

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. IPR2023-00527

U.S. Patent No. 10,357,628

**PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 10,357,628**

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EXHIBIT LIST

Exhibit No.	Description
1001	U.S. Patent No. 10,357,628 (<i>the '628 patent</i>)
1002	File History of U.S. Patent No. 10,357,628 (U.S. Application No. 16/006,915) (<i>'628 patent FH</i>)
1003	Declaration of Kent S. Knaebel, Ph.D. (<i>Knaebel Declaration</i>)
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>)

Exhibit No.	Description
1016	U.S. Patent No. 4,802,899 to Vrana and Bansal (<i>Vrana</i>)
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>)

Exhibit No.	Description
1037	U.S. Patent No. 6,544,318 to Dee, Chiang, Miller and Whitley (<i>Dee '318</i>)
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>)

Exhibit No.	Description
1053	<i>Intentionally Omitted</i>
1054	<i>Intentionally Omitted</i>
1055	U.S. Patent No. 7,954,490 ('490 patent)
1056	U.S. Patent No. 10,702,669 ('669 patent)
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	Bloomsbury English Dictionary, Second Edition, Bloomsbury Publishing, 2004, selected pages (<i>Bloomsbury</i>)
1062	Webster's Third New International Dictionary, Merriam- Webster Inc., 2002, selected pages (<i>Webster</i>)
1063	<i>Intentionally Omitted</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_distprofile0630.2022_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., Pressure Swing Adsorption (1994) (Ruthven)

Exhibit No.	Description
1069	<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. 34) (<i>D. Ct. Sotera Stipulation</i>)
1070	U.S. Patent No. 11,389,614 (<i>'614 patent</i>)
1071	File History of U.S. Patent No. 11,389,614 (U.S. Application No. 15/931,716) (<i>'614 patent FH</i>)
1072	3B's Alleged Infringement Claim Chart (<i>Infringement Chart</i>)
1073	U.S. Patent Application Publication No. 2005/0257686 A1 to Occhialini, Whitley, Wagner, LaBuda, and Steigerwalt (<i>Occhialini</i>)
1074	3B's Infringement Contentions for U.S. Patent No. 10,357,628 against Petitioner's Zen-O Lite product (<i>Infringement Contentions</i>)
1075	Selected pages of Breck, Donald W., Zeolite Molecular Sieves, 1984 (<i>Breck</i>)
1076	Zeochem Type 5A Adsorbent Product Information Sheet (<i>Zeochem</i>)
1077	Molsiv Type 5A Adsorbent Product Information Sheet (<i>Molsiv</i>)
1078	ARI Type 5A Property Summary Sheet, 2007 (<i>ARI 2007</i>)
1079	ARI Type 5A Property Summary Sheet, 2003 (<i>ARI 2003</i>)

I. INTRODUCTION

The Challenged Claims recite features long-known before the '628 patent. They are obvious over *Deane* (and the other Ground references). Indeed, very similar claims in the '628 patent's parent were considered unpatentable in view of *Deane* '426 (having the same relevant teachings as *Deane*).

II. BACKGROUND

The '628 patent relates to portable oxygen concentrators ("POCs"), which provide supplemental oxygen to elderly or physically compromised patients.

EX1003, ¶¶4-5. The general configuration of POCs using "pressure swing

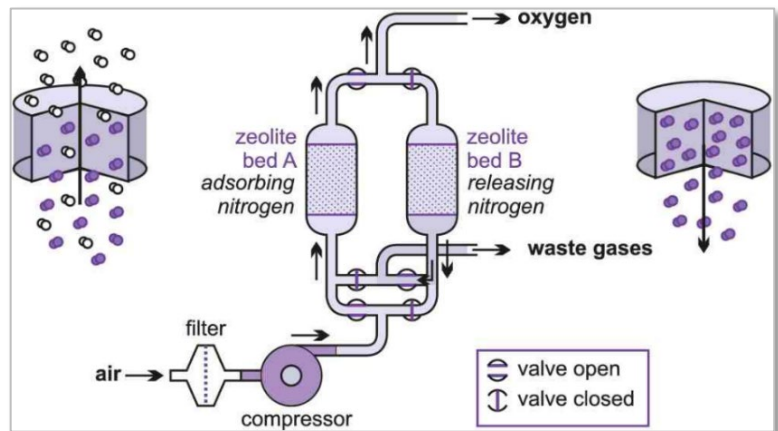
adsorption" ("PSA")¹ is shown

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 holding gas

molecules on its surface, *e.g.*, zeolite) that adsorbs nitrogen, leaving concentrated

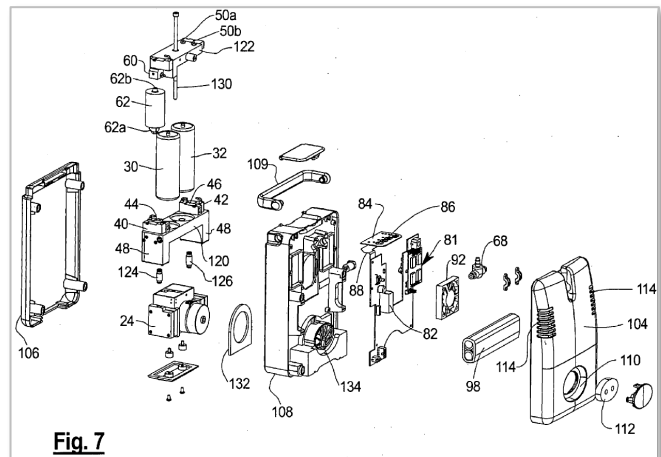
oxygen product gas (~85-95% oxygen) for the patient. *Id.*, ¶¶7, 10. The two beds

¹ A similar well-known process 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.*

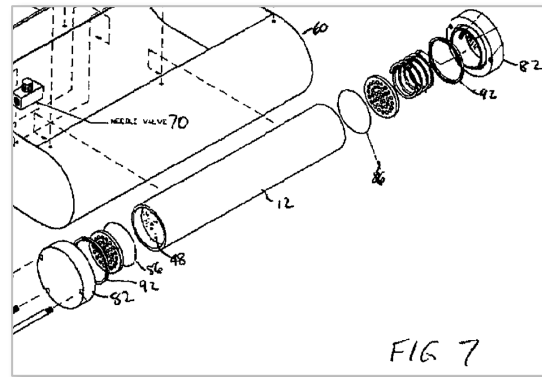
POCs of various constructions were well-known before the '628 patent. EX1003, ¶¶4-64. For example, by 2004-2005,² a person of ordinary skill in the art (“POSITA”) would have understood POCs to include housings with compressors, manifolds, valves, batteries, and zeolite adsorbent/adsorber beds with inlets and outlets. *Id.*, ¶¶13-24. *See, e.g.*, EXS1009-10, 1012-13. 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.



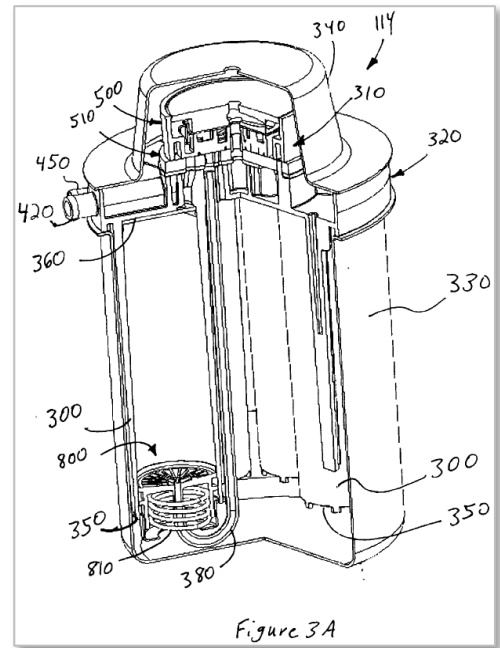
² “2004-2005” represents the timeframe before the Challenged Claims’ earliest possible filing date.

Regarding 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) were 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 '628 patent, including valves and/or manifolds provided on both ends of a POC's sieve beds to move gas in and out

thereof. EX1003, ¶¶32-36. *See, e.g.*, EX1009, ¶¶[0019]-[0020]; EX1010, ¶¶[0028]-[0029]; EX1012, ¶[0061]; EX1013, 5:42-43. By 2004-2005, POSITAs would have been well-aware of POCs utilizing sieve beds having inlets and outlets facing the same direction and/or on the same end to interface with a single manifold and/or valve assembly. EX1003, ¶¶37-48. *See, e.g.*, EX1015, Abstract, ¶¶[0045]-[0075], FIGS. 2-4 (FIG. 3A reproduced here); EX1014, ¶¶[0001]-[0006], [0056]-[0058], [0063]-[0078], FIG. 2; EX1016, 1:5-10, 1:63-66, 2:6-8, 2:38-42, 3:6-21, 3:34-4:13, 5:15-28, 5:55-6:2, FIGS. 1-3, EX1017, 2:1-8, 3:6-19, 4:60-5:2, FIGS. 1-2; EX1018, 4:54-5:59, FIGS 1, 2.



III. THE '628 PATENT

A. Alleged Invention

The '628 patent's claims are directed to a POC with a particular "separation cartridge" configuration. EX1003, ¶¶71-72. FIGS. 2/7 show, in the '628 patent's sole embodiment, separation cartridge 206 removable from module 116. EX1001, 3:60-4:17, 11:61-12:1.

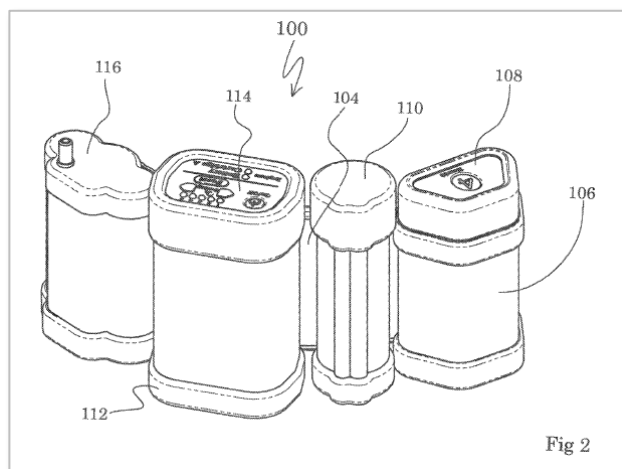


Fig 2

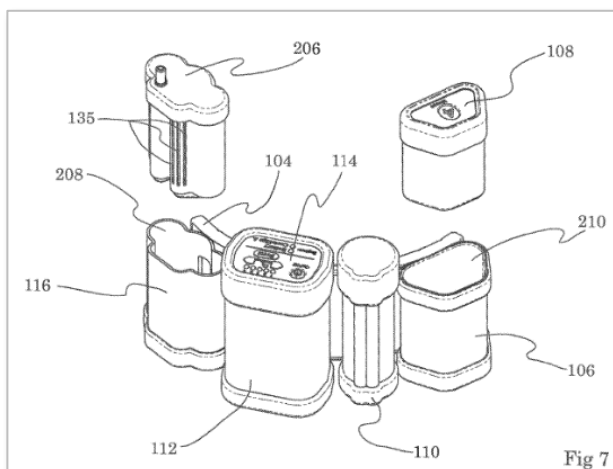


Fig 7

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 columns 130a-130c in place). EX1001, 18:30-19:14. EX1003, ¶¶73-75.

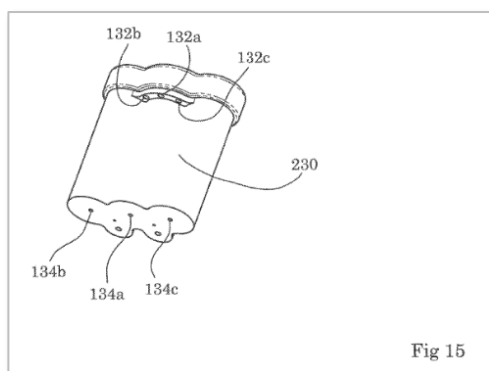


Fig 15

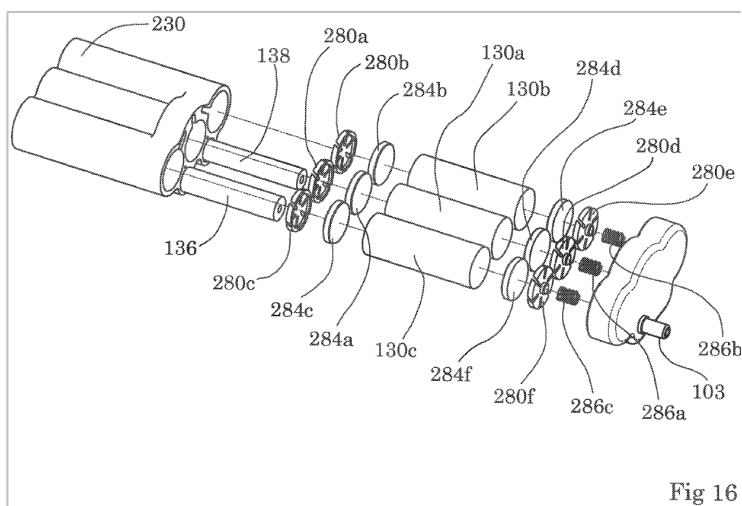
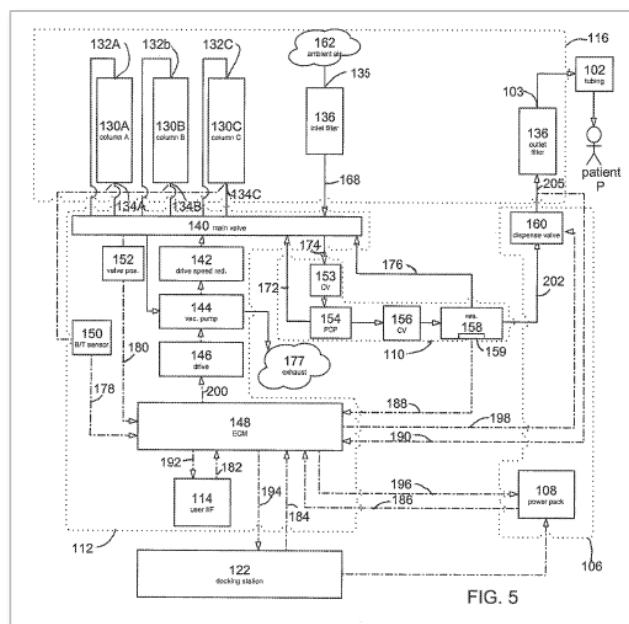


Fig 16

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 (e.g., at opposite ends) apart 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 and oxygen passes through filter 138 and outlet port 103 for delivery to patient P. *Id.*, 4:66-5:1, 6:47-54.

B. Prosecution History

The '628 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”)
13/795,977	3/12/2013	n/a	EX1051 (“977 application”)

Appl. #	Filing Date	Patent #	Notes
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	EX1002 (“’628 patent FH”); EX1001 (“’628 patent”)
15/931,716	5/14/2020	11,389,614	EX1071 (“’614 patent FH”), EX1070 (“’614 patent”); challenged in IPR2023-00326

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

The first three members of the ’628 patent’s family were directed to overall POC function/structure, not to separation cartridges. EX1003, ¶¶80, 109, 125.

2. ’669 Patent

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

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 (*e.g.*, first/second), each with a port (*e.g.*, first/third) on its

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

axis and another port (e.g., second/fourth) spaced apart from its axis, both facing the same direction. EX1052, 149-53. These claims read on the '669 (and '628) patent's FIG. 15/16 embodiment (EX1003, ¶148) and, as discussed below, are very similar to the Challenged Claims.

