UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

URT UMWELT UND RECYCLINGTECHNIK GMBH
Petitioner,

v.

DUESENFELD GMBH
Patent Owner.

Inter Partes Review No. IPR2024-00887
U.S. Patent No. 11,050,097

PATENT OWNER RESPONSE PURSUANT TO 37 C.F.R. § 42.120

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Ex. 2002	U.S. Patent No. 9,450,277 ("Dunagan")
Ex. 2003	DE 102012024876 A1 to Electrocycling GmbH ("Electrocycling") (German)
Ex. 2004	DE 102012024876 A1 to Electrocycling GmbH ("Electrocycling") (English)
Ex. 2005	Certification of Translation of the Electrocycling Patent
Ex. 2006	Gao Liu *et al.*, *Binder Interactions in the Electrodes of the Lithium-ion Batteries*, TFUG Conference, February 17, 2009
Ex. 2007	WO 2010/149611 A1 to LiMotive Company Ltd. ("LiMotive") (German)
Ex. 2008	WO 2010/149611 A1 to LiMotive Company Ltd. ("LiMotive") (English)
Ex. 2009	Certification of Translation of the LiMotive Patent
Ex. 2010	Declaration of Vani Dantam in support of Patent Owner's Preliminary Response to the Petition
Ex. 2011	U.S. Patent No. 7,198,865 to Sloop ("Ecobat")
Ex. 2012	Kinergy Corporation, *Transferring Heat with a Vibratory Bed Dryer* (2013) [https://web.archive.org/web/20131015131016/https://kinergy.com/uploads/documents/Transferring%20Heat%20with%20a%20Vibrating%20Fluidized%20Bed%20KDVFB-1.pdf]
Ex. 2013	MEWA User Manual (German)
Ex. 2014	MEWA User Manual (English)
Ex. 2015	Certification of Translation of the MEWA User Manual

Ex. 2016	Cross-flow hogger image [https://www.cutmetall.com/us/innovative-cross-flow-hogger-chain-head-set-p47892/] (last visited on August 17, 2024)
Ex. 2017	Commercial Air Filtration System Manual
Ex. 2018	ISO 3529-1 (1981)
Ex. 2019	ISO 3529-1 (2019)
Ex. 2020	J. West, Special Communication from the American Physiological Society, *Barometric Pressure on to Mt. Everest: New Data and Physiological Significance* at 1063 (1999) (Downloaded from journals.physiology.org/journal/jappl (075.061.098.021) on August 7, 2024)
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Ex. 2023	*Ascend Element, Inc.'s Answer to Complaint*, Case No. 1-23-cv-01194 (D. Del.)
Ex. 2024	Scheduling Order in Case No. 23-1194-JFM
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Ex. 2030	N. Somsuk et al., *Design and Development of a Rotary Airlock Valve for using in Continuous Pyrolysis Process to Improve Performance*, 2010 International Conference on Manufacturing Science and Technology (ICMST 2010)
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Ex. 2052	Press Release: *Andritz and Duesenfeld sign cooperation agreement for battery recycling*, dated February 10, 2025
Ex. 2053	Duesenfeld Brochure: Ecofriendly Recycling of Lithium-Ion Batteries

I. PATENT OWNER'S OPPOSITION TO INSTITUTED GROUNDS

Patent Owner Duesenfeld GmbH ("Patent Owner" or "Duesenfeld") submits this Patent Owner Response to the petition filed by URT Umwelt und Recyclingtechnik GmbH ("URT" or "Petitioner") on May 1, 2024 requesting *inter partes* review of claims 1-3, 7-10, 12-13, and 15-19 of U.S. Patent No. 11,050,097 (Ex. 1001, "the '097 patent") (Paper 2, "Pet." or the "Petition").

The inventors of the '097 patent pioneered an elegant solution that hazardous battery material could be rendered inactive by shredding these batteries and drying away the electrolyte solvents under vacuum, rather than attempting to detoxify the batteries with a variety of additives. Ex. 2025, ¶¶57-59. The LithoRec prior art cited by Petitioner shows only that there was a conceptualized system for battery shredding and packaging, but the conceptualized system did not incorporate vacuum drying. *Id.*, ¶¶94-145. In fact, the prior art cited by Petitioner does not even demonstrate that conceptualized system can preliminarily process shredded batteries to an inactivated state. Instead, the prior art proposed a conceptualized system that employed equipment using conventional convection heat and positive pressure gas movement to dry shredded recyclable batteries.

Nevertheless, the Patent Trial and Appeal Board (the "Board") instituted this proceeding on November 20, 2024 on the following grounds:

Ground 1: Claims 1-3, 7, 8,19 as obvious over LithoRec (Ex. 1016, "LithoRec") in view of DIN 28400 -1 (Ex. 1018, "DIN 28400") or Perry (Ex. 1006, "Perry").
Ground 2: Claim 9 as obvious over LithoRec in view of DIN 28400 and/or Perry and Hanisch (Ex. 1020, "Hanisch").
Ground 3: Claims 12, 13, 15, 16, 18, and 19 as anticipated by LithoRec.
Ground 4: Claims 17 as obvious over LithoRec in view of Hanisch.

(Paper 10 ("Inst. Dec." or "Institution Decision").) While instituting review on all challenged claims, the Board found that Petitioner did not show a reasonable likelihood that it would prevail in demonstrating that the challenged claims were unpatentable for Grounds 1 and 2. Inst. Dec. at 21, 22.

Petitioner bears "the burden of proving a proposition of unpatentability by a preponderance of the evidence." 35 U.S.C. § 316(e). As set forth herein, Petitioner has failed to meet its burden. In relation to claims 12, 13, 15, 16, 18-20, the Board's Institution Decision is based upon a finding that claim 12 expressly or inherently discloses a "vacuum installation connected to the drying device" based on a single sentence that suggests "drying under vacuum" Inst. Dec. at 14), but where the entire remainder of the reference offers no disclosure on how that could be accomplished. Not only does the reference <u>not</u> disclose all of the elements of claim 12, but there is no direction, and too much experimentation required, to anticipate the claimed invention. Moreover, the references do not disclose a battery processing method or installation that inactivates the battery material.

II. TECHNOLOGY OVERVIEW

Rechargeable batteries used for consumer electronics and electric vehicles (EVs) contain valuable metals that facilitate the storage of energy. Ex. 2025, ¶¶40-46; Ex. 2006 at 005. Although a rechargeable battery can easily be replaced, the depleted battery comprises toxic materials, including the rare earth metals, binders, and solvents contained in the battery cells. *Id*, ¶48.

In the early 2010's, an increased reliance on portable consumer electronics and an anticipated and growing market for EVs prompted consideration of how to safely recycle depleted rechargeable batteries. Ex. 2001 at 1:18-21. It was contemplated that rechargeable battery recycling would occur at centralized locations because of the environmental and industrial challenges related to battery recycling. Ex. 1016 at 24, 51-53, Figure A-18; Ex. 2025, ¶48. Centralized processing would require transporting the used batteries, which itself presented a challenge. Ex. 2025, ¶48.

Shipment and storage of used batteries could cause hazardous chemical reactions between their rare earth metal and chemical solvents components. Ex. Ex. 2025, ¶¶48-49; Ex. 2004 at [0002]; Ex. 2016 at 33. In order to make depleted rechargeable batteries more amenable to storage and transport, the depleted batteries were shredded (*i.e.*, comminuted). Ex. 2025, ¶48. Thereby the batteries are converted into an unstructured bulk, resulting in an uncontrolled mixture of

their chemical components. Ex. 2025, ¶¶48-49. The comminuted batteries, while more transportable, can be toxic and explosive. *Id.* At the time of the ’097 patent, chemical additives were applied to the comminuted batteries to mitigate the explosive and toxic nature of the material. *Id.*, ¶¶50-56. But in doing so, the chemical additives also contaminated the potentially recyclable material. *Id.*, ¶56.

III. OVERVIEW OF THE ’097 PATENT AND ASSERTED PRIOR ART

A. The ’097 Patent

The inventors of the ’097 patent recognized that comminuted batteries could be inactivated through a drying process by vacuum drying at a maximum pressure of 300 hPa. Ex. 2025 at ¶57. This meant that inactivation via additives, as in the prior art, was unnecessary. *Id*. Furthermore, the vacuum drying process was safer because it avoided the use of high heat, preventing or reducing the formation of toxic gases, particularly hydrogen fluoride. Ex. 1001 at 2:5-12; Ex. 2025 at ¶57.

Surprisingly, the inventors were able to vacuum-dry the comminuted material at a maximum pressure of 300 hPa and achieve inactivation of the material without any additive chemicals. Ex. 2025 at ¶57. Comminuted material is rendered “inactivated” after the drying process is complete. *See* Ex. 1001 8:54-55; Ex. 2025 at ¶¶57-59. The ’097 patent explains this goal of inactivating the battery material. Ex. 1001 at 1:63-2:4. The inactivated comminuted material can be

shipped to a central facility for further processing. Ex. 1001 at 5:46-6:15; Ex. 2025 at ¶59.

The specification teaches how to obtain inactivated comminuted material that is suitable for transport—*i.e.*, via drying under low atmospheric pressure and temperatures. *Id*. at 1:64-2:12, 3:5-14; Ex. 2025 at ¶¶63-64.

