart from the third line and extending parallel to the third line passes through the second inlet, and

[13q] wherein the portable oxygen concentrator is configured such that, during use, fluid flowing along the third line contacts the adsorbent material of the second bed and fluid flowing along the fourth line does not contact the adsorbent material of the second bed.

[14a] 14. The portable oxygen concentrator as recited in claim 13, wherein the portable oxygen concentrator is configured such that, during use:

[14b] fluid flows along the first line in the direction,

[14c] fluid flows along the second line opposite the direction,

[14d] fluid flows along the third line in the direction, and

[14e] fluid flows along the fourth line opposite the direction.

[15a] 15. The portable oxygen concentrator as recited in claim 14, wherein:

[15b] the first outlet is arranged adjacent a first end of the first bed,

[15c] a first spring is arranged adjacent a second end of the first bed opposite the first end,

[15d] the first spring is configured to hold the first bed in place,

[15e] the second outlet is arranged adjacent a first end of the second bed,

[15f] a second spring is arranged adjacent a second end of the second bed opposite the first end, and

[15g] the second spring is configured to hold the second bed in place.

16. The portable oxygen concentrator as recited in claim 13, wherein the first and second beds are contained within a common separation cartridge.

CERTIFICATE OF COMPLIANCE

Pursuant to 37 C.F.R. §42.24(d), Petitioner certify that this petition complies with the type-volume limitation of 14,000 words, includes 13,910 words, as measured by Microsoft Word, exclusive of the table of contents, table of authorities, mandatory notices under §42.8, certificates of service, word count, or appendix of exhibits.

Additionally, this petition complies with 37 C.F.R. § 42.6(a) and has been prepared using Microsoft® Word 2016 in 14-point Times New Roman.

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that a true and correct copy of the foregoing Petition for *Inter Partes* Review of U.S. Patent No. 11,389,614 and Exhibits 1001-1068 were served in their entirety on December 24, 2022, on the Patent Owner at the following addresses of record as listed on PAIR via Priority Mail Express® or Express Mail:

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The undersigned certifies that on December 23, 2022, a true and correct copy of the foregoing Petition for *Inter Partes* Review of U.S. Patent No. 11,389,614 and Exhibits 1001-1068 was also sent in their entirety via electronic mail to the attorneys of record for Defendant in the concurrent litigation matter:

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