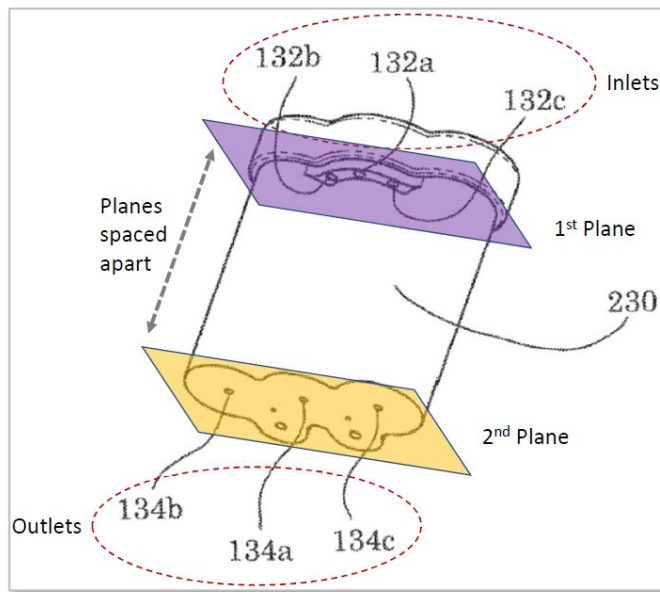
Examiner Vasat found the January 20, 2020 application claims 24/38 unpatentable over *Deane* '426 (EX1047), which has the same relevant disclosure as *Deane* (EX1004). EX1003, ¶151. To differentiate from *Deane* '426, he required application claim 30's language (reciting planes including, respectively, the first/third ports and second/fourth ports be spaced apart) be added into claims 24/38. EX1052, 19. EX1003, ¶¶149-151. This is depicted in annotated FIG. 15 of the '669/'628 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:

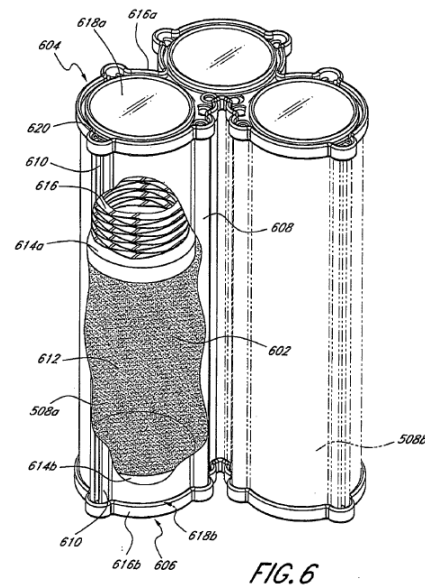
The closest prior art to new claims 24-42 is considered to be prior art to *Deane* (US 20050072426). *Deane* is considered to disclose an oxygen concentrator cartridge, best shown in Figure 6, having a first port corresponding to the filter portion 618a (par. 67) disposed along the first axis defined 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/'628 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. '628 Patent

The '628 patent is a continuation of the '669 patent. EX1001, Cover.

Applicant filed an IDS identifying the patent that ultimately issued from *Deane* (U.S. Patent No. 7,135,059; EX1038) and *Deane* '426 among more than 200 other prior art references. EX1002, 413-34.

As-filed independent claims 1/8 recite basic cartridge features, including inlet ports, outlet ports, and beds of adsorbent material and, with respect to claim 1, a requirement that the inlet and outlet ports are oriented in a common direction. EX1002, 399-401. These features are not substantively different from those recited in the January 20, 2020 versions of the '669 patent's claims that Examiner Vasat found not to distinguish over *Deane* '426/*Deane*. EX1003, ¶¶159-162. Any differences, such as the recitations of a power pack, pump, user interface, and carrying device, are taught by *Deane* '426/*Deane*. See §VII.A.2[d]-[g]. EX1003, ¶¶159-162.

Examiner Vasat should have rejected these claims based on *Deane* '426/*Deane*. EX1003, ¶¶159-162. He did not. Instead, he rejected the claims based on combinations of *Warren* '095 (EX1012), *Dechene* (EX1021), *McCombs* '924 (EX1009), *Bassine* (EX1026), and *Appel* '702 (EX1045). EX1002, 253-66; EX1003, ¶¶164-165.

Applicant responded by amending claims 1/8 to recite a receptacle and inlets/outlets facing a direction opposite the direction of cartridge removability from the receptacle, and arguing *Warren '095*'s configuration was different. EX1002, 231-33; EX1003, ¶166. These added features are also not substantively different from those recited in the January 20, 2020 versions of the '669 patent's claims and/or otherwise taught by *Deane '426/Deane*. EX1003, ¶167.

Examiner Vasat should have rejected these amended claims based on *Deane '426/Deane*. EX1003, ¶167. Again, he did not. He instead rejected the claims using the same art as before, along with *Miller '573*. EX1002, 134-57; EX1003, ¶168. Examiner Vasat also found claims 21 and 23 allowable if rewritten in independent form. EX1002, 157; EX1003, ¶169.

Applicant then accepted the Examiner's indicated level of allowability by amending claims 1/8, as shown:

1. (Currently Amended) A portable oxygen concentrator, comprising:
 - a cartridge module comprising a housing, the housing defining a receptacle;
 - a separation cartridge selectively removable from the receptacle by movement relative to the receptacle in a first direction, the separation cartridge comprising a case at least partially defining an outer volume of the separation cartridge, 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, the case at least partially surrounding the bed of adsorbent material;
 - a power pack removable from the portable oxygen concentrator;
 - a pump electrically coupled to the power pack, the pump operable to cause a flow of fluid to move relative to the adsorbent material;
 - a user interface configured to allow a patient to adjust and monitor operation of the portable oxygen concentrator;
 - a carrying device for transporting the portable oxygen concentrator;
 - wherein the housing of the cartridge module is configured to at least partially surround the case of the separation cartridge,
 - wherein the bed of adsorbent material is disposed along an axis, one of the inlet and the outlet is disposed along the axis, and the other of the inlet and the outlet is spaced-apart from the axis, and
 - wherein the first direction and the second direction are substantially parallel to the axis.

EX1002, 116-20. EX1003, ¶170.

The added features were not specifically recited in the '669 patent's January 20, 2020 independent claims Examiner Vasat found unpatentable over *Deane '426/Deane*. EX1003, ¶171. However, *Deane '426/Deane* teaches them, *e.g.*, in FIGS. 6/7A of each and as described in §VII.A.2[i]-[l]. EX1003, ¶171.

Examiner Vasat should have rejected the '628 patent's claims based on *Deane '426/Deane*. EX1003, ¶171. Again, he did not. He allowed them. EX1002, 30-38; EX1003, ¶172.

This allowance is surprising. *First*, the '628 patent's claims do not include the feature (*e.g.*, inlet/outlet ports located on different spaced apart planes) Examiner Vasat found distinguished the '669 patent's claims over *Deane* '426. EX1003, ¶173. *Second*, all the features of the allowed independent claims were either found by Examiner Vasat to be taught by *Deane* '426/*Deane* during the '669 patent's prosecution and/or are otherwise taught by *Deane* '426/*Deane* (*e.g.*, the claimed arrangement of the inlet, outlet, and bed relative to an axis is taught by FIGS. 6/7A of each). *Id.*, ¶174. Accordingly, Examiner Vasat should have rejected the '628 patent's claims in view of *Deane* '426/*Deane*. *Id.*, ¶¶174-177.

C. The Examiner Should Have Rejected the '628 Patent's Claims in View of *Deane* '426 During Prosecution

Examiner Vasat should not have allowed the '628 patent's Challenged Claims because they are very similar to (and broader than) the '669 patent's January 20, 2020 application claims 24/38 found unpatentable over *Deane* '426. EX1003, ¶¶192, 195. For example, the following compares the '669 patent's January 20, 2020 claim 38 with the '628 patent's issued claim 11. Similar claim elements are in the same color.

<u>'628 patent</u>	<u>'669 patent</u>
[11a] 11. A portable oxygen concentrator, comprising:	38. A portable oxygen concentrator, comprising:

<u>'628 patent</u>	<u>'669 patent</u>
[11b] a cartridge module comprising a housing, the housing defining a receptacle;	a receptacle;
[11c] a separation cartridge selectively removable from the 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; and [11d] a power pack removable from the portable oxygen concentrator, [11i] wherein the bed of adsorbent material is disposed along an axis, [11j] wherein one of the inlet and the outlet is disposed along the axis, [11k] wherein the other of the inlet and the outlet is spaced-apart from the axis, and [11l] wherein the first direction and the second direction are substantially parallel to the axis.	a cartridge selectively removable from the receptacle by movement relative to the receptacle in a first direction, the cartridge comprising: a first bed of adsorbent material disposed along a first axis, wherein the first axis is substantially parallel to the first direction; 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; 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; 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 fluid flowing to the second bed or to

<u>'628 patent</u>	<u>'669 patent</u>
	expel fluid flowing away from the second bed; wherein the first, second, third, and fourth ports are oriented in a second direction opposite the first direction.

Thus:

- Both claims recite a **POC** with a **cartridge selectively removable** from a **receptacle** in a **first direction**;
- Both claims recite that the **cartridge** includes **inlets and outlets (ports) facing a second direction opposite the first**;
- Both claims recite that the cartridge includes **adsorbent arranged on an axis** of the cartridge; and
- Both claims recite one of the cartridge's **inlets and outlets (ports) are** disposed on **the first axis** and the other is **spaced apart** from **the axis**.

EX1003, ¶193.

The only apparent differences between these claims are: (i) the '669 patent's claim 38 requires two adsorbent beds, while the '628 patent's claim 11 was drafted in an attempt to cover cartridges with at least one adsorbent bed (not shown in the '628 patent); (ii) the '628 patent's claim 11 specifies the receptacle is arranged in a cartridge module while claim 38 of the '628 patent does not; and (iii) the '628 patent's claim 11 specifies the presence of a removable power pack in the POC

while the '628 patent's claim 38 does not. EX1003, ¶194. Difference (i) is not a patentable difference, and *Deane '426/Deane* clearly teaches differences (ii) and (iii). *See* FIGS. 6/7A of each and [11b]-[11d]. EX1003, ¶194. The features Examiner Vasat required be added to the '669 patent's claims to distinguish *Deane '426* are not in the '628 patent's claims. *Id.*, ¶189. Examiner Vasat should have rejected the '628 patent's claims in view of *Deane '426/Deane*. *Id.*, ¶195. In other words, had Examiner Vasat properly considered *Deane '426/Deane*⁴, along with the remainder of the prior art cited herein (or other similar art), the '628 patent's claims would not have issued. *Id.* Thus, Examiner Vasat erred by allowing the '628 patent's claims. *Id.*

IV. IDENTIFICATION OF CHALLENGE

A. Statutory Grounds

Petitioner requests IPR and cancellation of claims 1-23 ("the Challenged Claims") as follows:

Grounds	Claims	Statutory Basis	Prior Art
1	1-4, 6-17, 19-23	§103	<i>Deane</i> in view of <i>Dubois</i> and <i>Berntson</i>

⁴ There is no evidence Examiner Vasat properly considered *Deane/Deane '426 vis-à-vis* the '628 patent, as he didn't issue prior-art rejections citing it or mention it in reasons for allowance. EX1003, ¶¶158, 175.

2	2-3, 14-15, 22-23	§103	<i>Deane</i> in view of <i>Dubois</i> , <i>Berntson</i> , and <i>Occhialini</i>
3	5, 18	§103	<i>Deane</i> in view of <i>Dubois</i> , <i>Berntson</i> , and <i>Basset</i>
4	1-4, 7-17, 19, 21-23	§103	<i>Deane</i>
5	2-3, 14-15, 22-23	§103	<i>Deane</i> in view of <i>Occhialini</i>
6	5, 18	§103	<i>Deane</i> in view of <i>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)

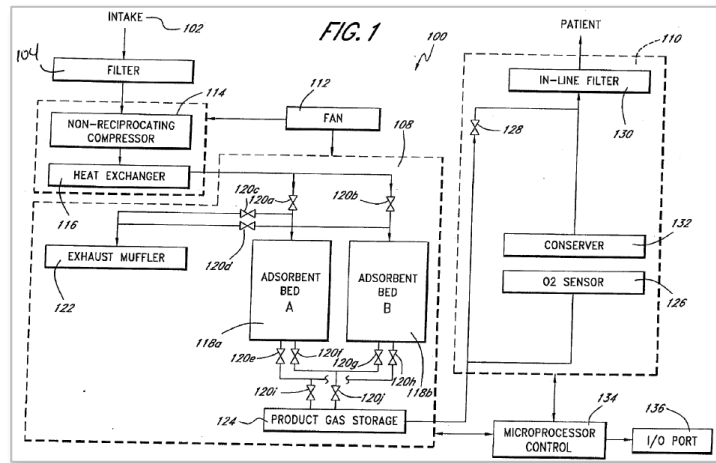
Deane (filed October 7, 2003; published April 7, 2005), is prior art under 35 U.S.C. §102(e)(1). *Deane* teaches⁶ a POC with PSA unit 108 having two adsorbent

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

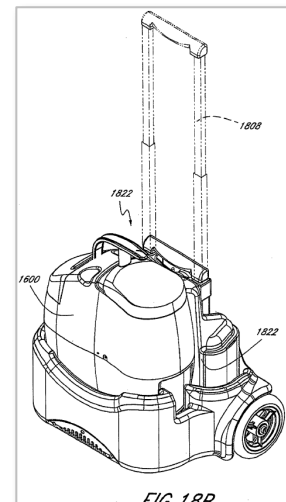
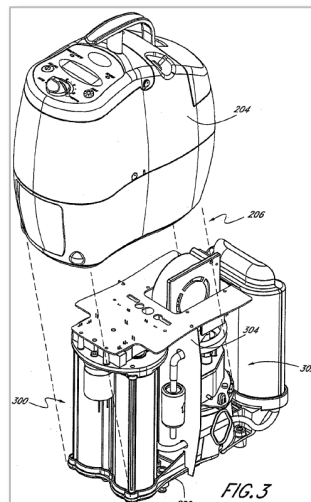
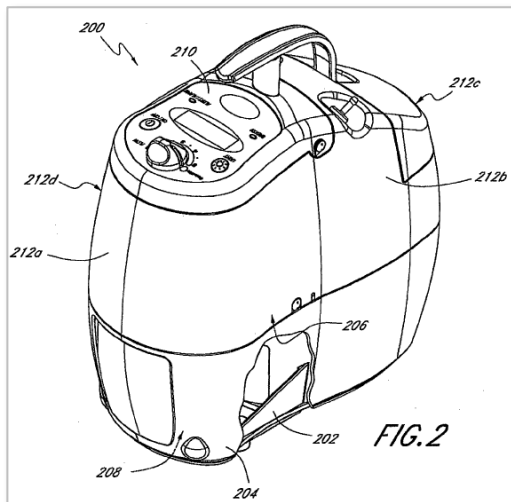
⁶ “Teaches” is used herein to mean “teaches or suggests.”

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, ¶202.

Deane's FIGS. 2/3 show



POC 200 includes chassis 202 and shell 204 forming a housing 206 where components are mounted. EX1004, ¶[0057]. EX1003, ¶¶203-204. Shell 204 is removable for testing, repair, or maintenance. EX1004, ¶[0058]. EX1003, ¶204. *Deane's* FIG. 18B shows POC 200 in “mobility cart” 1800. EX1004, ¶¶[0099]-[0101]. EX1003, ¶207.



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 614a, 614b (filters), and spring 616 to keep restraining disk 614a in position. EX1004, ¶[0068]. EX1003, ¶205.