B. LithoRec

LithoRec is a study of EV battery techniques published in April 2012 by a group of researchers from Technical University Braunschweig and several EV industry partners (together, the "LithoRec Partners"). Ex. 2025 at ¶¶65-66. The authors investigated storage and transport constraints (Ex. 1016 at 32-33), disassembly techniques (Ex. 1016 at 1-2), and synthesis of new electrodes from recycled materials (Ex. 1016 at 143-155). Ex. 2025 at ¶67.

The authors proposed a concept design for a pilot plant for comminuting batteries for subsequent processing. Ex. 2025 at ¶68. Described in a section titled "Conceptual design of a recycling pilot plant," it says that "a possible recycling plant was conceptualized," though there was "no existing facility." Ex. 1016 at 222; Ex. 2025 at ¶68.

LithoRec contemplates processing shredded batteries, and also suggests drying the shredded batteries as one of the processing steps, but expressly noted that "there is no reliable data" that would allow drying to be "reliably designed,"

especially since no drying manufacturers provided information in response to requests. *See* Ex. 1016 at 226; Ex. 2025 at ¶68.

LithoRec proposes specific equipment to perform each of the processing steps of the controlling embodiment. For example, LithoRec discloses a specific dryer: a vibratory fluidized bed dryer. Ex. 1016 at 227; Ex. 2025 at ¶69. A vibratory fluidized bed dryer is a machine that uses hot gases blown at high velocity to agitate and dry the material. Ex. 2012 at 1; Ex. 2025 at ¶¶69-72, 95-99. It is not a vacuum dryer. Ex. 2012 at 1; Ex. 2025 at ¶¶95-99. LithoRec specifies that the drying system contains a "blower," which generates positive pressure, contrary to a vacuum. Ex. 1016 at 235; Ex. 2025 at ¶¶71, 74 & 98. For comminuting the batteries, LithoRec specifies the use of a "cross-flow hogger," which does not work under vacuum. Ex. 1016 at 235; Ex. 2025 at ¶¶100-108. LithoRec teaches conducting the drying in a continuous process, rather than a batch process. Ex. 1016 at 226. A POSITA would understand that the continuous process avoids the accumulation of hazardous materials. Ex. 2025 at ¶115.1

C. Perry

Perry's Chemical Engineers' Handbook is a reference book. Ex. 1006; Ex. 2025 at ¶78. The portion of Perry relied on by Petitioner is entitled "Batch Through-Circulation Dryers." Ex. 1006 at 12-44; Ex. 2025 at ¶78. This section is dedicated entirely to batch drying. Ex. 1006 at 12-44; Ex. 2025 at ¶¶78, 81-82.

Where Perry does talk about a vacuum dryer, it is expressly directed to small items, such as pharmaceuticals, that are placed on shelves and dried in small batches. Ex. 1006 at 12-44; Ex. 2025 at ¶81. Perry discloses nothing about EV battery recycling. Ex 1006 at 12-44; Ex. 2025 at ¶82. Perry is also silent as to the continuous drying systems recommended in LithoRec. Ex. 1016 at 226; Ex. 2025 at ¶¶78, 82.

D. DIN 28400

DIN 28400 is a German glossary of terms related to vacuum technology. Ex 1018; Ex. 2025 at ¶83. DIN 28400 lists different ranges of vacuum pressures, from low vacuum to ultra-high vacuum. Ex. 1018 at 1 DIN 28400 Part 1, Section 1; Ex. 2025 at ¶¶83-84, 86-87. DIN 28400 defines the pressure range for a low vacuum as extending from 1000 hPa to 1 hPa (or 1000 mbar to 1 mbar). Ex. 1018 at 1 DIN 28400 Part 1, Section 1, Table 1; Ex. 2025 at ¶¶84-88. The mention in DIN 28400 of "300 mbar" (*i.e.*, 300 hPa) is merely a reference to the "lowest atmospheric pressure on the Earth's surface," *i.e.*, atop Mount Everest, which is inapposite here. Ex. 2025 at ¶¶130-136. DIN 28400 provides no teachings related to any particular application of vacuum technology. Ex. 2025 at ¶¶89, 129-137.

IV. LEVEL OF ORDINARY SKILL IN THE ART

The Board adopted a definition of the person of ordinary skill in the art for purposes of this *inter partes* review as "hav[ing] a B.S. degree in electrical

engineering, materials science, chemical engineering, or an equivalent field, as well as at least 2 to 3 years of academic or industry in the recycling or processing of lithium-ion batteries." Pet. at 14; POPR at 19; Inst. Dec. at 7-8. This definition was also adopted by the Board in the related proceeding brought by Ascend. *See Ascend Elements, Inc. v. Duesenfeld GmbH*, IPR2024-00948 ("Ascend IPR"), Paper 10 at 7-8 (PTAB Nov. 22, 2024). Petitioner agrees that this level of skill is appropriate. Ex. 2025, ¶¶17, 17.1.

V. CLAIM CONSTRUCTION

In the Institution Decision, neither party requested construction and the Board did not expressly construe any terms of the challenged claims. However, in its discussion of Claim 12, the Board provided guidance that the term "inactivation" should be equivalent to the term "drying," and thereafter provided a definition for these terms. Inst. Dec. at 12-13. Given this discussion, and to inform the Board of the rulings by the District Court, Duesenfeld respectfully requests construction of the below terms, solely for purposes of this proceeding.

A. "inactivate" and "inactivated"

The Board equated "inactivation" and "drying," agreeing with Petitioner that "inactivating and drying are used synonymously in the '097 patent." Inst. Dec. at 12-13. The Board stated that the meaning of both terms referred "to the removal of at least one solvent, such as dimethyl carbonate or ethyl methyl carbonate, from the

conducting salt[.]" Inst. Dec. at 13. Duesenfeld respectfully states that this guidance is inconsistent with the teachings of the '097 patent, which distinguishes the concepts of drying and inactivating, inconsistent with the co-pending IPR2024-00948, and inconsistent with the District Court's claim construction. Instead, the Board should adopt the express constructions below.

Term	Claim	Construction
inactivated	Claims 1, 2, 7, 13	ordinary meaning, which is rendered safe for transport
inactivate	Claims 12, 13, 15, 16, 18, and 19	ordinary meaning, which is to render safe for transport

Duesenfeld's proposed construction is consistent with the teachings of the '097 patent, which shows that inactivation, rather than being coextensive with drying, is a resulting end point of the drying process. *See* Ex. 1001, at 8:54-55 ("The drying of the comminuted material results in inactivated comminuted material."); *see also id.* at 1:56-58 ("The invention solves the problem by means of a method according to the preamble, in which the inactivation occurs at least also by way of drying the comminuted material.").

The specific end point that Duesenfeld proposes here, "safe for transport," would be understood by a person of skill in the art and is consistent with the guidance of the patent's specification, which describes both the end goal of

inactivation as safety for transport, as well as the particular ways that safety for transport may be achieved. *See* Ex. 1001 at 2:2-4 ("The comminuted material is therefore largely inert and can be transported safely, especially if it is packed under vacuum."); *id.* at 3:13-14 ("In addition, it is advantageous that a comminuted material is obtained that can be transported safely."); *see also, e.g.*, *id.* at Abstract ("The inactivation is performed by drying the comminuted material, and the comminuted material is dried until an electrolyte content is so low that an electrochemical reaction is not possible."); *id.* at 4:5-7 (same); *id.*, 10:60-63 (claim 2); *id.*, 11:16-23 (claim 7); Ex. 2025, ¶¶48, 57-60, 159, 163.2-163.3.

Indeed, the patent repeatedly discloses benchmarks (results) that indicate inactivation in various specifics of safety for transport. *See id.* at 3:49-55 (no flammable or explosive gas mixture can form or emerge in the transport container); 4:19-27 (build-up of heat so low that thermal runway ruled out), 4:28-40 (describing characteristics of inactivated material). Ex. 2025, ¶163.5.

This construction—the substantive end point of the drying process—is also consistent with the fact that the '097 patent teaches that "drying" and "inactivation" are distinct concepts. Use of different terms generally connotes different meanings. *See, e.g.*, *Comaper Corp. v. Antec, Inc.*, 596 F.3d 1343, 1348 (Fed. Cir. 2010); *CAE Screenplates Inc. v. Heinrich Fiedler GmbH*, 224 F.3d 1308, 1317 (Fed. Cir. 2000). This is consistent with the fact that the '097 patent

repeatedly makes clear that drying is the process, and inactivation is the result. Ex. 2025, ¶¶163.2-163.3; Ex. 1001, at 1:55-57 ("The invention solves the problem by means of a method according to the preamble, in which the inactivation occurs at least also by way of drying the comminuted material."); *id.* at "8:54-55 ("The drying of the comminuted material results in inactivated comminuted material."); *id.* at Fig. 2 & 9:7-23 (describing an embodiment of the invention where "comminuted material" becomes "inactivated comminuted material" after drying).

Distinguishing between drying and inactivation is also consistent with the construction rendered by the Board in co-pending IPR2024-00948, where the Board construed the term "inactivating," as to the same patent and same claim, as "to require the removal of sufficient amounts of dimethyl carbonate and/or ethyl methyl carbonate from the comminuted material *to make an electrochemical reaction either no longer possible or only possible to a negligibly small extent*." IPR2024-00948, Paper 10 at 12 (emphasis added). While Duesenfeld disagrees with this construction (as argued in IPR2024-00948), this construction nevertheless recognizes the necessary distinction between drying and inactivation.

Likewise, Duesenfeld's proposed construction, which recognizes the distinction between drying and inactivation, is consistent with the District Court's construction, as discussed below. Equating drying and inactivation would render nonsensical the District Court's construction.

B. "drying device configured to inactivate the comminuted material"

Term	Claim	Construction
drying device configured to inactivate the comminuted material	Claims 12-13, 15-19	a device configured to produce inactivated comminuted material as a result of drying

As explained above, Duesenfeld's proposed construction (which was entered by the District Court) properly upholds the distinction between "drying" and "inactivation," and reinforces that the '097 patent teaches drying as the process to achieve the result of inactivation, by laying out that the process of the "drying device" produces "inactivated comminuted material." Ex. 1001 at 8:54-55. This is consistent with the teachings of the '097 patent, which explains that the drying device is what transforms "comminuted material" into "inactivated comminuted material." Ex. 1001 at Fig. 2 & 9:7-23 (describing an embodiment of the invention where "comminuted material" becomes "inactivated comminuted material" after exiting the "drying device"); *see also id.* at 6:32-34 ("The drying device is configured to dry the comminuted material until an electrolyte content is so low that an electrochemical reaction is impossible."). Thus, a person of skill in the art would understand that the "drying device configured to inactivate the comminuted material" is "a device configured to produce inactivated comminuted material as a result of drying." Ex. 2025, ¶163.4. Indeed, Duesenfeld's proposed construction

here is the construction adopted by the District Court in the related proceeding, reflecting a stipulated agreement between the parties. *See* Ex. 2031, *Duesenfeld GmbH v. Ascend Elements, Inc.*, No. 1:23-cv-01194-JFM (D. Del. Oct. 30, 2024), ECF No. 62.

A. "drying the comminuted material"

Term	Claim	Construction
drying the comminuted material	Claims 1, 2, 7, 13	ordinary meaning, which is removing at least one solvent from the comminuted material

The Board stated that the term "drying" "refer[s] to the removal of at least one solvent, such as dimethyl carbonate or ethyl methyl carbonate, from the conducting salt[.]" Inst. Dec. at 13. Duesenfeld's proposed construction is that entered in the related district court proceeding. Ex. 2031. While the Board's statement and the district court's construction are similar, Duesenfeld submits the district court's construction should be adopted: "ordinary meaning, which is removing at least one solvent from the comminuted material." *Id.* Indeed, this is the very language the Board relied on in supporting its statement in the Institution Decision. Inst. Dec. at 12 (quoting Ex. 1001, 2:23-27). Duesenfeld's proposal (as agreed to by the defendant and as adopted by the District Court) substitutes the phrase "from the comminuted material" for the phrase "in the conducting salt" to

clarify that the solvent is removed from the comminuted material. *See, e.g.*, *id*. at 1:56-58, 3: 49-56, 4:28-36; Ex. 2025, ¶163.5. The language "conducting salt" is not dispositive of any issue in this *inter partes* review. Accordingly, Duesenfeld requests that the Board adopt its proposed construction, including for consistency between the PTAB and the District Court proceedings.

VI. GROUND 3: Claims 12, 13, 15, 16, 18, and 19 as anticipated by LithoRec

The Board found that Petitioner had carried its burden with respect to Ground 3; therefore, Patent Owner addresses this Ground first. Under Ground 3, Petitioner challenges Claims 12, 13, 15, 16, 18, and 19 of the '097 Patent under 35 U.S.C. § 102 as anticipated by LithoRec. Claim 12 recites:

> 12. A battery processing installation for treatment of used batteries, comprising:
>
> (a) a comminution unit configured to comminute the batteries such that comminuted material is obtained;
>
> (b) an inactivation device comprising a drying device configured to inactivate the comminuted material, wherein the inactivation device is configured to perform the inactivating step during or after the comminuting step of the comminution unit;
>
> (c) a filling device configured to fill a transport container with the inactivated comminuted material; and
>
> (d) a vacuum installation connected to the drying device and configured to generate a vacuum in the drying device.

Ex. 1001 at 11:48-61.

Of primary importance, Claims 12, and its dependents, Claims 13, 15, 16, 18, and 19, include both an "inactivation device comprising a drying device configured to inactivate the comminuted material" and a "vacuum installation connect to the drying device…" *Id.* Neither of these limitations is present in LithoRec. Ex. 2025, ¶¶90-123, 147, 164-169.

Prior art does not anticipate a claimed invention unless it discloses all elements of the claim within the four corners of the document. *Microsoft Corp. v. Biscotti, Inc*., 878 F.3d 1052, 1068 (Fed. Cir. 2017); *Sanofi-Synthelabo v. Apotex, Inc*., 550 F.3d 1075, 1083 (Fed. Cir. 2008). A single reference must "describe the claimed invention *with sufficient precision and detail* to establish that the subject matter existed in the prior art," and "ambiguous references do not, as a matter of law, anticipate a claim." *Wasica Fin. GmbH v. Cont'l Auto. Sys., Inc.,* 853 F.3d 1272, 1284 (Fed. Cir. 2017).

A reference does not anticipate where a limitation is "missing" even if a person of skill in the art would "'at once envisage' the missing limitation." *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co. Ltd*, 851 F.3d 1270, 1274–75 (Fed. Cir. 2017). Thus, "[a]nticipation is not proven by 'multiple, distinct teachings [in a single reference] that the artisan might somehow combine to achieve the claimed invention.'" *Microsoft*, 878 F.3d at 1071.

A. LithoRec does not disclose "a vacuum installation connected to the drying device and configured to generate a vacuum in the drying device"

1. There is no express disclosure of "a vacuum installation…" element

An anticipatory reference must "describe the claimed invention with sufficient precision and detail to establish that the subject matter existed in the prior art," and "ambiguous references do not, as a matter of law, anticipate a claim." *Wasica Fin. GmbH*, 853 F.3d at 1284. There is no precise and detailed language in LithoRec that discloses with sufficient precision and detail a "vacuum installation connected to a drying device …." that is part of the specific embodiment in LithoRec on which Petitioner relies. Ex. 2025, ¶¶147-158.

Petitioner does not identify any structure corresponding to the claimed "vacuum installation …." Ex. 2025 at ¶¶92, 94-123, 147-158, 159, 160-163, 164-167. Petitioner confirms the lack of any express disclosure in LithoRec by its own admission. *See* Pet. at 47 ("LithoRec is silent regarding the device that produces the vacuum for the dryer."). Nevertheless, Petitioner asserts that LithoRec's speculative suggestion that drying could occur under a vacuum constitutes sufficient express disclosure. *See* Pet. at 48. It does not. Ex. 2025, ¶¶94-123, 147-158. LithoRec discloses extensive details of the proposed system, including valves, filters, and fans. Ex. 1016 at 230; Ex. 2025, ¶¶95-123. But the system that

LithoRec discloses does not include a "vacuum installation." Ex. 2025, ¶¶94-123, 147-167.

Claiming that LithoRec expressly discloses a vacuum installation contravenes the actual disclosure of the LithoRec reference. The intent of the LithoRec disclosure was to provide a conceptual plan for a recycling plant, and specifically included a description of the drying capability to the extent known by LithoRec's authors. Ex. 1016 at 222, 226; Ex. 2025, ¶68. LithoRec only a sketch of the proposed drying capability. *Id.* at 226; Ex. 2025, ¶¶68, 92-94, 168. To the extent LithoRec expressly discloses any dryer in sufficient detail, it is not a vacuum dryer. Ex. 2025, ¶¶150-158.

The particular device that LithoRec discloses for drying is a "vibratory fluidized bed dryer." Ex. 1016 at 227. However, a vibratory fluidized bed dryer relies on a "blower," which uses a forceful flow of gas, under positive pressure, to suspend material and dry it. Ex. 2025 at ¶¶71-72, 74, 98, 151-152, 157, 166; Ex. 1016 at 235. A vibratory fluidized bed dryer does not work under vacuum. Ex. 2025 at ¶¶95-99, 165-167.2. LithoRec also makes a reference that "[c]onvection dryers are used for drying." Ex. 1016 at 226. A vibratory fluidized bed dryer is one kind of a convection dryer. Ex. 2025, ¶¶99.1-99.3; 167.2; Ex. 2026. Convection drying involves operating on the basis of use of airflow to dry

materials. *Id*. As such, convection dryers are distinct from vacuum dryers. Ex. 2025, ¶99.3.

The other components in LithoRec confirm that a vacuum is not used. As a shredding device, LithoRec recommends use of a "cross-flow hogger," which would be installed on a shared nitrogen line with the vibratory fluidized bed dryer. Ex. 1016 at 227, 230 & 235. However, cross-flow hoggers do not run on vacuum; to the contrary, they need a steady flow of air to avoid overheating. Ex. 2025 at ¶¶100-108. And because the cross-flow hogger is installed in shared gas circuit with the dryer, this confirms that the dryer is also not at vacuum. Ex. 1016 at 227; Ex. 2025 at ¶¶100, 108.1, 112, 154, 167.1. In its Institution Ruling, the Board noted the mention of a "rotor shredder" in addition to the recommended cross-flow hogger. However, as shown in Exhibit 2027, which is a representative rotor shredder, such machines are not vacuum devices. Ex. 2027; Ex. 2025 at ¶108.1.

At most, LithoRec contemplates the possibility of using vacuum. Ex. 1016 at 226 ("speaks in favor of drying under vacuum"). However, this suggestion is the only disclosure of using vacuum for drying. A mere suggestion to use vacuum is not a disclosure of a vacuum installation. *Wasica Fin. GmbH*, 853 F.3d at 1284 ("Anticipation requires that a single reference 'describe the claimed invention *with sufficient precision and detail* to establish that the subject matter existed in the prior art.'"). The actual mechanisms disclosed, such as the use of a QZ shredder in

combination with a vibratory fluidized bed dryer, cannot be used under vacuum. Ex. 2025, ¶¶97-99; 100-123.