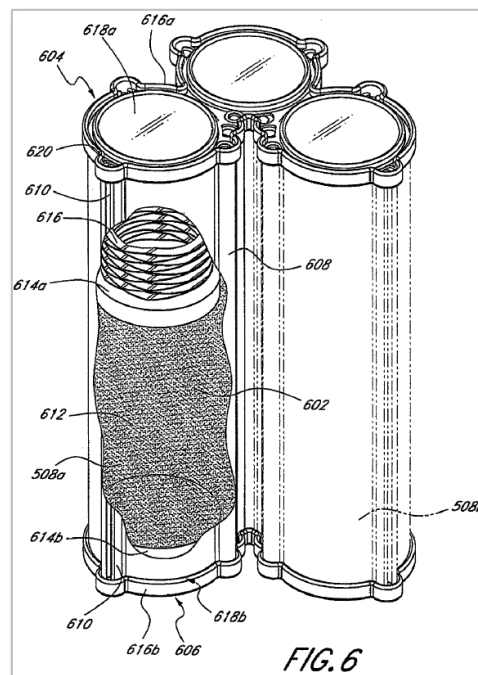
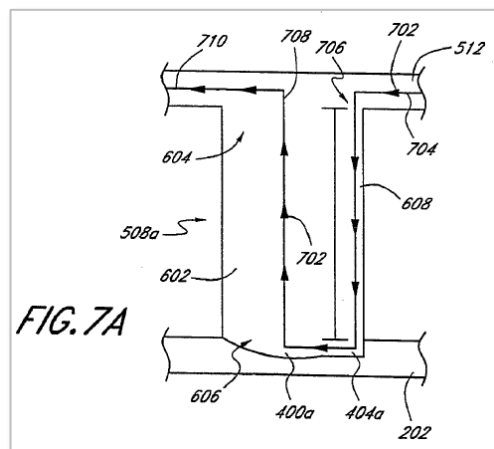
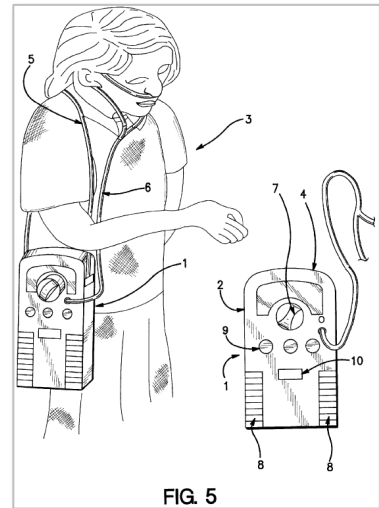


FIG. 7A illustrates gas flow in adsorbent bed columns 508a, 508b. Feed gas 702 is directed into upper opening 706 of feed tube 608, travels downwardly through tube 608 and through recess 400a into lower end 606 of housing 602, then travels upwardly through the adsorbent material in housing 602, which 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, ¶206.



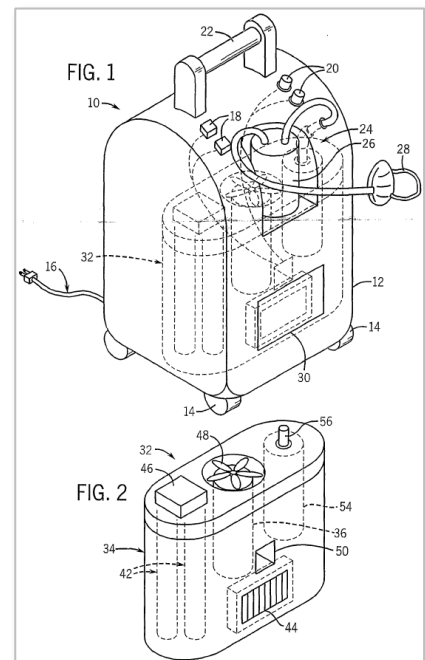
2. *Dubois* (EX1005)

Dubois (filed June 30, 2000; issued February 18, 2003), is prior art under 35 U.S.C. §102(b). *Dubois* teaches POC 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, ¶212.



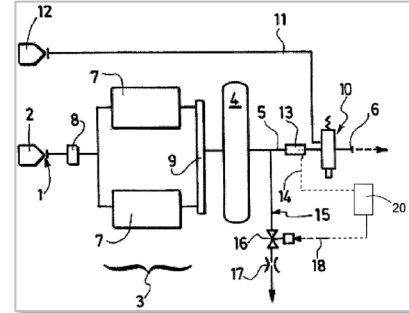
3. *Berntson* (EX1006)

Berntson (filed July 24, 2004; published February 3, 2005), is prior art under 35 U.S.C. §102(e)(1), and is entitled to its provisional’s filing date (July 24, 2003). EX1003, ¶¶455-461. *Berntson* teaches assembling multiple parts of oxygen concentrators together is difficult and reduces serviceability. EX1006, ¶¶[0004]-[0006]. *Berntson*’s solution is a separate oxygen-rich air generator (“ORAG”) unit 32 removably provided in housing 12 of oxygen concentrator 10, as shown in FIGS. 1/2. EX1006, ¶[0011], FIGS. 1-2. Chassis 34 of ORAG may be removably fastened to cabinet 12, and contains various components, including adsorbent containers 42. EX1006, ¶¶[0012]-[0013], [0017]. EX1003, ¶216.



4. *Basset* (EX1007)

Basset (filed August 2, 2004; published February 12, 2005) under 35 U.S.C. §102(e)(1). *Basset* teaches a POC with PSA unit 3 having two adsorbers 7 containing “[z]eolite, advantageously a lithium zeolite of the LiX type, preferably an LiLSX Zeolite.” EX1007, ¶¶[0001], [0012]-[0013]. EX1003, ¶220.



5. Occhialini (EX1073)

Occhialini (filed May 21, 2004; published November 24, 2005), is prior art under 35 U.S.C. §102(e)(1). *Occhialini* teaches there is a “need for optimized design of small, easily-carried, adsorption-based oxygen concentrators” and that many variables, including weights of POC components, may be tuned to achieve particular POC performance metrics. EX1073, ¶¶0004]; EX1003, ¶224. *Occhialini* teaches various examples of relationships between the total system, adsorbent, compressor, and battery weight related to various POC performance metrics. EX1073, ¶¶0098]-[0124], FIGS. 2-17. EX1003, ¶225.

C. Grounds for Standing

Petitioner certifies the '628 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 '628 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 1-6 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; EX1069.

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 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 USPTO hasn't previously considered the Grounds and arguments herein, based on *Deane* combined with *Dubois* and *Berntson* (and *Basset* and *Occhialini*) (or *Deane*, *Basset*, and *Occhialini*). While *Deane*, *Dubois*, and *Occhialini* were submitted (among ~200 other references) via IDS during the '628 patent's prosecution (EX1002, 413-434), the Examiner didn't apply *Deane*, *Dubois*, or *Occhialini* in any rejection or otherwise mention them during prosecution. EX1003, ¶¶208, 213, 226. *Berntson* and *Basset* were not of record. *Id.*, ¶¶217, 221. 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, ¶195. 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 '628 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 POCs 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, ¶¶227-230.

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*

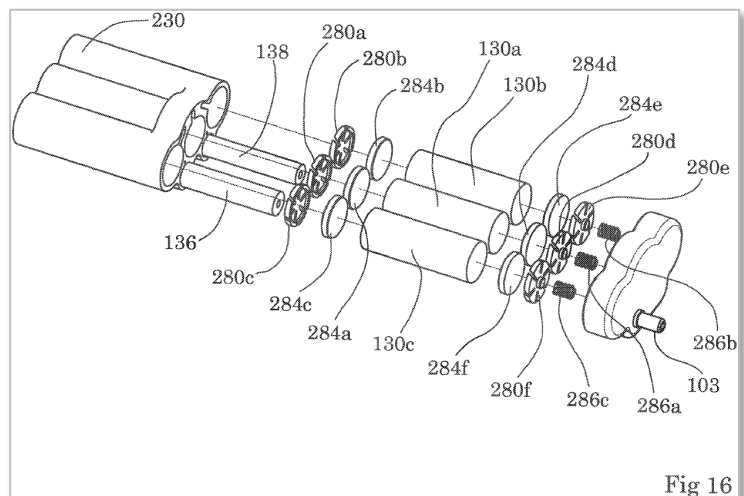
here, all terms have their plain and ordinary meaning. Petitioner does not waive any litigation argument as to scope, meaning, or invalidity.

A. “Separation Cartridge”

This term is found throughout the Challenged Claims. It has no specific meaning in the art. EX1003, ¶236. Outside the ’628 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, ¶238), each embodiment describes the separation cartridge as a case with multiple adsorbent columns, each having a dedicated inlet and outlet.

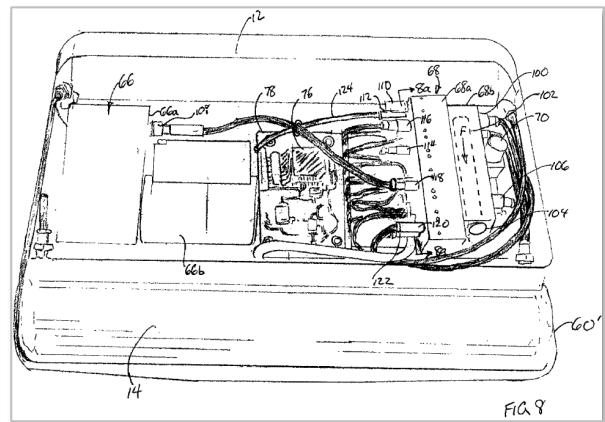
EX1001, 4:7-42, 4:60-5:4, 12:6-14, 18:30-40, 18:57-19:3, FIGS. 5, 7, 15-16 (reproduced here).



EX1003, ¶¶240-244. In the context of the ’628 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, ¶244. It also allows the use of single inlet/outlet filters (136/138) for the adsorbent columns. EX1003, ¶¶244-245.

During prosecution, the Examiner
a “separation cartridge.” EX1002, 253-
255. Applicant noted the Examiner’s
position, but did not agree, thus
providing little context. EX1002, 253-
255; 237. But the prosecution history of
the other members of the ’628 patent’s



family is more instructive. For example, 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), but 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). EX1003, ¶¶251-256. This supports “separation cartridge” meaning a module with multiple adsorber beds. EX1003, ¶255.

Accordingly, a POSITA would have understood “separation cartridge” in the context of the ’628 patent as “a housing that holds multiple adsorbent columns for gas separation and provides separate inlet and outlet ports for each adsorbent column.” EX1003, ¶¶246-248, 258-259.

B. “Receptacle”

This term is found in Challenged Claims 1/11. It has no specific meaning in the art. EX1003, ¶261. Outside the ’628 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.*, ¶262.

The ’628 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, ¶¶263-264.

The ’628 patent’s file history is also instructive, as the Examiner compared prior art features to “receptacles” (*e.g.*, *Warren* ’095’s (EX1012) housing 60 and *Dechene*’s (EX1021) housing A). EX1053, 135-39. Applicant didn’t disagree.

EX1053, 115-22. EX1003, ¶268. *See also* EX1052, 149, 183-84, 301-02. EX1003, ¶267.

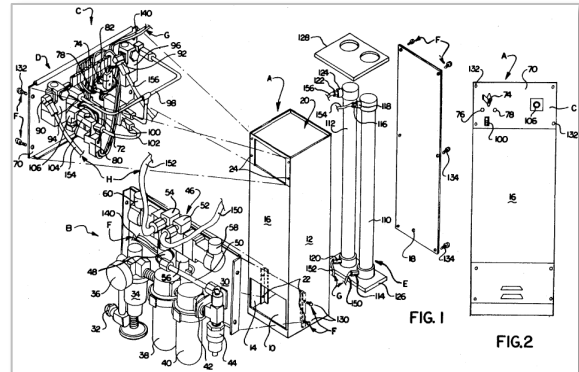
Accordingly, a POSITA would have understood “receptacle” in the context of the ’628 patent as “a structure that releasably interfaces with the inlet(s) and outlet(s) of the separation cartridge and at least partially contains the separation cartridge.” EX1003, ¶¶269-270.

C. “Selectively Removable [From A Receptable]”

This term is found in Challenged Claims 1/11. It has no specific meaning in the art. EX1003, ¶272. Outside the ’628 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.*, ¶273.

The ’628 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, ¶275. Regarding “removable,” the specification describes separation cartridges as “removable.” *See, e.g.*, EX1001, 2:54-58, 3:6-8, 11:61-12:3. EX1003, ¶276. 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 '628 patent's file history is also instructive, as 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, ¶¶281-282.



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, ¶284.

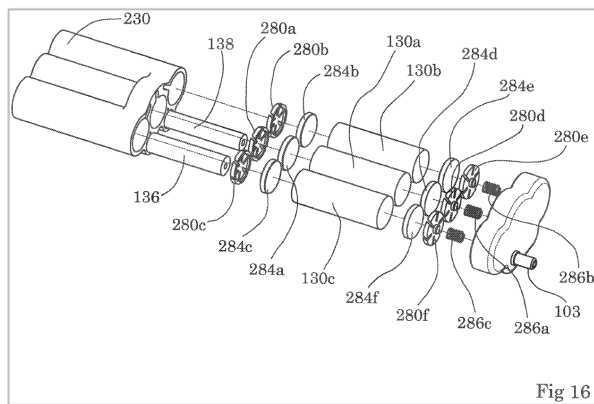
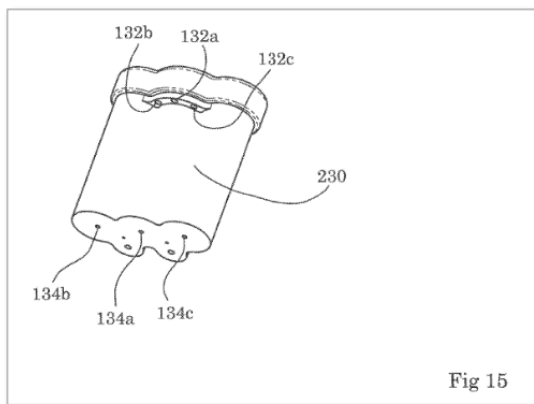
Accordingly, a POSITA would have understood “selectively removable [from a receptacle]” in the context of the '628 patent means the separation cartridge is “withdrawable or separable as a whole from a receptable.” EX1003, ¶¶283, 285.

D. “Axis”

This term is found in Challenged Claims 1/11. It has no specific meaning in the art. EX1003, ¶287. Outside the '628 patent's context, a POSITA would have generally understood it to describe a straight line with respect to which a body or

figure is symmetrical. *Id.* Claim 1 does not provide further guidance as to the meaning of this term other than specifying that “the bed of adsorbent material is disposed along an axis,” which would indicate to a POSITA that the relevant axis is the centerline of the adsorbent material itself. *Id.*, ¶288.

The '628 patent's specification provides no explicit definition for “axis,” and does not describe any separation cartridge features using “axis.” EX1003, ¶288. FIGS. 15-16 (*see below*) are instructive when read with the claims, as they show outlets 134 centered at the ends of adsorbent columns 130. Because the claims also require one of the inlets and outlets to be arranged on the axis, this reinforces the understanding that the axis is the centerline of the adsorbent material beds.



EX1003, ¶289.

Accordingly, a POSITA would have understood “axis” in the context of the '628 patent means the centerline of the bed of adsorbent material. EX1003, ¶290.

VII. CHALLENGED CLAIMS

A. Ground 1

A POSITA would have found claims 1-4, 6-17, and 19-23 obvious based on *Deane*, *Dubois*, and *Berntson*'s teachings. EX1003, ¶292.

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

Deane teaches the features of at least claims 1-4, 6-17, and 19-23. *See* §VII.A.2-17. If the Challenged Claims are understood to require more portability than taught by *Deane* (they shouldn't be), it would have been obvious to modify *Deane* in view of *Dubois*, which teaches a patient-wearable POC. *See* §VII.A.2.[1a]. And if the Challenged Claims are understood to require a more distinct cartridge than 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]-[1c].

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, ¶293. *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, ¶294. 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*, among other references discussed herein). EX1003, ¶295.

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 of the importance of making POCs highly-portable. EX1003, ¶296. 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, ¶297. 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, ¶298.

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, ¶302. Similarly, *Berntson* teaches a POC with a “separation cartridge” (its ORAG unit) mountable inside a concentrator’s housing and removed for maintenance. EX1006, ¶[0019]. EX1003, ¶¶300-301. 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, ¶302. 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, ¶303. 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.*, ¶304.

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.*, ¶305.

Therefore, at the time of the alleged invention of the Challenged Claims, a POSITA would have been motivated to combine (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) 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, ¶¶299, 306.

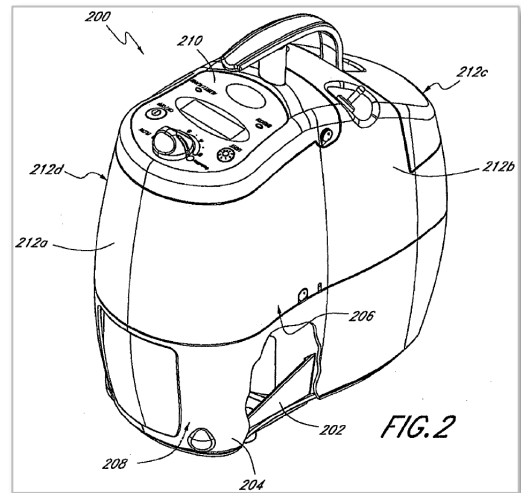
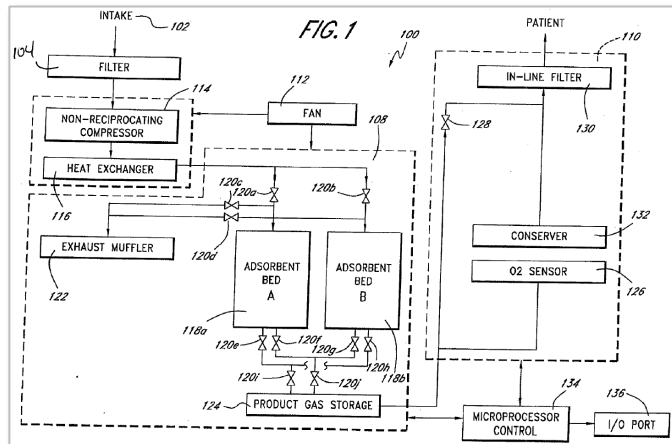
2. Claim 1

The combination of *Deane*, *Dubois*, and *Berntson* renders Claim 1 obvious. EX1003, ¶307.

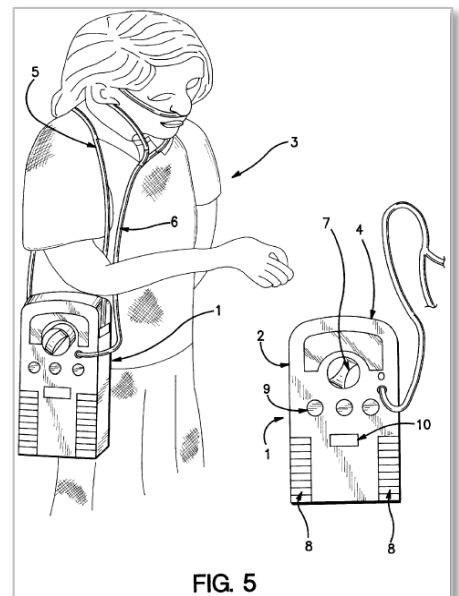
[1a] 1. A portable oxygen concentrator, comprising:
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If a limitation (it is not), *Deane* combined with *Dubois* and *Berntson* renders [1a] obvious because *Deane* teaches “a portable gas fractionalization system” or “compact oxygen concentrator that 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]-[0013], [0093] (“portable oxygen concentrator unit 1600”); elements [1b]-[11] below. EX1003, ¶¶308-312, 319.



Deane also teaches throughout the portable nature of its POC, including in the above-cited portions and in view of, for example, its handle and wheeled mobility cart 1800. EX1004, FIGS. 2, 16A, 18A-18B, ¶¶[0099]-[0101]. EX1003, ¶313. Should PO argue *Deane*’s teachings are deficient regarding portability, it would have been obvious to make *Deane*’s POC even more portable, including by sizing it for a patient-wearable belt or strap as depicted in *Dubois*’s figures.



EX1005, 3:25-30, 6:21-25, FIG. 5 (reproduced here). EX1003, ¶314. As discussed above, a POSITA would have been motivated to modify *Deane* in view of *Dubois*

to improve *Deane*'s POC's portability. EX1003, ¶315. Moreover, portable/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, ¶316.

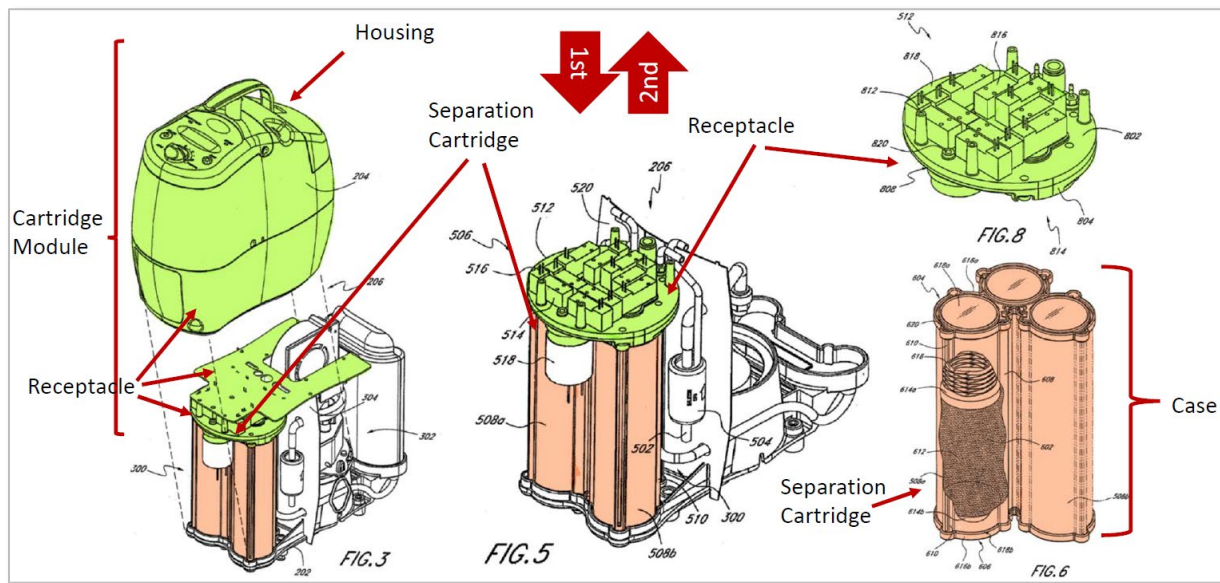
Further, during prosecution of a member of the '628 patent's family, applicant confirmed *Deane* '059, which is similar to *Deane*, teaches a POC. EX1049, 40, 178-179. EX1003, ¶317.

Lastly, *Deane*'s (with/without *Dubois*) teaching of [1a] is consistent with infringement assertions in the related litigation. EX1003, ¶318.

[1b] a cartridge module comprising a housing, the housing defining a receptacle;

Deane combined with *Dubois* and *Berntson* renders [1b] obvious because *Deane* teaches a cartridge module comprising a housing (e.g., at least shell 204, shaded green in the annotated drawings below), the housing defining a receptacle (e.g., manifold 512 or a combination of manifold 512 and inner surfaces of shell 204, shaded green in the annotated drawings below, along with circuit board 1314 and/or other intervening components). EX1004 at, e.g., ¶¶[0007]-[0008], [0010]-[0011], [0013]-[0014], [0016]-[0019], [0024]-[0027], [0035]-[0036], [0057]-[0059], [0062]-[0070], [0086], [0092]-[0093], FIGS. 2-3, 5-8, 13-16. *Berntson* also teaches a housing or cabinet of an oxygen concentrator defining a "receptacle" into

which a “separation cartridge”—oxygen-rich air generator (ORAG) unit—can be mounted. EX1006, ¶¶[0011]-[0012]. EX1003, ¶¶320-321, 334. The annotated versions of *Deane*’s FIGS. 3, 6, and 7A below provide further explanation and examples of how *Deane* teaches [1b] as described herein. EX1003, ¶322.



“a cartridge module comprising a housing ...”: More specifically (and further to the above), *Deane* renders this feature of [1b] obvious because it teaches a POC with shell 204 (shaded green in the annotated drawings), which a POSITA would have understood to be a cartridge module with a housing. EX1004 at, e.g., ¶¶[0007]-[0008], [0010]-[0011], [0013]-[0014], [0018], [0024]-[0027], [0035]-[0036], [0057]-[0059], [0062]-[0070], [0086], [0092]-[0093], FIGS. 2-3, 7, 13-16. EX1003, ¶323. A POSITA would have considered outer surfaces of shell 204 to be the outer surface of the cartridge module’s housing and one or more of the

elements identified below, including the inner surface of shell 204, as forming the inner portion of the “housing” defining the “receptacle.” EX1003, ¶323.

“... the housing defining a receptacle”: Per §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. EX1003, ¶324.

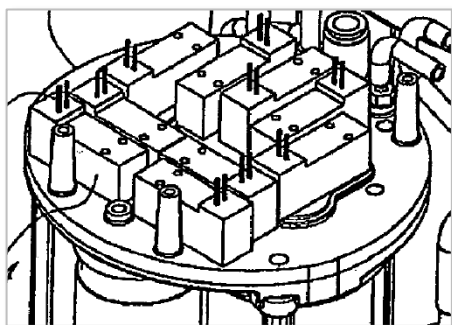
Deane renders this feature of [1b] obvious because it teaches its housing (*e.g.*, shell 204) defines a receptacle formed by: (i) manifold 512; or (ii) a combination of manifold 512 and the inner portion of shell 204 (shaded **green** in the annotated figures), as those elements releasably interface with the inlet(s) and outlet(s) of the separation cartridge (adsorbent housing 602⁷ / adsorbent bed columns 508a, 508b, shaded **orange** in the annotated drawing, *see* [1c]) and at least partially contain the separation cartridge. EX1003, ¶324. EX1004 at, *e.g.*, ¶¶[0007]-[0008], [0010]-[0011], [0014], [0016]-[0019], [0024]-[0026], [0035]-[0036], [0057]-[0059], [0062]-[0070], [0086], [0092]-[0093], FIGS. 3, 5, 6, 7, 8, 13-15. EX1003, ¶324. More specifically, *Deane* teaches a “receptacle” formed of manifold 512 or the combination of manifold 512 and the inner portion of shell 204, for several reasons. EX1003, ¶¶325-326.

⁷ Adsorbent housing 602 houses adsorbent material and should not be confused with the claimed housing, which corresponds to, *e.g.*, *Deane*’s shell 204.

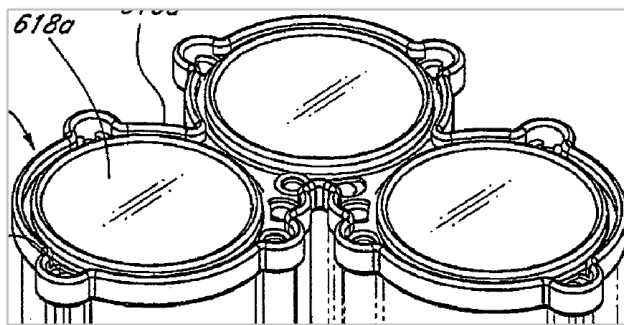
First, *Deane* teaches its separation cartridge (e.g., adsorbent housing 602 / adsorbent bed columns 508a, 508b; see [1c])) may be connected to integrated manifold 512, which releasably interfaces with the inlet(s) and outlet(s) on the upper end of adsorbent housing 602 / adsorbent bed columns 508a, 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], [0063] (“[I]ntegrated manifold 512 contains a plurality of integrated flow passages formed in a single plane that permit fluid to flow to and from the columns 508a-b, 510.... [T]he integrated manifold 512 is mounted on the upper end of the columns 508a-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], [0086], FIGS. 3, 5-7. EX1003, ¶327.

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 following partial reproductions. For example, *Deane* repeatedly teaches these features are “mounted” to each other. *See, e.g.*, EX1004, Abstract, ¶¶[0007], [0014], [0017]-[0018], [0059], [0062], [0063], [0065], [0066]-[0067], [0070], [0086], FIGS. 3, 5-7. As shown below,

when they are mated, manifold 512 couples to and partially surrounds/contains housing 602 / adsorbent bed columns 508a, 508b. EX1003, ¶328.



Deane FIG. 5



Deane FIG. 6

Third, *Deane* teaches the inner portion of its shell 204 also at least partially contains adsorbent housing 602 / adsorbent bed columns 508a, 508b (e.g., a “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, ¶329.

Thus, a POSITA would have understood *Deane*’s: (i) manifold 512; or (ii) manifold 512 and inner portion of 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 inner portion of shell 204 together at least

partially contain adsorbent housing 602 / adsorbent bed columns 508a, 508b.

EX1003, ¶¶330-331.⁸

Finally, should PO argue *Deane* doesn't teach the above features, *Berntson* does. For example, *Berntson* teaches a housing defining a "receptacle" into which a "separation cartridge"—oxygen-rich air generator (ORAG) unit—can be mounted. EX1006, ¶¶[0011]-[0012]. As explained in §VII.A.1, 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 that is removable as a whole from the receptacle of a concentrator, *e.g.*, for maintenance purposes. EX1006, ¶[0019], FIGS. 1-2. EX1003, ¶332.

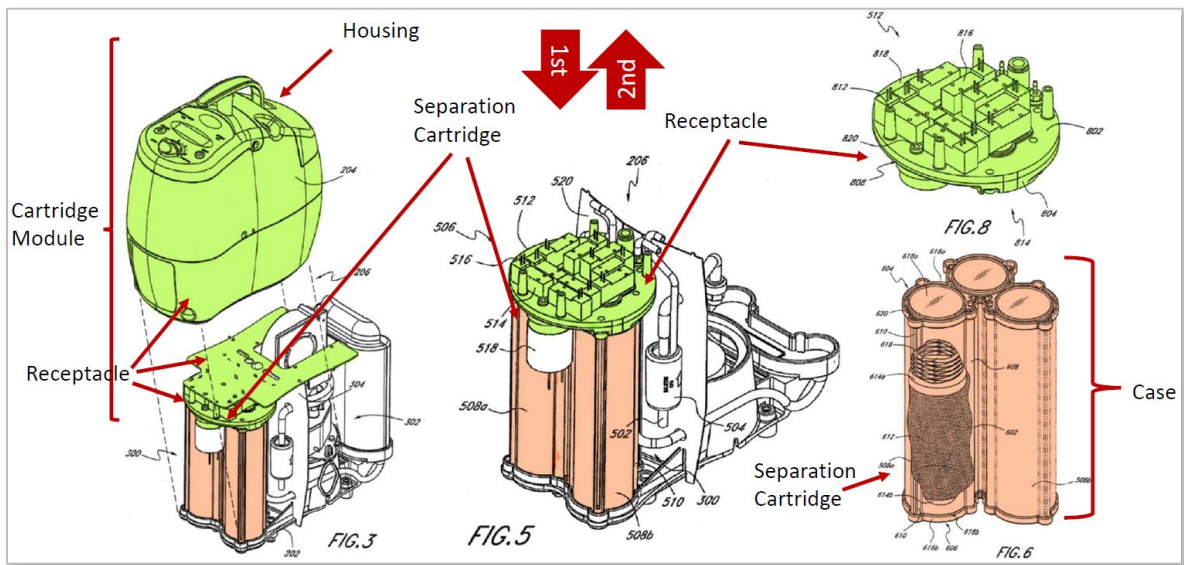
Lastly, *Deane*'s (with/without *Berntson*) teaching of [1b] is consistent with infringement assertions in the related litigation. EX1003, ¶333.