Even if a person of ordinary skill in the art reading LithoRec could "at once envisage" the details of the claim vacuum installation missing from LithoRec, anticipation does not permit a skilled artisan to fill in missing limitations. *Nidec*, 851 F.3d at 1274-75 (anticipation precedent "does not permit the Board to fill in missing limitations simply because a skilled artisan would immediately envision them"); Ex. 2025 at ¶¶94, 148-158, 168.

2. LithoRec does not inherently disclose "a vacuum installation…"

The claimed "vacuum installation …" limitation is also not inherently disclosed in LithoRec. An element is inherently disclosed in a reference if the element is necessarily and always present based on the disclosure of the reference, and cannot be premised on probabilities or possibilities. *Trintec Inds., Inc. v. Top-U.S.A. Corp.*, 295 F.3d 1292, 1295 (Fed. Cir. 2002); *In re Oelrich*, 666 F.2d 578, 581 (CCPA 1981). The "very essence of inherency is that one of ordinary skill in the art would recognize that a reference unavoidably teaches the property in question." *Agilent Technologies, Inc. v. Affymetrix, Inc.*, 567 F.3d 1366,1383 (Fed. Cir. 2009). Here, what is disclosed in LithoRec does not require use of vacuum pressure to function, and in fact cannot function under vacuum pressure. Ex. 2025,

¶¶97-123, 148-158. Accordingly, the "vacuum apparatus…" element is not disclosed inherently. *Id.*

Amid all the details disclosed in LithoRec, the absence of details is conspicuous when it comes to vacuum drying. Expressly, the authors tried and failed to obtain input from dryer manufacturers. Ex. 1016 at 226 (noting authors' attempt to obtain information from "manufacturers of drying systems" whom declined to provide "an offer"); Ex. 2025, ¶¶68, 167.3. Therefore, the authors then made assumptions regarding the process steps. *Id.* Thus, it cannot be said that the "vacuum installation…" element is necessarily present. While the authors may have contemplated using vacuum drying, there is no disclosure of a vacuum installation (and to the contrary, the QZ shredder and fluidized bed dryer recommended by the authors do not function under vacuum). Ex. 2025, ¶¶97-108, 148-158. Convection dryers, generally, rely on air flow, and not vacuum, to function. *Id.*, ¶¶99.1-99.3, 167.2; *see also* ¶108.1 (rotor shredders not under vacuum). Thus, the inherency argument that a vacuum installation for drying is necessarily present is inconsistent with the author's intended disclosure of the system, particularly in view of the devices that are taught which are inconsistent with the use of a vacuum.

The disclosure of components that create negative pressure does not teach the inherent presence of a "vacuum assembly …". For example, the operation of

the nitrogen circuit under "negative pressure" is not associated with the dryer mechanism. Ex. 2025, ¶¶109-114. LithoRec teaches a "fan" to exhaust a portion of the nitrogen gas through an activated carbon filter into the environment. Ex. 1016 at 227, 230; Ex. 2025, ¶109. This fan might potentially be sufficient to run the nitrogen circuit at a slight negative pressure (*e.g.*, under 1 hPa), to promote workplace safety by preventing dust from escaping. Ex. 2025 at ¶¶109-114, 155-157. Whatever negative pressure there might be in the exhaust line says nothing about the pressure in the dryer, which contains a "blower," which runs at positive pressure. Ex. 1016 at 2035; Ex. 2025 at ¶¶98, 109-114, 157-158. The existence of the disclosed "fan" and its operation, unassociated with the disclosed dryer mechanism, does not indicate that a "vacuum assembly… configured to generate a vacuum in the drying device" would be present in LithoRec's disclosed system, let alone necessarily. Ex. 2025, ¶¶109-114.

B. LithoRec does not disclose "an inactivation device comprising a drying device configured to inactivate the comminuted material"

In its Institution Ruling, the Board determined that Petitioner had carried its burden of showing that LithoRec discloses "an inactivation device comprising a drying device configured to inactivate the comminuted material." Inst. Dec. at 12-13. This ruling was premised on an erroneous claim construction. The Board credited Petitioner's argument that "inactivating and drying are used

synonymously in the ’097 patent,” and held that “drying and inactivation are intended to have similar, if not identical, meanings.” *Id.* at 12. Finding that LithoRec discloses removing some of the solvent from the battery materials, the Board credited Petitioner’s position that LithoRec discloses inactivation.

This conclusion is in error. Once the Board’s conclusion that “drying” and “inactivation” are not synonymous is corrected, it is clear that LithoRec does not disclose that it is configured to inactivate the comminuted material. *See supra*, Section V.A.

Petitioner is attempting to prove anticipation. There is no express disclosure in LithoRec that it is “configured to inactivate the comminuted material.” At most, LithoRec discloses a goal that the system “eliminates the potential hazard of flammable solvents.” Ex. 1016 at 226. But there is not a disclosure that LithoRec is “***configured***” to achieve that goal. Ex. 2025, ¶¶148, 159-163.6; *Sanofi-Synthelabo*, 550 F.3d at 1083 (anticipatory reference “must not only disclose all elements of the claim within the four corners of the document, but must also disclose those elements arranged as in the claim.”). There is no disclosure that the LithoRec authors ever configured a vacuum drying apparatus, let alone that it was configured to inactivate the comminuted material. Ex. 2025, ¶¶148, 159-163.6. Nor is there an enabling disclosure of any such configuration, *see infra* Section VI.C.

The only evidence that Petitioner points to in support of its position is the disclosure of the '097 patent. Pet. at 44-45; Ex. 1003 ¶142. However, it is improper to cite to the '097 patent as the basis of its Petition. *See* 35 U.S.C. § 311 (a patent may be canceled only on the basis of prior art).

Nor could Petitioner argue that there is inherent disclosure of the requirement that LithoRec is "configured to inactivate the comminuted material." "Inherent anticipation requires that the missing descriptive material is 'necessarily present,' not merely probably or possibly present, in the prior art." *Trintec Inds., Inc. v. Top-U.S.A. Corp.*, 295 F.3d 1292, 1295 (Fed. Cir. 2002). It is far from necessary that LithoRec would be configured to inactivate comminuted material. Neither expressly nor inherently, LithoRec does not disclose a system that inactivates comminuted battery material. There is no vacuum pump disclosed. Ex. 2025, ¶¶148-158. To the contrary, the components that are disclosed would work at cross-purposes to vacuum drying. Ex. 2025, ¶¶97-123, 139, 150-158. In particular, LithoRec teaches the use of a fluidized bed dryer, which cannot work under vacuum conditions. Ex 2025, ¶¶69-77, 95-99; Ex. 1016 at 227. And LithoRec teaches that the dryer shares the same nitrogen line "in a common gas circuit" as the shredder. Ex. 1016 at 227. But the disclosed shredder (the "QZ 1200 depressurized") cannot work under vacuum. Ex. 2025, ¶¶105-107, 153-154;

Ex. 1016 at 235. Thus, the structures disclosed are inconsistent with vacuum drying.

Furthermore, in view of the use of the continuous process with a vibratory fluidized bed dryer, the fluidizing action of the dryer may result in a mixing of wet material that is newly exiting the shredder with material that has been in the dryer for some time. Ex. 2025, at ¶¶119-120, 160-163. This mix of partially wet and partially dry material could hinder the effective inactivation of the comminuted material. *Id.* LithoRec does not provide for any controls to ensure that the material that continuously exits the dryer is not a mix of partially wet and partially dry material. *Id.* at ¶¶120, 160.

In addition, LithoRec does not disclose any controls to ensure proper drying of the solvents. The comminuted batteries contemplated by LithoRec may contain a mixture of solvents. Ex. 1016 at 227 (noting that the solvent "adheres more or less strongly to the arrester foils"). In a continuous process, there will be a steady supply of new comminuted material containing various solvents, and some will preferentially evaporate before others. Ex. 2025 at ¶¶119-120, 161. By mixing together in a single process freshly-introduced comminuted material with material that has been partially dried, this would inhibit the ability of the system to dry the material to the state of inactivation. Ex. 2025 at ¶¶120, 160-161. Ex. 2025 at ¶120. As a result, the LithoRec system may still output comminuted battery product that

had been subject to drying, but which did not reach a point of being inactivated. Ex. 2025, ¶¶120, 145.1-145.2, 160-161, 169.1. Accordingly, LithoRec does not anticipate Claim 12 because there is no express, nor inherent, disclosure showing that the comminuted material discharged from the LithoRec claimed dry would be actually inactivated.

C. LithoRec does not provide an enabling disclosure of "a vacuum installation connected to the drying device and configured to generate a vacuum in the drying device" nor "an inactivation device comprising a drying device configured to inactivate the comminuted material"

LithoRec is not enabled to anticipate the challenged claims. "In order to anticipate a claimed invention, a prior art reference must enable one of ordinary skill in the art to make the invention without undue experimentation." *Impax Lab'ys, Inc. v. Aventis Pharms., Inc*., 545 F.3d 1312, 1314 (Fed. Cir. 2008). Here, Petitioner cannot show that the ambiguous and speculative statements in LithoRec enable a disclosure that reads on the claimed invention, including through resort to any presumption of enablement. Duesenfeld has presented sufficient evidence of non-enablement such that the burden is shifted back to Petitioner (if the burden was ever on Duesenfeld, which it submits it should not have been). And Petitioner cannot show that speculative, future work that is in fact non-operational in practice can be enabled.

i. Petitioner may not rely on a presumption of enablement.