⁸ Should PO argue manifold 512 and shell 204 cannot satisfy "receptacle" because they are not integral, PO would be incorrect. EX1003, ¶348. Making components separate/integral is obvious as a matter of law where no functionality is gained or lost via that choice. *In re Larson*, 340 F.2d 965, 968 (C.C.P.A. 1965); *KSR*, 550 U.S. at 417. 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, ¶348.

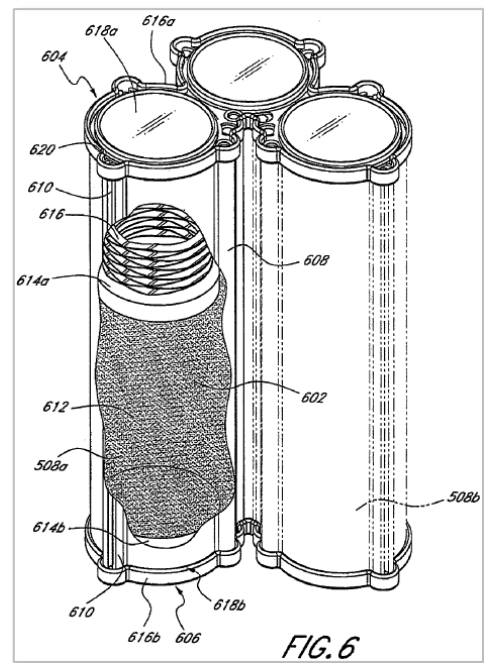
[1c] a separation cartridge selectively removable from the receptacle by movement relative to the receptacle in a first direction, the separation cartridge comprising a case at least partially defining an outer volume of the separation cartridge, an inlet oriented in a second direction opposite the first direction, an outlet oriented in the second direction, and a bed of adsorbent material configured to preferentially adsorb nitrogen, the case at least partially surrounding the bed of adsorbent material;

Deane combined with *Dubois* and *Berntson* renders [1c] 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 the 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 annotated figures below), the separation cartridge comprising a case at least partially defining an outer volume of the separation cartridge (*e.g.*, adsorbent housing 602 and/or other outer surfaces of adsorbent housing 602 / adsorbent bed columns 508a, 508b, shaded in orange in the annotated drawings below), 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 annotated 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), the case at least partially surrounding the bed of adsorbent material (e.g., housing 602). EX1004 at, e.g., ¶¶[0007]-[0008], [0010]-[0011], [0014], [0017]-[0018], [0035]-[0036], [0057]-[0059], [0062]-[0063], [0065]-[0070], [0086], [0092], FIGS. 3, 6-7. EX1003, ¶335-336, 369. *Berntson* also teaches a “separation cartridge selectively removable from a receptacle”—oxygen-rich air generator (ORAG) unit mountable inside a housing of a concentrator and “removably fastened” to the housing within what a POSITA would have understood is a “receptacle.” EX1006, ¶¶[0011]-[0012]. EX1003, ¶335-336, 369. The annotated versions of *Deane*’s FIGS. 3, 6, and 7A below provide further explanation and examples of how *Deane* teaches [1c] as described herein. EX1003, ¶337.



“a separation cartridge...”: Per §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 [1c] obvious because (further to the above), it teaches an adsorbent housing 602 / adsorbent bed columns 508a, 508b component (as shown in FIG. 6)⁹, where each column 508a, 508b contains adsorbent material 612 (*e.g.*, zeolite)



⁹ “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

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] (“Each adsorbent bed column 508a-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 508a-b, 510 are mounted side by side in the housing 206.”), [0066]-[0070], [0092], FIGS. 3, 6, 7. EX1003, ¶338. Columns 508a, 508b also each have a separate inlet and outlet, as discussed below. EX1003, ¶338.

If “separation cartridge” is defined more broadly as requiring a housing with at least one adsorber column, inlet, and outlet (not supported by the ’628 patent), *Deane* also teaches such a configuration, for at least the reasons above, as (for

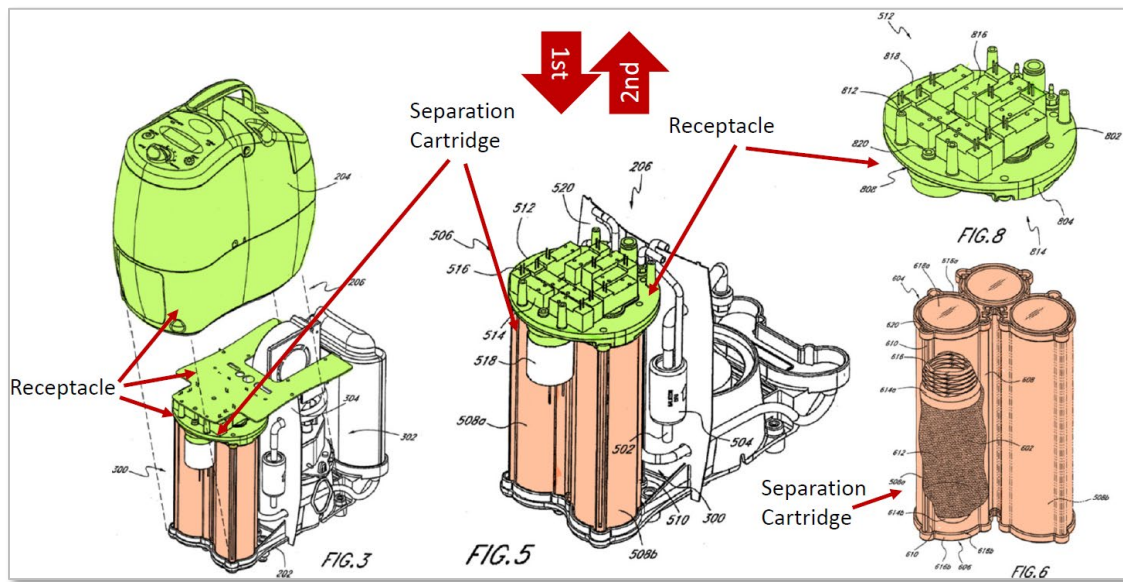
shown in FIG. 6. If one component is identified singly herein for brevity, it is intended to mean the entire structure. A POSITA would have understood *Deane* to teach that housing 602 extends around each of the adsorbent bed columns (*e.g.*, 508a, 508b) and/or each adsorbent bed column (*e.g.*, 508a, 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, ¶338.

example) a housing with multiple adsorber columns would also be a housing with at least one adsorber column. EX1003, ¶339.

Additionally, during prosecution of the ‘628 patent family, examiners repeatedly compared *Deane*’s above features to a “separation cartridge” without disagreement by applicant. EX1050, 58-59; EX1052, 16. EX1003, ¶340.

“...selectively removable from the receptacle...”: More specifically (and further to the above), per §VI.C, “selectively removable [from a receptacle]” means that the separation cartridge is “withdrawable or separable as a whole from a receptacle” and, as discussed in [1b], *Deane* teaches a “receptacle” as manifold 512, or a combination of manifold 512 and inner portion of shell 204 (shaded **green** in the annotated figures). EX1003, ¶341.

Deane renders this feature of [1c] obvious because it teaches adsorbent housing 602 / adsorbent bed columns 508a, 508b (the “separation cartridge” discussed above and shaded **orange** in the annotated figures) is withdrawable or separable as a whole (*e.g.*, “selectively removable”) from manifold 512, or a combination of manifold 512 and inner portion of shell 204 (*e.g.*, the “receptacle,” shaded **green** in the figures). EX1003, ¶342.



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, as discussed above, that integrated manifold 512 is “mounted” to adsorbent housing 602 / adsorbent bed columns 508a, 508b. *See, e.g.*, EX1004, Abstract, ¶¶[0007], [0014], [0017]-[0018], [0059], [0062]-[0063], [0065]-[0067], [0070], [0086], FIGS. 3, 5-7. EX1003, ¶343. 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 inner portion of 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 inner portion of shell 204). EX1003, ¶¶343, 346. Indeed, a POSITA would have recognized these

components are disconnectable, or would have considered it obvious to make such disconnection possible, because adsorption beds must periodically be replaced. EX1003, ¶344. *Deane* also teaches its components can be connected/disconnected for repair/maintenance. EX1004, ¶¶[0057]-[0058]. EX1003, ¶345.

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 removable from battery slot 412. EX1004, ¶¶[0059], [0080]-[0081], [0099], [0100]. EX1003, ¶347.

Further, should PO argue *Deane* doesn’t teach a separation cartridge “selectively removable from a receptacle,” *Berntson* teaches such a feature because it teaches its ORAG unit removable as a whole from the receptacle of a concentrator, *e.g.*, for maintenance. EX1006, ¶[0019]. EX1003, ¶350. ORAG 32 contains adsorbent containers 42, among other components, and includes inlet filtration 44 and oxygen-rich air outlet 56. EX1006, ¶[0012]. ORAG 32 is “removably fastened” in the concentrator housing in what a POSITA would have understood to be a “receptacle.” EX1006, ¶¶[0011]-[0012], [0019]. EX1003, ¶350. 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 structure is a receptacle as properly construed. EX1003, ¶350. As explained above, a POSITA would have been motivated to incorporate *Berntson*'s teachings into *Deane*'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. EX1006, ¶[0019]. EX1003, ¶349.

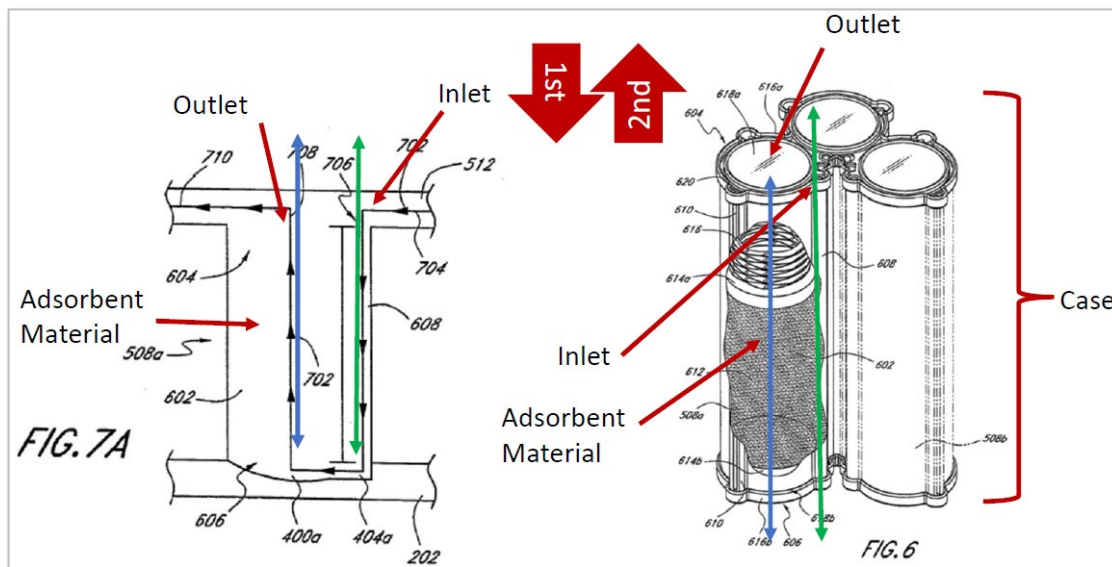
Lastly, selectively removable components, including batteries and separation cartridges, were generally known by POSITAs by 2004-2005. EX1003, ¶351. Thus, should PO argue *Deane* (and/or *Berntson*) is somehow deficient as to teaching this feature of [1c], it would have been obvious to a POSITA based 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, ¶351.

“...by movement relative to the receptacle in a first direction...”: More specifically (and further to the above), *Deane* renders this feature of [1c] obvious because, as shown in the annotated figures, a POSITA would have understood 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. EX1003, ¶352. A POSITA would have recognized this to be the intended removal direction: (i) by reviewing *Deane*’s Figures (EX1003, ¶352); and (ii) 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 (EX1003, ¶352). Further, if removal in a direction other than the 1st direction would even have been possible, a POSITA would have considered it obvious to separate these components in the “1st” direction to maintain the airtightness of the various connections. EX1003, ¶352.

“... the separation cartridge comprising a case at least partially defining an outer volume of the separation cartridge, an inlet oriented in a second direction opposite the first direction, an outlet oriented in the second direction ...”: More specifically (and further to the above), *Deane* renders this feature of [1c] obvious because it teaches its adsorbent housing 602 / adsorbent bed columns 508a, 508b (*e.g.*, the “separation cartridge” as discussed above and shaded **orange** in the annotated images) has a case (*e.g.*, the adsorbent housing 602 and/or other outer surfaces of adsorbent housing 602 / adsorbent bed columns 508a, 508b, shaded **orange** in the annotated drawings above), inlets (*e.g.*, 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 annotated figures below), and outlets (e.g., upper ends 604 of each column 508a, 508b) oriented in the second direction.¹⁰ EX1004, [0066], [0070]. EX1003, ¶¶353, 358.



Regarding the “case,” as shown in FIG. 6, *Deane* teaches adsorbent housing 602 (and/or other outer surfaces of adsorbent housing 602 / adsorbent bed columns 508a, 508b) with upper/lower ends 604/606 and integrated feed tube 608 that contains adsorbent material 612 (zeolite). EX1004, ¶[0068]. As discussed above, a

¹⁰ 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. EX1003, ¶353.

POSITA would have understood *Deane* to teach housing 602 extends around each adsorbent bed column (*e.g.*, 508a, 508b) and/or each adsorbent bed column (*e.g.*, 508a, 508b) to have individual housings 602 that are interconnected. EX1003, ¶354. In either case, this outer structure defines a case. EX1003, ¶354. *Berntson* also teaches its ORAG unit (a “separation cartridge” for the reasons above) includes an outer case, as shown in FIGS. 1-2. EX1006, ¶¶[0011]-[0012], FIGS. 1-2. As explained above, a POSITA would have been motivated to incorporate *Berntson*’s teachings into *Deane*’s POC to provide an improved removable cartridge. EX1006, ¶[0019], FIGS. 1-2. EX1003, ¶355.

Regarding the “inlet,” *Deane* teaches opening 706 of feed tube 608 at upper end 604 of each column 508a-b is an inlet into which feed gas 702 (ambient air) flows. EX1004, FIG. 7, ¶[0066], [0070]. 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. EX1004, FIGS. 5, 6. EX1003, ¶356.

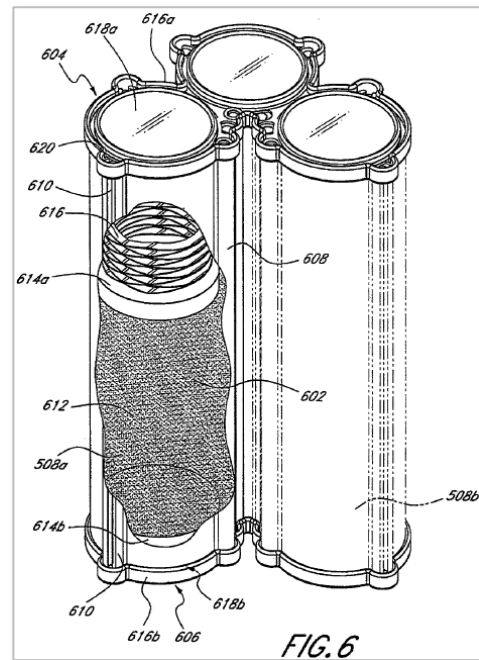
Regarding the “outlet,” *Deane* teaches product gas 708 flows out of upper end 604 of each column 508a-b into a product stream. EX1004, FIG. 7, ¶[0070]. Opening 604 is oriented in the same direction as opening 706—opposite the direction in which the housing 602 / adsorbent bed columns 508a, 508b is removed from manifold 512. EX1003, ¶357.