It is Petitioner's burden to demonstrate that LithoRec is enabled. A presumption of enablement has been recognized for patent references and for references considered by the Patent Office in prosecution. *See, e.g., Impax Lab'ys, Inc, 545 F.3d at 1316; In re Antor Media Corp*., 689 F.3d 1282, 1289 (Fed. Cir. 2012). LithoRec is neither of these, as it is a printed publication never considered by the Patent Office during prosecution of a patent. Thus, there is no precedent (nor logical rationale) as to why the Board should presume a printed publication such as LithoRec, which merely proposes a future system, is enabled.

Regardless, once a patent owner has put forward evidence of non-enablement, which Duesenfeld does here, the burden shifts back to "the party asserting invalidity to ultimately demonstrate by clear and convincing evidence that the prior art is enabled." *See, e.g., Forest Lab'ys, Inc. v. Ivax Pharms., Inc*., 438 F. Supp. 2d 479, 487 n.3 (D. Del. 2006), *aff'd*, 501 F.3d 1263 (Fed. Cir. 2007). And even were the presumption applied, the Board would still need to evaluate whether LithoRec in fact would require undue experimentation before a person of skill in the art could arrive at the invention of Claim 12: "Any presumption of enablement of prior art does not exclude consideration of whether undue

experimentation would be required to achieve enablement." *Sanofi-Synthelabo v. Apotex, Inc.*, 550 F.3d 1075, 1085 (Fed. Cir. 2008).

ii. Speculative and future work is not enabled.

LithoRec is not enabled because it represents a future proposal – a concept design for a pilot plant for comminuting batteries for subsequent processing. Ex. 2025 at ¶¶68, 168; Ex. 1016 at 222. A proposal for implementation does not enable to the extent the proposal does not instruct one of skill in the art how to achieve that which was proposed. *Apple v. Int'l Trade Comm'n*, 725 F.3d 1356, 1364 (Fed. Cir. 2013); *see also Forest Lab'ys. Inc. v. Ivax Pharms., Inc.*, 501 F.3d 1263, 1268 (Fed. Cir 2007); *Star Sci. Inc. v. R.J. Reynolds Tobacco Co.*, 655 F.3d 1364, 1376 (Fed. Cir. 2011). That is the case here with LithoRec—its proposal for a dryer, and suggestion of a dryer, does not guide one of skill in the art as to how to achieve such a component in its system.

Apple v. Int'l Trade Comm'n is instructive. In an ITC investigation involving a patent related to touchscreen technology, Motorola argued its assertedly anticipatory reference's mention of transparent electrodes included sufficient disclosure to enable a skilled artisan to build a touchscreen that incorporated transparent electrodes. *Apple*, 725 F.3d at 1363. The ITC disagreed, and the Federal Circuit affirmed, noting that the disclosure of transparent electrodes appeared in a section called "Conclusions and Directions for Future Work," which

addressed "future research directions," and which did not indicate that "the authors had achieved a transparent touch screen[.]" *Id.* at 1363-1264. Without having produced transparent electrodes, and without instructions to do so, the court held that the asserted prior art was not enabled. *Id*. Other Federal Circuit cases are similar: where a reference discloses a prediction or speculation without instruction or guidance, it is not enabled. *See, e.g.*, *Forest Lab'ys*, 501 F.3d at 1268 (no enablement where reference discloses predictions and "does not state how to obtain" a result); *Star Sci. Inc.*, 655 F.3d at 1376 (reference not enabling because its "speculative and tentative disclosure of what 'might' or 'may' lead to nitrite and TSNA production does not sufficiently direct or instruct one of skill in this art").

Likewise, LithoRec is not enabled because it reflects speculative and future work. LithoRec expressly notes that what it discloses is a proposal that is not reduced to practice:

> **G Conceptual design of a recycling pilot plant**
>
> In PB G, a possible recycling pilot plant was conceptualized, which was put together form the individual steps of the previous project areas. The entire facility is a new design, i.e. no existing facility is being converted or extended, but a completely new facility is being built on a greenfield site.

Ex. 1016 at 222 (original bolding omitted). LithoRec outlines "planning principles" that the LithoRec Partners considered in making their proposal. *Id*. at

231; Ex. 2025, ¶¶68, 168. Also included is a listing of proposed equipment and potential sources for that equipment, *id*. at 234-235, but no disclosure of any facility that was actually constructed. Ex. 2025, ¶68. As the cases illustrate, the reference to future or conceptualized work, which itself has yet to be performed, cannot serve as enabled prior art. *Apple*, 725 F.3d at 1363; *Forest Lab'ys*, 501 F.3d at 1268; *Star Sci. Inc.*, 655 F.3d at 1376.

"Tossing out the mere germ of an idea does not constitute enabling disclosure." *Enzo Biochem, Inc. v. Calgene, Inc.*, 188 F.3d 1362, 1374 (Fed. Cir. 1999). The mere reference to potential "drying by vacuum" or "eliminat[ing] the potential hazard of flammable solvents," Ex. 1016 at 226, as part of proposal does not show a person of ordinary skill in the art how to make the vacuum assembly work, nor achieve inactivation, as it does in the '097 patent, and does not avoid a need for undue experimentation. Ex. 2025, ¶¶164-168.

iii. Non-operational combinations of machines cannot anticipate.

Another reason that the "drying by vacuum" and "eliminate the potential hazard" language in Litho-Rec is not enabled is that the combination of disclosed machines with the purportedly disclosed vacuum dryer would be non-operational, and would not be configured to inactivate battery material. "Under [Federal Circuit] precedent… [i]noperative embodiments cannot be anticipatory." *Apple*

Inc. v. Corephotonics, Ltd., 861 F. App'x 443, 450 (Fed. Cir. 2021) (citations omitted); *see also Seymour v. Osborne*, 78 U.S. 516, 555 (1870) (to support a defense of anticipation, a reference must disclose "a complete and operative invention capable of being put into practical operation").

The machines disclosed by LithoRec as part of the conceptualized system do not operate under vacuum pressure. The drying device recommended by LithoRec is a vibratory fluidized bed dryer, which is not a vacuum dryer. Ex. 1016 at 227; Ex. 2025 at ¶¶69-77, 95-123, 150-158, 162-163. LithoRec discloses that the liquid to be evaporated adheres to foils, which are part of the battery structure, and therefore LithoRec recommended the use of "mechanical stress" to agitate the materials. Ex. 1016 at 227; Ex. 2025 at ¶¶69-70. LithoRec notes use of a dryer "that can ensure material transport by exciting the flow bottom." Ex. 1016 at 227; Ex. 2025 at ¶70. The dryer recommended by LithoRec to address this need is a vibratory fluidized bed dryer. Ex. 1016 at 227; Ex. 2025 at ¶¶71, 95.

At the time of the invention, it was known that vibratory fluidized bed dryers operate at atmospheric pressure, contrary to operating at a vacuum pressure. Ex. 2025, ¶¶96-97. A vibratory fluidized bed dryer utilizes high-velocity heated gas, typically air or nitrogen, to simultaneously agitate and dry materials. Ex. 2025 at ¶¶69, 95-97; Ex. 2012 at 1. The combination of gas flow and vibratory motion creates a fluidized state where materials are suspended and in constant motion. Ex.

2025 at ¶¶95-97. Fluidized bed dryers typically operate under atmospheric pressure, not vacuum. Ex. 2012 at 1 ("Thermodynamically, it is a constant heat process which makes it adiabatic, and it typically occurs at atmospheric pressure."); Ex. 2025 at ¶97.

Furthermore, LithoRec states that the drying system contains a "blower." Ex. 1016 at 235. Blowers are used in fluidized bed dryers to generate a forceful flow of gas to fluidize the material being dried. Ex. 2012 at 1 ("Add air that is simultaneously forced up openings in the conveying surface so it permeates through the mat depth of material."); Ex. 2025 at ¶¶74, 98, 166. Blowers generate positive pressure, not vacuum pressure. Ex. 2025 at ¶¶98-99, 151-152. Thus, LithoRec's own recommended components teach generating a positive pressure, not a vacuum, in the drying device. Ex. 2025 at ¶¶71, 74, 98-99, 112-114, 151-152.

The comminution device disclosed and recommended in LithoRec also does not operate at a vacuum pressure. LithoRec teaches shredding the batteries using a cross-flow hogger. Ex. 1016 at 227, 230, 235; *see also* Ex. 2025 at ¶100. LithoRec specifies the use of a "QZ 1200 depressurized" cross-flow hogger from MEWA. Ex. 1016 at 235. A manual for this device (in German), dated 2009, is attached as Exhibit 2013. *See also* Ex. 2014 (English translation of Ex. 2013). A cross-flow hogger contains a rotary hammer mounted on a chain, that whirls at high forces and smashes into materials, breaking them into pieces. Ex. 2025 at ¶¶101-103; Ex.

2014 at 81. The metal-on-metal smashing generates a tremendous amount of heat. Ex. 2025 at ¶104. A flow of gas is needed to cool the device and additionally to carry away dust particles generated by the hammering. Ex. 2025 at ¶104. LithoRec depicts this flow of gas to remove the dust, with a dotted line going from the cross-flow hogger to the Jet filter. Ex. 1016 at 230; Ex. 2025 at ¶104.