Should PO argue *Deane* is somehow deficient as to teaching these features of [1c], providing a separation cartridge with a case and inlets/outlets at the same end 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 teachings to improve replacement speed or simplify the manifold configuration. EX1003, ¶359.

Lastly, both the applicant and Examiner in related applications confirmed *Deane*'s teachings render this feature of [1c] obvious. EX1049, 40; EX1052, 16. EX1003, ¶¶360-361.

“... the separation cartridge comprising ... a bed of adsorbent material configured to preferentially adsorb nitrogen, the case at least partially surrounding the bed of adsorbent material”: More specifically (and further to the above), *Deane* renders this feature of [1c] obvious because it teaches its adsorbent housing 602 / adsorbent bed columns 508a, 508b (the “separation cartridge” as discussed above and shaded **orange** in the annotated images above) has beds of adsorbent material 612 configured to preferentially adsorb nitrogen, and the case (housing 602 and/or other outer surfaces of adsorbent housing 602 / adsorbent bed columns 508a, 508b) at least partially surrounds those beds. EX1003, ¶¶362, 365.

First, as shown repeatedly above, *Deane* teaches its separation cartridge includes two adsorbent columns 508a-b and beds 118a-b that preferentially adsorb nitrogen. EX1004, [0036], [0062], [0068]. EX1003, ¶363. Second, as discussed above, as shown in FIG. 6, *Deane* teaches its housing 602 (and/or other outer surfaces of adsorbent housing 602 / adsorbent bed columns 508a, 508b) contains



(therefore at least partially surrounds) adsorbent material 612 (zeolite). EX1004, ¶[0068], FIG. 6. EX1003, ¶364.

Additionally, providing adsorbent material in a cartridge was generally known by POSITAs by 2004-2005. EX1003, ¶366. Thus, should PO argue *Deane* is somehow deficient as to teaching this feature of [1c], 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. *Id.*, ¶366.

Further, the Examiner in a related application confirmed *Deane's* teachings render this feature of [1c] obvious. EX1047, FIG. 6. EX1003, ¶367.

Finally, *Deane's* teaching of [1c] (with or without the teachings of *Berntson*) is consistent with infringement assertions in the related litigation. EX1003, ¶368.

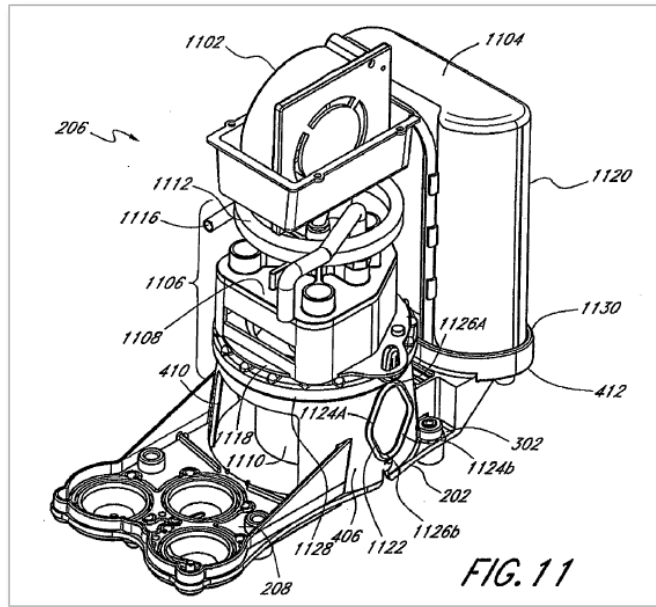
- | | |
|------|--|
| [1d] | a power pack removable from the portable oxygen concentrator; |
| [1e] | a pump electrically coupled to the power pack, the pump operable to cause a flow of fluid to move relative to the adsorbent material; |
| [1f] | a user interface configured to allow a patient to adjust and monitor operation of the portable oxygen concentrator; |
| [1g] | a carrying device for transporting the portable oxygen concentrator; |
| [1h] | wherein the housing of the cartridge module is configured to at least partially surround the case of the separation cartridge, |

Deane combined with *Dubois* and *Berntson* renders [1d]-[1h] obvious because *Deane* teaches a power pack removable from the portable oxygen concentrator (e.g., battery 1104); a pump electrically coupled to the power pack, the pump operable to cause a flow of fluid to move relative to the adsorbent material (e.g., compressor 1108); a user interface configured to allow a patient to adjust and monitor operation of the portable oxygen concentrator (e.g., user interface panel 1602); a carrying device for transporting the portable oxygen concentrator (e.g., the POC handle and/or mobility cart 1800); wherein the housing of the cartridge module is configured to at least partially surround the case of the separation cartridge (e.g., shell 204 and/or other components identified in [1b] surrounds housing 602 and/or other outer surfaces of adsorbent housing 602 / adsorbent bed columns 508a, 508b). EX1004 at, e.g., ¶¶[0056], [0068], [0080]-[0081], [0092], [0094], [0098]-[0100], FIGS. 3, 5-6, 11. *Dubois* also teaches a

carrying device. EX1005, 3:25-30, 6:21-25, FIG. 5 (*e.g.*, belt or strap). EX1003, ¶¶370-371, 381.

“[1d] a power pack removable from the portable oxygen concentrator”:

Deane renders [1d] obvious because it teaches battery 1104 removably mountable (from “battery bail”) on a POC and powering all its systems. EX1004, ¶¶[0068], [0081], [0100], EX1003, ¶372. *Dean’s* removable battery 1104 is shown in FIG. 11.



See also EX1004, ¶¶0099 (spare batteries). EX1003, ¶372.

“[1e] a pump electrically coupled to the power pack, the pump operable to cause a flow of fluid to move relative to the adsorbent material”: Deane renders [1e] obvious because it teaches compressor 1108 pressurizes air and delivers it (via heat exchanger) as feed gas to adsorbent columns to produce product gas. EX1004, ¶¶0092]. EX1003, ¶373. A POSITA would have understood that, for feed gas (a claimed “flow of fluid”) to become product gas after being supplied to Deane’s adsorbent columns, the feed gas would “move relative to the bed of adsorbent material.” EX1003, ¶373. That is how POCs such as Deane’s work. EX1003, ¶373. Deane teaches “the compressor 1108 can...be a vacuum pump or a combination of

a vacuum pump and a compressor.” EX1004, ¶[0080]. *Deane*’s compressor/pump 1108 is electrically coupled to battery 1104, as shown in FIG. 11; this is also clear because *Deane*’s battery powers all its POC’s systems. EX1003, ¶373.

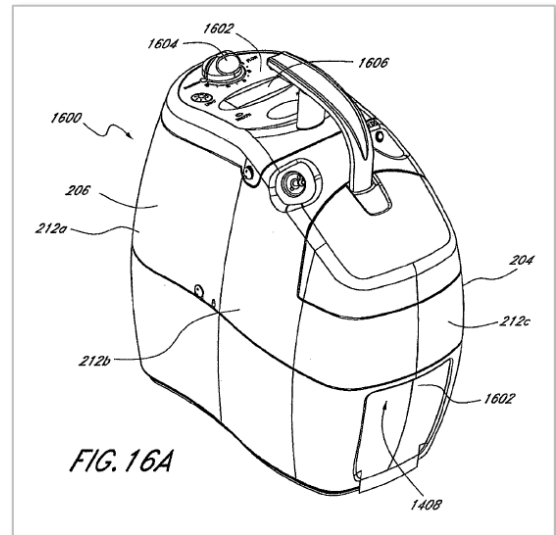
“[1f] a user interface configured to allow a patient to adjust and monitor operation of the portable oxygen

concentrator”: *Deane* renders [1f] obvious because it teaches “user interface panel 1602 containing a plurality of system controls 1604 such as flow rate and on-off switches.” EX1004, ¶[0094], FIG. 16.

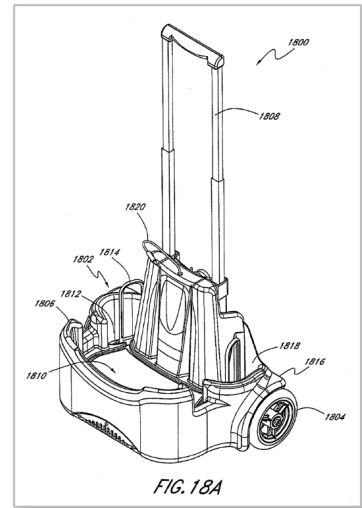
EX1003, ¶374. *Deane*’s user interface

allows patient adjustment of *Deane*’s POC operation (*e.g.*, adjust flow rate or turn on/off). EX1004, ¶[0094]. A POSITA would have understood *Deane*’s user interface would also monitor POC operation (*e.g.*, flow rate, oxygen content).

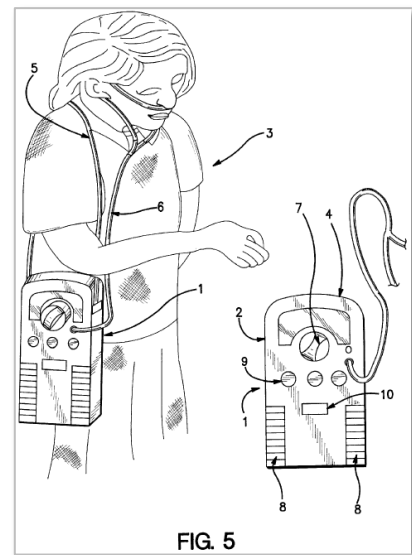
EX1004, ¶¶[0056], [0094]. EX1003, ¶374.



“[1g] a carrying device for transporting the portable oxygen concentrator”: *Deane* alone or in combination with *Dubois* renders [1g] obvious because *Deane* teaches its POC has a handle to grip/lift the POC for transport, and that the POC may be placed in mobility cart 1800. EX1004, ¶[0099], FIGS. 16A, 18A. EX1003, ¶375. Either is a carrying device. EX1003, ¶375.

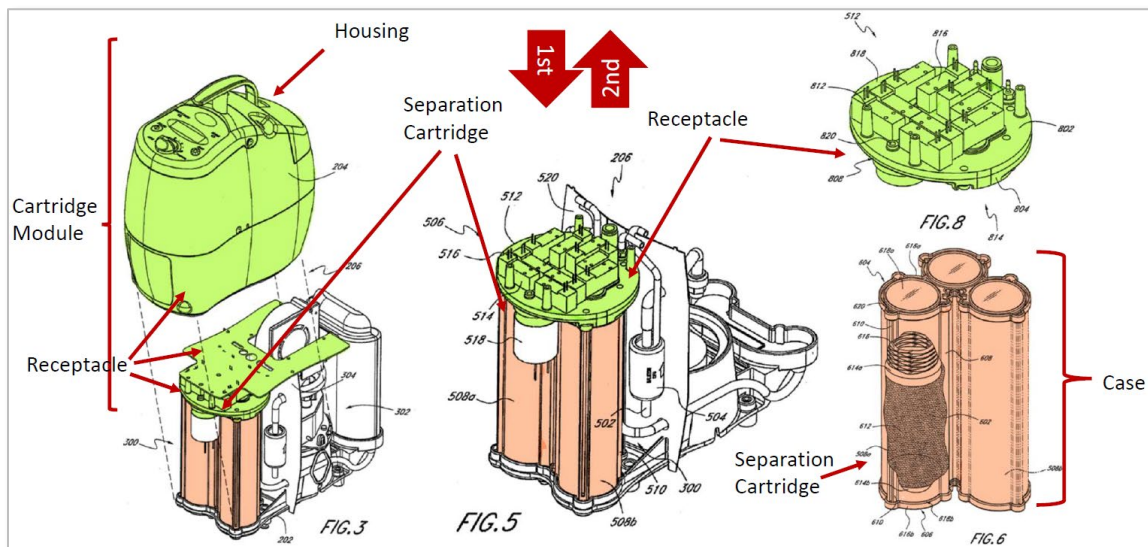


Should PO argue *Deane*’s POC’s handle and/or mobility cart is not a claimed “carrying device,” *Dubois* discloses such a device and, as explained above, a POSITA would have been motivated to combine *Deane* and *Dubois* as described herein such that *Deane*’s POC would be sized for carrying. EX1003, ¶376. For example, *Dubois* teaches a POC wearable on a strap or belt, as shown in FIG. 5. EX1005, 3:25-30, 6:21-25, FIG. 5. EX1003, ¶376.



“[1h] wherein the housing of the cartridge module is configured to at least partially surround the case of the separation cartridge”: *Deane* alone or in combination with *Berntson* renders [1h] obvious because *Deane* teaches its cartridge module housing (e.g., shell 204 and/or other components as discussed in

[1b] and shaded **green** in the annotated figures below) at least partially surrounds its separation cartridge case (e.g., housing 602 and/or other outer surfaces of adsorbent housing 602 / adsorbent bed columns 508a, 508b, as discussed in [1c] and shaded **orange** in the annotated figures below). EX1003, ¶377.



Should PO argue *Deane* doesn't teach this feature, *Berntson* teaches it because, as discussed above, *Berntson* teaches an ORAG unit “removably fastened” within (e.g., such that the ORAG is at least partially surrounded) what a POSITA would have understood is a “receptacle” of an oxygen concentrator housing/cabinet. EX1006, ¶¶[0011]-[0012], [0019], FIGS. 1-2. EX1003, ¶378.

Further, the Examiner in a related application confirmed *Deane*'s teachings render almost all of [1d]-[1h] obvious. EX1050, 58-59, EX1003, ¶379.

Finally, *Deane*'s teachings of [1d]-[1h] is consistent with infringement assertions in the related litigation. EX1003, ¶380.