Cross-flow hoggers typically run at atmosphere pressure. Ex. 2025 at ¶107. These systems cannot run in a vacuum, because the convective heat capacity of the gas at atmospheric pressure is needed to cool the system, and a robust flow of gas is needed to carry away the dust. *Id*. The QZ 1200 specified in LithoRec can be equipped with an inert gas system, to run the device under nitrogen. Ex. 2014 at 52. As confirmation that the system does not run under vacuum, it states that a fault may trigger if the nitrogen pressure drops. *Id.* ("Leakage in the gas-tight enclosure. Insufficient nitrogen inertization (tank pressure dropped?)."); Ex. 2025 at ¶107. The only time the QZ 1200 manual mentions the word "vacuum" is in the context of the occasional need to clean the unit with a vacuum cleaner. Ex. 2025 at ¶106.

LithoRec specifies the cross-flow hogger as "QZ 1200 depressurized." Ex. 1016 at 235. The description of "depressurized" refers to the ability to depressurize the device due to the build-up of solvent vapors in the controlled nitrogen atmosphere as heat is generated by the hammering action and the solvents volatize.

Ex. 2025 at ¶105. This is further confirmation that the cross-flow hogger does not run under vacuum—there would be no need to depressurize it if it operated at less than atmospheric pressure. Ex. 2025 at ¶105.

LithoRec depicts the cross-flow hogger as being connected to the same nitrogen circuit as the dryer. Ex. 1016 at 230; *see also id*. at 227; Ex. 2025, ¶¶100, 167.1. Because the cross-flow hogger operates at atmospheric pressure, emptying into the dryer, and the two devices share the same nitrogen circuit, both devices are at atmospheric pressure. Ex. 2025 at ¶¶100, 107, 143, 167.1.

Other machines referenced in LithoRec also do not provide enabling disclosure. While LithoRec generally mentions "convection dryers," Ex. 1016 at 226, these are just a broad classification of dryers, of which vibratory fluidized bed dryers are a subset, which require air flow to dissipate heat generated through operation—characteristics the LithoRec authors viewed as desirable in their proposal. Ex. 2025, ¶¶99.1-99.3, 167.2; Ex. 2026. Convection drying operates on the basis of the use of airflow to dry materials, which is different from how drying via a vacuum environment achieves a dried product. *Id*., ¶¶99.2-99.3, 167.2. Whereas convection dryers operate with the need for airflow to drive the drying process, vacuum dryers operate under the principle of low pressure. *Id.*. Industry literature confirms both that (1) the category of convection dryers includes

vibratory fluidized bed dryers and (2) that they are a distinct category of dryers from vacuum dryers. *Id*.

LithoRec also broadly identified "rotor shredders." Ex. 1016 at 226. Attached as Exhibit 2027 is a representative brochure of a rotor shredder. Ex. 2027; Ex. 2025, ¶¶108.1, 167.2. As confirmed in this brochure, no vacuum is present – to the contrary, it shows the option for a "rotor cooling" design, underscoring the concerns of heat generation. Ex. 2027; Ex. 2025, ¶¶108.1, 167.2. Nor has Petitioner presented any evidence that rotor shredders operate under vacuum. Ex. 2025, ¶¶154.1, 167.2. To the contrary, LithoRec says that the shredder should be operated under a nitrogen environment, contradicting the suggestion that there is a vacuum in the shredder. Ex. 1016 at 227 ("Drying must take place in a protective gas atmosphere (nitrogen), just like the crushing process beforehand."); Ex. 2025, ¶108.1.

Thus, the recommended devices specified by LithoRec would work at cross-purposes to vacuum drying, undermining the supposed disclosure of "a vacuum installation connected to the drying device and configured to generate a vacuum in the drying device." And because this system does not show vacuum drying and lacks controls for achieving sufficient drying levels, it is not an enabling disclosure of "an inactivation device comprising a drying device configured to inactivate the comminuted material."

iv. The disclosure in LithoRec would require a person of ordinary skill in the art to unduly experiment to arrive at the invention of Claim 12.

To be anticipatory, a prior art reference must enable one of ordinary skill in the art to make the invention without undue experimentation. *Impax Lab'ys*, 545 F.3d at 1314-15. After initial evidence of experimentation is put forward, the test of whether the experimentation a person of ordinary skill in the art must undertake is "undue" considers eight factors: "(1) the quantity of experimentation; (2) the amount of direction or guidance present; (3) the presence or absence of working examples; (4) the nature of the invention; (5) the state of the prior art; (6) the relative skill of those in the art; (7) the predictability or unpredictability of the art; and (8) the breadth of the claims." *Id*. (citing *In re Wands*, 858 F.2d 731, 737 (Fed. Cir. 1988)); *see also Amgen Inc. v. Sanofi, Aventisub LLC*, 987 F.3d 1080, 1084 (Fed. Cir. 2021). Under this standard and factors developed by the Federal Circuit, Petitioner cannot meet its burden to demonstrate that the argued anticipatory reference LithoRec is enabled.

As supported by the arguments above, the evidence identified by these factors demonstrate the need to engage in undue experimentation. Ex. 2025, ¶¶144, 167.4, 168. Under **factors one two, and three**, there is a complete absence of both direction and guidance as to how to include a vacuum dryer in the system of LithoRec, or to inactivate the battery material, which would require extensive

experimentation. Whereas LithoRec mentions the possibility of drying under vacuum, the recommended equipment disclosed by LithoRec is incompatible with vacuum drying, because the vibratory fluidized bed dryer operates with a blower under positive pressure, and the QZ shredder also needs air flow to avoid overheating. Ex. 2025, ¶¶97-108. The general references in LithoRec to "convection dryers" or to "rotor shredders" do not provide any more guidance on how to configure a vacuum drying system – these are not vacuum devices. *Id.*, ¶¶99.1-99.3, 108.1, 167.2. LithoRec does not teach how to allow for solid material to continuously enter and exit a system that is supposedly under vacuum, which is a complex problem. Ex. 2025, ¶118; Ex. 2030. Thus, a POSITA would need to completely reconfigure the recommended framework and bill of materials if vacuum drying was the goal, which would require extensive experimentation. *Id.*, ¶167.4, 168.

These factors together weigh in favor of non-enablement. *See Enzo Biochem, Inc.*, 188 F.3d at 1374 (noting "virtually no guidance, direction, or working examples were provided and that "Here, … the teachings set forth in the specifications provide no more than a 'plan' or 'invitation' for those of skill in the art to experiment …; they do not provide sufficient guidance or specificity as to how to execute that plan," and were thus not enabling).

The nature of the invention, and the predictability or unpredictability of the art (**factors four and seven**), also confirm the lack of enablement. As LithoRec confirms, it was difficult to experiment with processing of EV batteries in the 2015 time period. LithoRec notes the "high level of uncertainty" in being able to obtain volumes of EV batteries to work with. Ex. 2025, ¶167.3 (citing Ex. 1016 at 8). The batteries "cannot be processed as a homogeneous mass due to the different chemical compositions of the battery variants." *Id.* (citing Ex. 1016 at 8). Even transporting used batteries to a processing center would be dangerous. *Id.* (citing Ex. 1016 at 33 ("The danger posed by defective batteries must be eliminated by suitable measures before transportation (deactivation)."). Safety hazards would complicate any experimentation. *See id.* (citing Ex. 1016 at 96 ("Due to the high reactivity of the electrolyte salt to water (humidity) and the associated difficulty and costly handling when opening the cells, safe operating concepts must be developed as a first step.")). If the $LiPF_6$ is hydrolyzed, deadly hydrogen fluoride gas could be released. Ex. 2025, ¶47. A "fire and explosion-proof environment" is needed. *Id.* ¶167.3 (citing Ex. 1016 at 96). Regulatory burdens are significant. *Id.* (citing Ex. 1016 at 220). And it is difficult and costly to obtain the drying equipment contemplated in LithoRec – even the authors could not secure cooperation of manufacturers of drying systems. *Id.* (citing Ex. 1016 at 226).

For the state of the prior art (**factor five**), it was widely assumed that batteries needed to be detoxified before they could be comminuted. Ex. 2025, ¶¶50-55. The prior art focused on adding various chemicals to the batteries, or pre-treating the batteries in some fashion, before the metals could be recycled. Ex. 2025, ¶¶50-55. For example, prior art approaches treated the batteries with fire retardants (Ex. 2008 at 4:1-6); aqueous solution or a deactivating powder (Ex. 2004 at 005:0034-0035); mineral acids (Ex. 2001 at 11:13-17; 4:38-47; 5:18-52; 5:64-67); brine solutions (Ex. 2002 at 5:4-39); and pressurized solvents (Ex. 2011 at 3:3-5); Ex. 2025, ¶¶51-55. Thus, the prior art did not provide guidance on how to inactivate by drying. Ex. 2025, ¶¶51-56.

The level of skill in the art (**factor six**) is relatively low. The Board properly ruled that a POSITA would have had a bachelor's degree in a relevant field as well as at least 2-3 years of relevant experience. Inst. Dec. at 7. Persons at this skill level would face greater challenges in experimentation than, say, a Ph.D. Ex. 2025, ¶167.

As to the breadth of the claims (**factor eight**), this factor is neutral.

Weighing all the factors, it is clear that LithoRec does not enable the system of Claim 12, which is configured to inactivate using a vacuum installation, because if a person of skill in the art, considering LithoRec, ever arrived at the invention of Claim 12, it would only be after undue experimentation.

D. Dependent Claim 13: "The battery processing installation according to claim 12, wherein the drying device is configured to dry the comminuted material until an electrolyte content in the comminuted material is so low that an electrochemical reaction is impossible."

In addition to the reasons set forth above with respect to independent Claim 12, Petitioner has failed to establish anticipation with respect to dependent Claim 13. Petitioner has presented no evidence that the drying device is "configured to dry" the comminuted material to an endpoint where "an electrolyte content in the comminuted material is so low that an electrochemical reaction is impossible." The most that LithoRec discloses are certain goals of removing solvents to render the battery material safe. Ex. 1016 at 266 & 229; Ex. 2025, ¶169.1. However, these expressions of goals fall short of a disclosure that the device is <u>configured to dry</u> the battery material to a point that an electrochemical reaction is impossible. *See, e.g.*, *Sanofi-Synthelabo*, 550 F.3d at 1083 (anticipatory reference "must also disclose those [claimed] elements arranged as in the claim." Anticipation must establish every element of the claim, and Petitioner does not muster this proof.

VII. GROUND 4: Claim 17 for obviousness over LithoRec and Hanisch

Petitioner challenges claim 17 of the '097 Patent under 35 U.S.C. § 103 based on the references LithoRec and Hanisch. Petitioner relies on Hanisch for its alleged disclosure of a "air jet sieving device." Pet. at 56-57. Petitioner does not, however, rely on the disclosure of Hanisch to teach any of the elements of Claim

12, including those that are addressed above and which are not disclosed in LithoRec. Accordingly, because Claim 12 is not anticipated by LithoRec, Claim 17 is not obvious in view of LithoRec and Hanisch.

VIII. GROUND 1: Claims 1-3, 7-8, and 10 for obviousness over LithoRec, DIN 28400, and Perry.

Petitioner challenges claims 1-3, 7, 8, and 10 under 35 U.S.C. § 103 based on the references LithoRec, DIN 28400, and Perry. Claim 1 recites:

> 1. A method for the treatment of used batteries, comprising the steps:
>
> (a) comminuting the batteries such that comminuted material is obtained;
>
> (b)inactivating the comminuted material such that an inactivated comminuted material is obtained, wherein the inactivating step is performed during or after the comminuting step; and
>
> (c) filling a transport container with the inactivated comminuted material;
>
> wherein the inactivating step is performed by drying the comminuted material, and
>
> wherein the drying occurs at a maximum pressure of 300 hPa.

Ex. 1001, 10:45-59. In its Institution Decision, the Board determined that Petitioner did not establish a reasonable likelihood of prevailing on invalidating Claims 1-3, 7, 8, and 10 as being obvious in view of LithoRec and Perry or DIN

28400. The Board should confirm its preliminary determination that these references in combination do not demonstrate that these claims are obvious.

A. LithoRec does not disclose "inactivating comminuted material such that inactivated comminuted material is obtained"

In assessing Ground 1, the Board credited Petitioner's argument that LithoRec discloses "inactivating comminuted material such that inactivated comminuted material is obtained." Inst. Dec. at 13. The Board's ruling was expressly premised on the Board's erroneous understanding that "drying" and "inactivating" have the same meaning. *Id.* at 12-13. As set forth in Section V.A, *supra*, this is an incorrect claim construction. Applying the plain meaning of "inactivated" (*i.e.*, rendered safe for transport), this limitation is not taught by LithoRec. Ex. 2025, ¶91.

Neither expressly nor inherently, LithoRec does not disclose a system that would result in obtaining inactivated comminuted material. As set forth in Section VI.B, *supra*, Petitioner has failed to show that the disclosed system would be configured to inactivate comminuted batteries. As set forth in greater detail above, the disclosed components would work at cross-purposes with one another (notably, LithoRec's supposed call for vacuum drying is incompatible with the vibratory fluidized bed dryer and the cross-flow hogger that are taught). Section VI.C.iii, *supra*; Ex. 2025 at ¶¶95-123. Furthermore, in view of the use of the continuous

process with a vibratory fluidized bed dryer, the fluidizing action of the dryer may result in a mixing of wet material that is newly exiting the shredder with material that has been in the dryer for some time. *Id.* at ¶¶119-120, 160-163. LithoRec does not provide for any controls to ensure that the material that continuously exits the dryer is not a mix of partially wet and partially dry material. *Id*. As a result, the LithoRec system may still discharge comminuted battery product that had been subject to drying, but which did not reach a point of being inactivated. *Id.*

The most that LithoRec discloses is the goal that the system "eliminates the potential hazard of flammable solvents." Ex. 1016 at 226. However, this expression of a goal is not a disclosure of a method including "inactivating comminuted material such that inactivated comminuted material is obtained." Ex. 2025, ¶¶68, 93-95, 168. No inactivated comminuted material was ever "obtained" in LithoRec. *See, e.g.*, *Enzo Biochem, Inc.*, 188 F.3d at 1374 (disclosing plan for idea insufficient to invalidate). Accordingly, LithoRec does not disclose this limitation.

B. LithoRec does not disclose vacuum drying or drying "at a maximum pressure of 300hPa."

The Board ruled that Petitioner failed to establish that LithoRec, taken in combination with Perry or DIN 28400, would have taught vacuum drying "at a

maximum pressure of 300 hPa." Institution Decision at 20-21. The Board should reaffirm its earlier ruling.

LithoRec does not teach vacuum drying, as discussed in Section VI.A, *supra*. Petitioner admits that at least the claim limitation "wherein the drying occurs at a maximum pressure of 300 hPa" is not disclosed in LithoRec. Ex. 1003 at ¶96. Petitioner does not assert that LithoRec discloses any pressure limitation, or that the knowledge of a person of ordinary skill in the art would provide this pressure limitation. Pet. at 24-28; Ex. 1003 at ¶96. Instead, Petitioner relies on two separate references – Perry and DIN 28400 – neither of which supply the missing element.

C. LithoRec in view of Perry does not disclose drying "at a maximum pressure of 300 hPa."

The Board correctly determined that a person of ordinary skill in the art would not have "considered Perry's teachings regarding a shelf vacuum dryer to define the operating pressure" for the allegedly disclosed vacuum dryer of LithoRec. Inst. Dec. at 21.

Perry is incompatible with LithoRec. Ex. 2025 at ¶127. The portion of Perry relied on by Petitioner is entitled "Batch Through-Circulation Dryers." Ex 1006 at 12-44; Ex. 2025 at ¶126. This section is dedicated entirely to batch drying. Ex. 1006 at 12-44; Ex. 2025 at ¶126. Perry's discussion of a vacuum dryer is expressly

directed to items that are placed on shelves and dried in batches, such as pharmaceuticals. Ex. 1006 at 12-44 ("The material to be dried is placed in pans or trays onto heated shelves."); Ex. 2025 at ¶¶80-81. By contrast, LithoRec specifically instructs the person of ordinary skill in the art *not* to use batch drying. Ex. 1016 at 226. Batch dryers and continuous dryers have fundamentally different designs such that one cannot be simply substituted for the other. Ex. 2025 at ¶¶118, 127.

Petitioner's reliance on Perry as to the pressure to use for vacuum drying comminuted rechargeable batteries is misplaced. *See* Pet. at 26. Perry is unrelated to battery recycling; Perry is focused on drying items like pharmaceuticals, food, and seeds. Ex 1006 at 12-44-45; Ex. 2025 at ¶¶80-82. Perry does not discuss evaporating the kinds of organic solvents at issue in LithoRec. Ex. 2025 at ¶82. Perry does not address pressure ranges for performing vacuum drying in combination with the vibratory fluidized bed dryer taught in LithoRec, wherein a blower uses positive pressure to force high gas densities up into the shredded battery material. Ex. 1006 at 12-44; 1016 at 227; Ex. 2025 at ¶¶82, 127.

Petitioner cites to no expert opinion to explain why LithoRec could or would be combined with Perry. *See, e.g.*, Pet. at 25-26. This attorney argument is entitled to no weight. *See* 35 U.S.C. § 312(a)(3); *see also Estee Lauder*, 129 F.3d at 595. Thus, Petitioner fails to present evidence in support of combining Perry with

LithoRec to arrive at the 300 hPa limitation that is absent from LithoRec. Ex. 2025 at ¶128.

D. LithoRec in view of DIN 28400 does not disclose drying "at a maximum pressure of 300 hPA."

The Board also initially determined that a person of ordinary skill in the art would not have considered DIN 28400 as providing sufficient teaching that would allow for selection of 300 hPa pressure limitation disclosed in the claim. Inst. Dec. at 20. The Board should reconfirm this initial determination.

DIN 28400 provides a table stating ranges of low, medium, high, and ultra-high vacuum pressures. Ex. 1018 at 1 DIN 28400 Part 1, Section 1, Table 1 ("Table 1"); Ex. 2025 at ¶¶83-88. According to Table 1, a low (or "rough") vacuum is characterized by pressures ranging from 1000 mbar to 1 mbar (*i.e.*, 1000 hPa to 1 hPa). Ex. 1018 at Table 1; Ex. 2025 at ¶¶87-88; 129-131. Among these various ranges of vacuum, there is nothing in DIN 28400 that would tell a person skilled in the art which level of vacuum to use in the context of EV battery recycling. Ex. 2025 at ¶¶89, 129.

Petitioner identifies a statement in DIN 28400 in support of its assertion that DIN 28400 teaches the use of a pressure of 300 hPa. Ex. 1018 at 1 DIN 28400 Part 1, Section 1.1 ("Vacuum refers to the state of a gas when the pressure of the gas, and thus the number density of molecules, in a container is lower than outside,

or when the pressure of the gas is lower than 300 mbar, i.e., lower than the lowest atmospheric pressure on the Earth's surface."); Ex. 2025, ¶132. The pertinent part of this definition is that a vacuum exists when the pressure "in a container is lower than outside," as confirmed by the International Standards Organization standard on which DIN 28400 relies. *Id.*; Ex. 2018 (defining a vacuum as a state of a gas having a pressure "below the prevailing atmospheric level"); Ex. 2025 at ¶132-134.