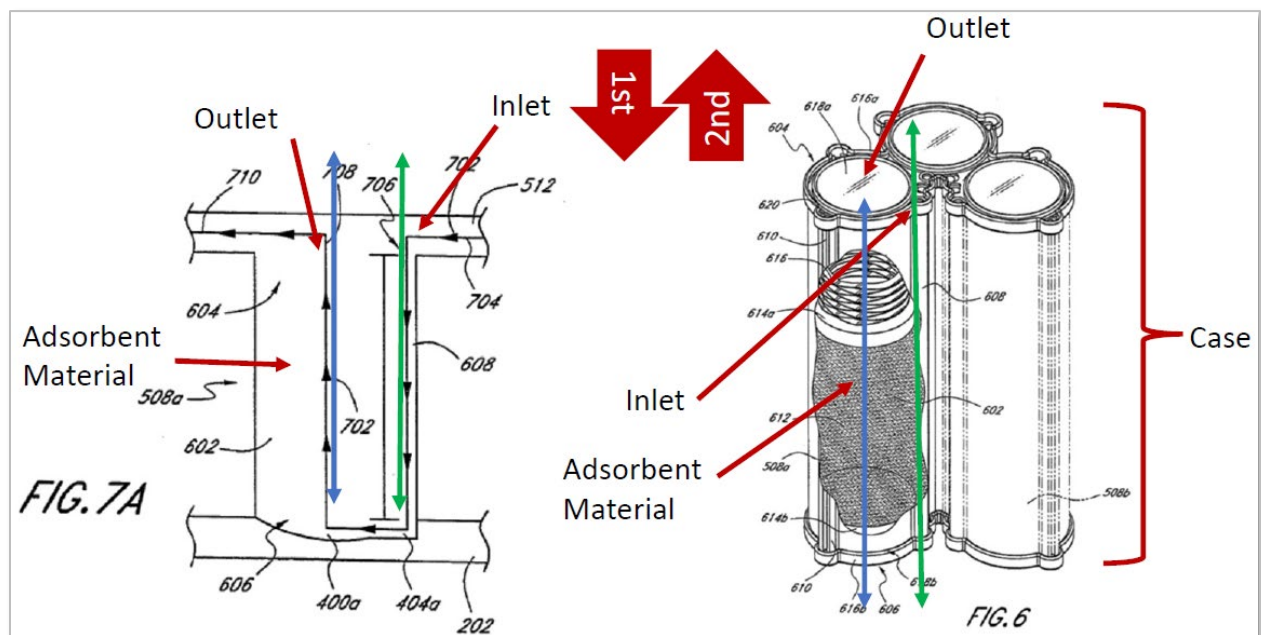
- | | |
|------|--|
| [1i] | wherein the bed of adsorbent material is disposed along an axis, |
| [1j] | one of the inlet and the outlet is disposed along the axis, and |
| [1k] | the other of the inlet and the outlet is spaced-apart from the axis, and |
| [1l] | wherein the first direction and the second direction are substantially parallel to the axis. |

Deane combined with *Dubois* and *Berntson* renders [1i]-[1l] obvious because *Deane* teaches the bed of adsorbent material is disposed along an axis (e.g., adsorbent material 612 in adsorbent bed columns 508a, 508b is arranged along an axis, or centerline (see §V.D),¹¹ of each column as shown by the [blue line](#) in the annotated figures below), one of the inlet and the outlet is disposed along the axis (e.g., the [blue line](#) in the annotated figures below passes through outlet 604 of adsorbent housing 602 / adsorbent bed columns 508a, 508b), and the other of the inlet and the outlet is spaced-apart from the axis (e.g., the [green line](#) in the annotated figures below passes through inlet 706/608 of adsorbent housing 602 / adsorbent bed columns 508a, 508b and is spaced apart from the axis shown by the [blue line](#)), and wherein the first direction and the second direction are substantially parallel to the axis (e.g., the [blue line](#) is parallel to the first and second directions

¹¹ Should PO disagree “axis” is the centerline of the adsorbent bed (*see* §V.B), the [blue line](#) is still a line passing through both the adsorbent material and outlet as claimed, and therefore satisfies [1i]-[1l]. EX1003, ¶388.

shown by the red arrows, which are discussed above in [1c]). EX1004, ¶¶[0059], [0062], [0066], [0068], [0070], FIGS. 6, 7A. EX1003, ¶¶382-383, 390-391.

The annotated versions of *Deane's* FIGS. 6 and 7A reproduced here provide further explanation and examples of how *Deane* teaches each feature of [1i]-[1l]. EX1003, ¶384.



Deane teaches the arrangement of [1i]-[1l], as depicted in FIGS. 6 and 7A and described in *Deane's* ¶¶[0059], [0062], [0066], [0068], [0070], discussed in detail above. EX1003, ¶385. Additionally, various inlet/outlet arrangements to provide appropriate connectivity were generally known by POSITAs by 2004-2005. EX1003, ¶386. Thus, should PO argue *Deane* is somehow deficient as to teaching these elements, it would have been obvious to a POSITA based on the

POSITA's general knowledge to configure *Deane*'s inlets and outlets as claimed to provide appropriate connectivity. EX1003, ¶386.

Further, the Examiner in a related application confirmed *Deane*'s teachings render [1i]-[1l] obvious. EX1052, 16. EX1003, ¶387.

Finally, *Deane*'s teaching of [1i]-[1j] is consistent with infringement assertions in the related litigation. EX1003, ¶389.

3. Claims 2-3

[2]	2. The portable oxygen concentrator as recited in claim 1, wherein the portable oxygen concentrator weighs less than 3 pounds.
[3]	3. The portable oxygen concentrator as recited in claim 1, wherein the power pack is a battery having a weight of less than 0.7 pounds.

Deane combined with *Dubois* and *Berntson* renders claims 2-3 obvious because *Deane* teaches "lightweight" POCs are needed (EX1004, ¶[0006]) and its POC weighs "no [more] than about 10 pounds" (EX1004, ¶[0093]). *Dubois* teaches reduction of a POC's overall and battery weight is important and depicts a lightweight wearable POC. EX1005, 3:64-4:2, FIG. 5. EX1003, ¶392.

Additionally, per §II, a POSITA would have been well-aware that making POCs lighter/smaller was a widely-recognized design goal. *See, e.g.*, EX1009, ¶¶[0005], [0025] (< 10 lbs.); EX1010, ¶¶[0007], [0036] (< 5 lbs.); EX1012, Abstract, ¶[0002]; EX1013, Abstract, 1:7-10, 9:66 (2-15 lbs.). A POSITA would have understood a POC's weight includes a battery (*see* EX1013, 4:66-5:12 (two-pound

system includes concentrator, battery, sensors, and control unit), 9:66). EX1003, ¶393.

Thus, a POSITA would have understood POC weight reduction (overall and battery) to be important and would have considered it obvious to make the POC and battery of the *Deane*, *Dubois*, and *Berntson* combination as light as possible, including within the claimed weight ranges, to improve the resultant POC's portability. EX1003, ¶¶393-394. Making a POC lighter where weight reduction is a well-recognized goal in the art is routine experimentation and obvious. EX1003, ¶395. *Pfizer Inc. v. Apotex Inc.*, 480 F.3d 1348, 1368 (Fed. Cir. 2007) (stating that subject matter arrived through routine experimentation is “the work of a skilled artisan, not of an inventor”).

4. Claim 4

[4]	4. The portable oxygen concentrator as recited in claim 1, wherein the bed of adsorbent material comprises a bed of zeolite which provides preferential adsorption of nitrogen.
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Deane combined with *Dubois* and *Berntson* renders claim 4 obvious for the reasons in [1c] (*e.g.*, *Deane* teaches adsorbent bed columns 508a-b contain zeolite for preferential nitrogen adsorption (EX1004, ¶[0062]). EX1003, ¶¶396-397.

5. Claim 6

[6]	6. The portable oxygen concentrator as recited in claim 1, wherein the carrying device is a belt.
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Deane combined with *Dubois* and *Berntson* renders claim 6 obvious for the reasons in [1a] (*e.g.*, *Dubois* teaches a POC on a strap/belt (EX1005, 3:25-30, 6:21-25, FIG. 5). EX1003, ¶398.

6. Claim 7

[7]	7. The portable oxygen concentrator as recited in claim 1, wherein the inlet is an inlet port, and the outlet is an outlet port.
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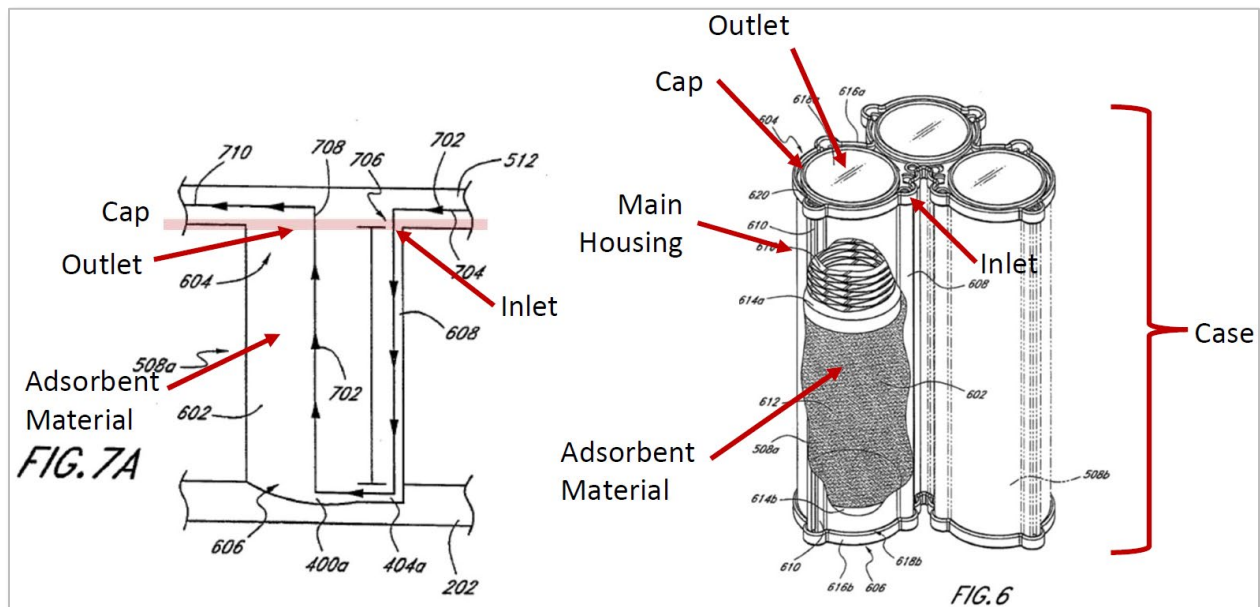
Deane combined with *Dubois* and *Berntson* renders claim 7 obvious for the reasons in [1c] and the following. EX1003, ¶399. A POSITA would have understood feed tube openings 706 to be inlet ports and upper ends 604 of columns 508a-b to be outlet ports because each connects to manifold 512. EX1004, FIG. 7, ¶[0066], [0070]. EX1003, ¶¶400-405.

7. Claim 8-10

[8]	8. The portable oxygen concentrator as recited in claim 1, wherein the case includes a main housing and a cap coupled to the main housing.
[9]	9. The portable oxygen concentrator as recited in claim 8, wherein both the inlet and the outlet are formed in the main housing.
[10]	10. The portable oxygen concentrator as recited in claim 8, wherein the other of the inlet and the outlet is disposed adjacent the cap.

Deane combined with *Dubois* and *Berntson* renders claims 8-10 obvious for the reasons in [1c] and the following. EX1003, ¶406. *Deane* teaches its case (*e.g.*,

adsorbent housing 602 and/or other outer surfaces of adsorbent housing 602 / adsorbent bed columns 508a, 508b, shaded in orange in the annotated drawings above) includes a main housing (*e.g.*, vertical walls of housing 602) and a cap (*e.g.*, the structure at the top end of the vertical walls of housing 602) coupled to the main housing, that both the inlet (*e.g.*, openings 706) and the outlet (*e.g.*, upper ends 604) are formed in the main housing (*e.g.*, both openings 706 and upper ends 604 are defined by the top end of the vertical walls of housing 602 and/or other outer surfaces of adsorbent housing 602 / adsorbent bed columns 508a, 508b), and that the other of the inlet and the outlet is disposed adjacent the cap (*e.g.*, both openings 706 and upper ends 604 are also disposed adjacent the structure at the top end of the vertical walls of housing 602). EX1004, ¶¶[0066]-[0070], FIGS. 6, 7. EX1003, ¶407, 409, 411. The annotated version of *Deane*'s FIGS. 6 and 7A here provides further examples of how *Deane* teaches claims 8-10. EX1003, ¶408.



Additionally, should PO assert any features of *Deane's* separation cartridge identified above are not distinct elements, simply making components integrated or separate is not patentable and is considered obvious as a matter of law. EX1003, ¶410. *In re Larson*, 340 F.2d at 968; *KSR*, 550 U.S. at 417 (“[W]hen a patent simply arranges old elements with each performing the same function . . . the combination is obvious.”).

8. Claim 11

The combination of *Deane*, *Dubois*, and *Berntson* renders claim 11 obvious. EX1003, ¶412.

[11a] 11. A portable oxygen concentrator, comprising:

The *Deane*, *Dubois*, and *Berntson* combination teaches [11a], rendering it obvious, for the reasons in [1a]. EX1003, ¶413.

[11b] a cartridge module comprising a housing, the housing defining a receptacle;

The *Deane, Dubois, and Berntson* combination teaches [11b], rendering it obvious, for the reasons in [1b]. EX1003, ¶414.

[11c] a separation cartridge selectively removable from the 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; and

The *Deane, Dubois, and Berntson* combination teaches [11c], rendering it obvious, for the reasons in [1c]. EX1003, ¶415.

[11d] a power pack removable from the portable oxygen concentrator,

The *Deane, Dubois, and Berntson* combination teaches [11d], rendering it obvious, for the reasons in [1d]. EX1003, ¶416.

[11i] wherein the bed of adsorbent material is disposed along an axis,
[11j] wherein one of the inlet and the outlet is disposed along the axis,
[11k] wherein the other of the inlet and the outlet is spaced-apart from the axis, and
[11l] wherein the first direction and the second direction are substantially parallel to the axis.

The *Deane, Dubois, and Berntson* combination teaches [11i]-[11l], rendering them obvious, for the reasons in [1i]-[1l]. EX1003, ¶417.

9. Claim 12

**[12] 12. The portable oxygen concentrator as recited in claim 11, wherein:
the separation cartridge further comprises a case at least partially
defining an outer volume of the separation cartridge, and
the case at least partially surrounds the bed of adsorbent material.**

The *Deane, Dubois, and Berntson* combination teaches Claim 12, rendering it obvious, for the reasons in [1c]. EX1003, ¶418.

10. Claim 13

**[13] 13. The portable oxygen concentrator as recited in claim 12, wherein:
the case includes a main housing and a cap coupled to the main housing,
the other of the inlet and the outlet is disposed adjacent the cap.**

The *Deane, Dubois, and Berntson* combination teaches claim 13, rendering it obvious, for the reasons in claims 8-10. EX1003, ¶419.

11. Claim 14-15

**[14] 14. The portable oxygen concentrator as recited in claim 11, wherein the
portable oxygen concentrator weighs less than 3 pounds.**
**[15] 15. The portable oxygen concentrator as recited in claim 11, wherein the
power pack is a battery having a weight of less than 0.7 pounds.**

The *Deane, Dubois, and Berntson* combination teaches claims 14-15, rendering them obvious, for the reasons in claims 2-3. EX1003, ¶420.

12. Claim 16

[16] 16. The portable oxygen concentrator as recited in claim 15, further comprising a pump electrically coupled to the power pack, the pump operable to cause a flow of fluid to move relative to the adsorbent material.

The *Deane, Dubois, and Berntson* combination teaches claim 16, rendering it obvious, for the reasons in [1e]. EX1003, ¶421.

13. Claim 17

[17] 17. The portable oxygen concentrator as recited in claim 11, wherein the bed of adsorbent material comprises a bed of zeolite which provides preferential adsorption of nitrogen.

The *Deane, Dubois, and Berntson* combination teaches Claim 17, rendering it obvious, for the reasons in claim 4. EX1003, ¶422.

14. Claim 19

[19] 19. The portable oxygen concentrator as recited in claim 11, further comprising a carrying device for transporting the portable oxygen concentrator.

The *Deane, Dubois, and Berntson* combination teaches claim 19, rendering it obvious, for the reasons in [1g]. EX1003, ¶423.

15. Claim 20

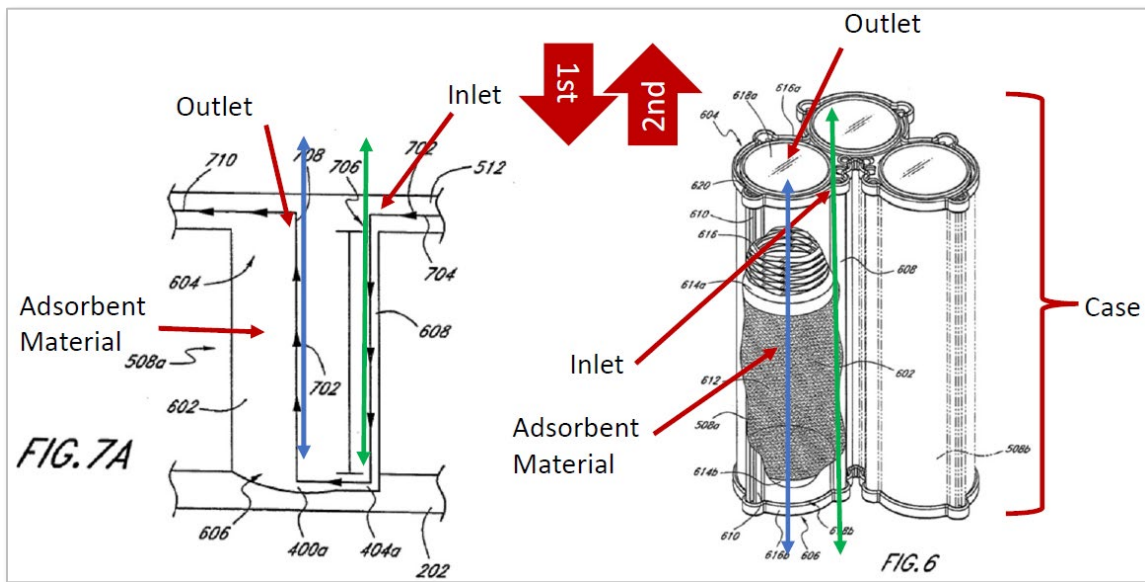
[20] 20. The portable oxygen concentrator as recited in claim 19, wherein the carrying device is a belt.

The *Deane, Dubois, and Berntson* combination teaches Claim 20, rendering it obvious, for the reasons in claim 6. EX1003, ¶424.

16. Claim 21

[21] 21. The portable oxygen concentrator as recited in claim 11, wherein the bed of adsorbent material is one of a plurality of beds of adsorbent material within the separation cartridge.

Deane combined with *Dubois* and *Berntson* renders claim 21 obvious for the reasons in [1c]/[11c] (e.g., adsorbent housing 602 has two adsorbent bed columns 508a-b with beds of adsorbent material (EX1004, [0036], [0062], [0068])). EX1003, ¶¶425-426.



17. Claim 22-23

- [22] **22. The portable oxygen concentrator as recited in claim 11, wherein the bed of adsorbent material contains between five and twenty-five cubic centimeters of adsorbent material.**
- [23] **23. The portable oxygen concentrator as recited in claim 22, wherein the bed of adsorbent material contains between fourteen and sixteen cubic centimeters of adsorbent material.**

Deane combined with *Dubois* and *Berntson* renders claims 22-23 obvious for the reasons in claims 2-3, and the following. EX1003, ¶427. As described above, a POSITA would have understood POC size/weight reduction, including sieve bed size/weight reduction, to be a widely-recognized goal in the art. EX1003, ¶¶427-429. It would have been obvious to provide smaller and lighter sieve beds falling within the claimed volume range to improve the resultant POC's portability. EX1003, ¶429. Further, lessening the weight/size of a prior art component where reduced weight/size is a recognized goal in the art is routine experimentation and obvious. *Pfizer*, 480 F.3d at 1368.

B. Ground 2

A POSITA would have found claims 2-3, 14-15, and 22-23 obvious based on the combination of *Deane*, *Dubois*, *Berntson*, and *Occhialini*. EX1003, ¶431.

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

As explained above, *Deane* teaches a compact/lightweight POC with a separation cartridge, adsorbent material beds, and battery, along with other

elements to provide patients with “greater ease of mobility.” EX1004, Abstract, ¶¶[0002], [0005], [0032], [0062]-[0070], FIGS. 5-7. EX1003, ¶432. *See also* §IV.A.1 and [1a]-[1j].

As discussed above, *Occhialini* teaches there was a “need for optimized design of small, easily-carried, adsorption-based oxygen concentrators.” EX1073, ¶[0004]. *Occhialini* teaches variables, including POC component weights, may be tuned to achieve particular performance metrics, and provides related examples. EX1073, ¶¶[0004], [0098]-[0114], FIGS. 2-17. EX1003, ¶433. Accordingly, a POSITA would have found it obvious to combine *Deane*’s teachings with *Occhialini*’s optimization teachings because such a combination would have provided an improved, more mobile POC with lighter components, characteristics a POSITA would have recognized as highly-desirable by 2004-2005. EX1003, ¶434.

Beyond the motivations provided by the references, further motivation support can be found in a POSITA’s general knowledge (*see* references in §§II and IV) that making lighter POCs was important. EX1003, ¶435. Further, a POSITA would have found it obvious to combine *Deane* and *Occhialini*’s teachings as described herein, and would have had a reasonable expectation of success in doing so, at least because both references relate to POCs using common components, the optimization of which *Occhialini* teaches. EX1003, ¶¶436-437.

Therefore, at the time of the '628 patent's alleged invention, a POSITA would have been motivated to combine (and it would have been obvious to a POSITA having the teachings of *Deane* and *Occhialini* before him or her, along with the other knowledge explained above) *Deane* and *Occhialini*'s teachings as described herein to provide improved functionality, with a reasonable expectation of success. EX1003, ¶438.

2. Dependent Claim 2-3, 22-23

- | | |
|------|--|
| [2] | 2. The portable oxygen concentrator as recited in claim 1, wherein the portable oxygen concentrator weighs less than 3 pounds. |
| [3] | 3. The portable oxygen concentrator as recited in claim 1, wherein the power pack is a battery having a weight of less than 0.7 pounds. |
| [22] | 22. The portable oxygen concentrator as recited in claim 11, wherein the bed of adsorbent material contains between five and twenty-five cubic centimeters of adsorbent material. |
| [23] | 23. The portable oxygen concentrator as recited in claim 22, wherein the bed of adsorbent material contains between fourteen and sixteen cubic centimeters of adsorbent material. |

Deane combined with *Dubois*, *Berntson*, and *Occhialini* renders claims 2-3 and 22-23 obvious for the reasons in Ground 1 and the following. EX1003, ¶439. Further to the above, *Occhialini* teaches examples of relationships between the total system, adsorbent, compressor, and battery weight related to various POC performance metrics. EX1073, ¶¶[0098]-[0124], FIGS. 2-17. These examples include POCs falling in the claimed ranges. EX1003, ¶440. As discussed above, it would have been obvious to modify the configuration of *Deane* alone or in

combination with *Dubois* and/or *Berntson* to implement *Occhialini*'s lighter weight teachings to provide a lighter POC. EX1003, ¶445.

Claims 2 and 3: *Occhialini* teaches, in examples, total system and battery weight less than 3 and 0.7 pounds, respectively. *See, e.g.*, Examples 1-16 in ¶¶[0098]-[0124] and related FIGS. 2-17, along with the desirable weight ranges for the battery in FIG. 20 and ¶[0129]. *See also* ¶¶[0098]-[0124] (describing battery weights). EX1003, ¶441.

Claims 22 and 23: *Occhialini* teaches, in examples, systems with a total adsorbent weight of 0.2-1.5 pounds. *See, e.g.*, Examples 1-16 in ¶¶[0098]-[0124] and related FIGS. 2-17, along with the desirable weight ranges shown in FIG. 18 and ¶[0127]. A POSITA would have understood *Occhialini* teaches per-bed weights of 0.04-0.375 pounds (18-170 grams). EX1003, ¶442. A POSITA would have known the bulk density of 5A Zeolite is 0.70-0.79 kg/l (or 0.70 to 0.79 g/cc). EX1068, p. 131; EX1075, Table 9.6 (pp. 747-749); EXS1076-79. EX1003, ¶442. Accordingly, a POSITA would have understood *Occhialini*'s examples to teach bed volumes of 22.7-242.8 cubic centimeters, teaching at least claim 22. EX1003, ¶442.

Further, a POSITA would have understood *Occhialini* teaches even lower bed volume relationships in FIG. 18. For example, a POSITA would have understood *Occhialini*'s upper curve in FIG. 18 to include an adsorbent weight of

0.12 pounds, which for a five-bed system corresponds to a per-bed adsorbent weight of 0.024 pounds (10.9 grams) and a per-bed volume of 14.7 cubic centimeters, teaching claims 22 and 23. EX1003, ¶443.

Further, lessening the weight/size of a prior art component where less weight/size is a recognized goal in the art is routine experimentation and obvious. *Pfizer*, 480 F.3d at 1368.

3. Dependent Claims 14-15

- [14] 14. The portable oxygen concentrator as recited in claim 11, wherein the portable oxygen concentrator weighs less than 3 pounds.
- [15] 15. The portable oxygen concentrator as recited in claim 11, wherein the power pack is a battery having a weight of less than 0.7 pounds.

The combination of *Deane*, *Dubois*, *Berntson*, and *Occhialini* teaches claims 14 and 15, rendering them obvious, for at least the reasons described above in claims 2 and 3. EX1003, ¶446.

C. Ground 3

A POSITA would have found claims 5 and 18 obvious based on the combination of *Deane*, *Dubois*, *Berntson*, and *Basset*. EX1003, ¶447.

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

As discussed above, *Deane* (alone and in combination with *Dubois* and *Berntson*) teaches the use of zeolite adsorbent beds. *See* §VII.A.2.[1c]. EX1003, ¶448. *Basset* teaches POC adsorbers containing “Zeolite, advantageously a lithium

zeolite of the LiX type, preferably an LiLSX Zeolite.” EX1007, 1:10-14, 2:13-29. EX1003, ¶449.

A POSITA would have found it obvious to combine *Deane*’s zeolite teachings with *Basset*’s LiLSX teachings because such a combination would have provided improved adsorbent performance. EX1003, ¶450. POSITAs were well-aware LiLSX provided performance improvements over other zeolites, which a POSITA would have recognized as highly-desirable by 2004-2005. *Id.*

Beyond the specific motivations provided by the references, further motivation support can be found in a POSITA’s general knowledge that both zeolite and LiLSX zeolite were commonly used as adsorbents. EX1003, ¶451. Moreover, 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 zeolite as an adsorbent. *Id.*, ¶452.

Therefore, at the time of the alleged invention of the ’628 patent, a POSITA would have been motivated to combine (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) the these teachings as described herein 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, ¶453.

2. Claims 5, 18

- [5] **5. The portable oxygen concentrator as recited in claim 4, wherein the zeolite is an LiLSX adsorbent.**
- [18] **18. The portable oxygen concentrator as recited in claim 17, wherein the zeolite is an LiLSX adsorbent.**

Deane combined with *Dubois*, *Berntson*, and *Basset* renders claim 5 obvious because *Deane* teaches a zeolite adsorbent bed ([1c]) and *Basset* teaches use of a “Zeolite, advantageously a lithium zeolite of the LiX type, preferably an LiLSX Zeolite.” EX1007, 2:21-22. EX1003, ¶¶454-457.

D. Grounds 4-6

If PO does not contest, or the Board finds, *Deane* alone teaches all the features of claim 1, a POSITA would have found: (i) claims 1-4, 7-17, 19, 21-23 obvious based on *Deane* (Ground 4); (ii) claims 2-3, 14-15, 22-23 obvious based on *Deane* combined with *Occhialini* (Ground 5); and (iii) claims 5 and 18 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 *Occhialini*, 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, ¶458.

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 ’628 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. 3B has counterclaimed for infringement.

The ’628 patent is in the same family as U.S. Patent No 11,389,614. Petitioner has filed an IPR challenging the ’614 patent. *See* IPR2022-00326. To Petitioner’s best knowledge, the ’628 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: February 10, 2023

Respectfully submitted,

/s/ Robert M. Masters

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U.S. Patent No. 10,357,628
Petition for *Inter Partes* Review

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CLAIM APPENDIX

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

[1b] a cartridge module comprising a housing, the housing defining a receptacle;

[1c] a separation cartridge selectively removable from the receptacle by movement relative to the receptacle in a first direction, the separation cartridge comprising a case at least partially defining an outer volume of the separation cartridge, 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, the case at least partially surrounding the bed of adsorbent material;

[1d] a power pack removable from the portable oxygen concentrator;

[1e] a pump electrically coupled to the power pack, the pump operable to cause a flow of fluid to move relative to the adsorbent material;

[1f] a user interface configured to allow a patient to adjust and monitor operation of the portable oxygen concentrator;

[1g] a carrying device for transporting the portable oxygen concentrator;

[1h] wherein the housing of the cartridge module is configured to at least partially surround the case of the separation cartridge,

[1i] wherein the bed of adsorbent material is disposed along an axis, [1j] one of the inlet and the outlet is disposed along the axis, and [1k] the other of the inlet and the outlet is spaced-apart from the axis, and

[1l] wherein the first direction and the second direction are substantially parallel to the axis.

2. The portable oxygen concentrator as recited in claim 1, wherein the portable oxygen concentrator weighs less than 3 pounds.

3. The portable oxygen concentrator as recited in claim 1, wherein the power pack is a battery having a weight of less than 0.7 pounds.

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

5. The portable oxygen concentrator as recited in claim 4, wherein the zeolite is an LiLSX adsorbent.

6. The portable oxygen concentrator as recited in claim 1, wherein the carrying device is a belt.

7. The portable oxygen concentrator as recited in claim 1, wherein the inlet is an inlet port, and the outlet is an outlet port.

8. The portable oxygen concentrator as recited in claim 1, wherein the case includes a main housing and a cap coupled to the main housing.

9. The portable oxygen concentrator as recited in claim 8, wherein both the inlet and the outlet are formed in the main housing.

10. The portable oxygen concentrator as recited in claim 8,
wherein the other of the inlet and the outlet is disposed adjacent the cap.

[11a] 11. A portable oxygen concentrator, comprising:

[11b] a cartridge module comprising a housing, the housing defining a receptacle;

[11c] a separation cartridge selectively removable from the 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; and

[11d] a power pack removable from the portable oxygen concentrator,

[11i] wherein the bed of adsorbent material is disposed along an axis,

[11j] wherein one of the inlet and the outlet is disposed along the axis,

[11k] wherein the other of the inlet and the outlet is spaced-apart from the axis, and

[11l] wherein the first direction and the second direction are substantially parallel to the axis.

12. The portable oxygen concentrator as recited in claim 11, wherein:
the separation cartridge further comprises a case at least partially defining an outer volume of the separation cartridge, and
the case at least partially surrounds the bed of adsorbent material.

13. The portable oxygen concentrator as recited in claim 12, wherein:
the case includes a main housing and a cap coupled to the main housing,
the other of the inlet and the outlet is disposed adjacent the cap.

14. The portable oxygen concentrator as recited in claim 11, wherein the portable oxygen concentrator weighs less than 3 pounds.

15. The portable oxygen concentrator as recited in claim 11, wherein the power pack is a battery having a weight of less than 0.7 pounds.

16. The portable oxygen concentrator as recited in claim 15, further comprising a pump electrically coupled to the power pack, the pump operable to cause a flow of fluid to move relative to the adsorbent material.

17. The portable oxygen concentrator as recited in claim 11, wherein the bed of adsorbent material comprises a bed of zeolite which provides preferential adsorption of nitrogen.

18. The portable oxygen concentrator as recited in claim 17, wherein the zeolite is an LiLSX adsorbent.

19. The portable oxygen concentrator as recited in claim 11, further comprising a carrying device for transporting the portable oxygen concentrator.

20. The portable oxygen concentrator as recited in claim 19, wherein the carrying device is a belt.

21. The portable oxygen concentrator as recited in claim 11, wherein the bed of adsorbent material is one of a plurality of beds of adsorbent material within the separation cartridge.

22. The portable oxygen concentrator as recited in claim 11, wherein the bed of adsorbent material contains between five and twenty-five cubic centimeters of adsorbent material.

23. The portable oxygen concentrator as recited in claim 22, wherein the bed of adsorbent material contains between fourteen and sixteen cubic centimeters of adsorbent material.

CERTIFICATE OF WORD COUNT

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 13,944 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. 10,357,628 and Exhibits 1001-1052, 1055-1062, 1064-1079 were served in their entirety on February 10, 2023, 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 February 10, 2023, a true and correct copy of the foregoing Petition for *Inter Partes* Review of U.S. Patent No. 10,357,628 and Exhibits 1001-1052, 1055-1062, 1064-1079 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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