The reference in DIN 28400 to "300 hPa" describes the "lowest atmospheric pressure on the Earth's surface." Ex. 1018 at 1 DIN 28400 Part 1, Section 1.1; Ex. 2025, ¶135. This refers to the pressure atop Mount Everest, as confirmed by a subsequent version of the ISO standard upon which DIN 28400 is based. Ex. 2019 at 1, Section 3.1.2, n.2 ("The prevailing atmospheric pressure on ground depends on weather conditions and altitude and ranges from 31 kPa (altitude of the Mount Everest, weather condition 'low') up to 110 kPa (altitude Dead Sea, weather condition 'high')"); Ex. 2025 at ¶135. This fact was likewise known by 2015. Ex. 2020 at 1063; Ex. 2025 at ¶135.

A person of ordinary skill in the art would not be motivated to combine the reference to "300 hPa" in DIN 28400 with LithoRec. Ex. 2025 at ¶¶136-137. The reference to "300 hPa" pressure, equivalent to conditions atop Mount Everest, is irrelevant to EV battery recycling processes, which typically operate under vastly different atmospheric conditions, near sea level. *Id.*

Petitioner's brief offers no evidence that a person of skill would apply this "300 hPa" teaching to the LithoRec context. Pet. at 25 ("One of the conditions that meets the international standard ISO 3529-1:1981 for a vacuum is that the pressure is between 0 and 300 millibars (*i.e.*, between 0 and 300 hPa)."); Ex. 2025 at ¶132, 136-139. Not only is this statement a tautology, but it is unsupported by any expert evidence. *See also* Pet. at 26 (asserting without support that "it was part of the international standard and thus certainly would have been used by a POSITA who already knew to implement a dryer with a vacuum from LithoRec"); Ex. 2025 at ¶132. These attorney arguments should be accorded no weight. *See* 35 U.S.C. § 312(a)(3); *see also Estee Lauder*, 129 F.3d at 595; *C.R. Bard*, IPR2015-00511, Paper 9 at 15.

E. Petitioner does not support its proposed motivation to combine LithoRec with Perry or DIN.

Petitioner fails to provide proper evidentiary support to establish that a person of skill in the art would have combined LithoRec, Perry, and DIN 28400. Ex. 2025 at ¶¶124-128, 129-139. Rather, the Petition is rife with unsupported attorney arguments that go to the core of the supposed motivation to combine. *See, e.g.*, Pet. at 26-28. Such conjectures regarding what a person of ordinary skill would have understood are attorney argument and should be disregarded. *See* 35 U.S.C. § 312(a)(3); *see also Estee Lauder*, 129 F.3d at 595. Once these

unsupported assertions are properly discounted, there is nothing left of Petitioner's argument to suggest that a person of ordinary skill would have combined LithoRec, DIN 28400, and Perry.

F. The asserted combination is not enabled.

The proposed combination of LithoRec with Perry and DIN 28400 would not have enabled a person of skill to practice the claimed invention of the '097 patent. Ex. 2025 at ¶¶140-144; *Raytheon*, 993 F.3d at 1380.

Patent Owner incorporates by reference the section above detailing why Petitioner has failed to establish that LithoRec is enabling, for purposes of its challenge to Claim 12. The same rationale applies for Claim 1 and its dependent claims. *See* Section VI.C, *supra*.

G. Dependent Claims 2-3, 7-8, and 10 are not obvious because Claim 1 is not obvious.

If an independent claim is not obvious, then a dependent claim also cannot be obvious because it depends from a nonobvious claim. *Ortho-McNeil*, 520 F.3d at 1365. Claims 2-3, 7-8, and 10 depend from independent Claim 1 and, as shown above, Claim 1 is not obvious. Accordingly, Claims 2-3, 7-8, and 10 are also not obvious.

H. Dependent Claim 2: "The method according to claim 1, wherein the comminuted material is dried until an electrolyte content in the comminuted material is so low than an electrochemical reaction is impossible."

In addition to the foregoing positions regarding independent Claim 1, Petitioner fails to establish obviousness of dependent Claim 2. Petitioner does not provide evidence to show that LithoRec teaches that drying progresses sufficiently far that "electrolyte content in the comminuted material is so low than an electrochemical reaction is impossible." Ex. 2025, ¶145.1. Even if LithoRec discloses that some drying of some solvents occurs, there is no disclosure that drying is so thorough that electrolyte content in the comminuted material is so low that an electrochemical reaction is impossible. Ex. 2025, ¶145.1. As noted above, LithoRec's system would mix freshly-introduced comminuted battery material with partially-dried material, which would frustrate drying the material to the point of inactivation. *See supra*, Section VIII.A; Ex. 2025, ¶¶160-163. The most that LithoRec teaches are generalized goals about solvent removal and safety. Ex. 1016 at 226 & 229. However, stating these goals does not amount to a teaching that the electrolyte content is so low that an electrochemical reaction is impossible. *See, e.g.*, *Enzo Biochem, Inc.*, 188 F.3d at 1374. Petitioner cites to no <u>evidence</u> that this specific metric of drying is disclosed, and its attorney argument should be disregarded. *Vivid Technologies, Inc. v. American Science & Eng'g, Inc.*, 200 F.3d

795, 812 (Fed. Cir. 1999); *see also* Ex. 2025, ¶145.1. Even if the Board were to sift through the accompanying declaration of Volker Spies, which is not cited by Petitioner, it would not find evidence that this limitation is obvious in view of the prior art. *DeSilva v. DiLeonardi*, 181 F.3d 865, 867 (Fed. Cir. 1999); *C.R. Bard, Inc. v. Medline Indus., Inc.*, IPR2015-00511, Paper 9 at 15 (PTAB July 15, 2015).

I. Dependent Claim 7: "The method according to claim 1, wherein the drying of the comminuted material is only completed if one or more of the following conditions is met: no flammable or explosive gas mixture is formable above the comminuted material in the transport container, and the comminuted material is so dry that no flammable or explosive gas mixture is able to emerge in the transport container."

Similar to Claim 2, Petitioner fails to establish obviousness of dependent Claim 7. Petitioner does not provide evidence to show that LithoRec teaches that drying progresses sufficiently far that "no flammable or explosive gas mixture is formable above the comminuted material in the transport container," and/or that "the comminuted material is so dry that no flammable or explosive gas mixture is able to emerge in the transport container." For the same reasons that Petitioner fails in its challenge to Claim 2, its attack on Claim 7 fares no better. See Ex. 2025, ¶145.2.

IX. GROUND 2: Claim 9 for obviousness over LithoRec, Perry, DIN 28400, and Hanisch

Petitioner challenges claim 9 of the ’097 Patent under 35 U.S.C. § 103 based on the references LithoRec, DIN 28400, and Perry, and further in view of Hanisch. Claim 9 depends from Claim 1. Pet. at 35. Petitioner relies on Hanisch to allegedly disclose the temperature limitation claimed in Claim 9. *Id.* at 37. Petitioner, however, does not rely on any disclosure in Hanisch to cover any of the limitations of Claim 1, including limitations not disclosed in LithoRec, DIN 28400, and Perry. As Claim 1 is not unpatentable for the reasons stated above, Claim 9 is likewise not unpatentable.

Furthermore, the disclosure in Hanisch relied on by Petitioner does not teach inactivation. Ex. 2025, ¶146.1. The referenced disclosure is to the low-temperature “pre-dryer” of Hanisch. Ex. 1020 at 8:8-9. However, Petitioner fails to show that the “pre-dryer” of Hanisch inactivates the comminuted battery material. Ex. 2025, ¶146.1. Indeed, the Board found in its Institution Decision in IPR2024-00948 that the Petitioner in that matter failed to show that the pre-dryer sufficiently dries the battery material to the point of inactivation. IPR2024-00948, Paper 10 at 13. In the present matter, Petitioner has presented no evidence that Hanisch discloses inactivation.

Because Petitioner has failed to show there is vacuum drying performed in LithoRec (and the express disclosures are contrary to the use of vacuum), Petitioner has failed to show that the electrolyte solvents would evaporate from the battery material, particularly at the low temperature range recited in Claim 9. The boiling point of the solvents in lithium batteries is higher than 80°C. Ex. 2025, ¶120. Because the dryer disclosed in LithoRec is incompatible with vacuum drying, Petitioner has failed to show that there would be drying below 80°C.

Furthermore, Petitioner has failed to establish that Perry can be combined with LithoRec and/or Hanisch. The same deficiencies set forth above in Ground 1, *see* Section VIII.C, *supra*, equally pertain to Ground 2. LithoRec and Hanisch recommend continuous, not batch processes, for drying batteries. Ex. 1016 at 226 ("batch drying is not used"); Ex. 1020 at 4 ("The method according to the invention is preferably carried out as a continual process, as opposed to in batches."). But Perry is specific to vacuum shelf dryers using batch drying. Ex. 1006 at 12-44 ("Batch Through-Circulation Dryers"). Petitioner fails to justify how these disparate teachings could be combined, as the Board has already ruled. Institution Decision at 21.

Moreover, there would be no need for the pre-dryer in Hanisch to inactivate the comminuted battery material, because after the material exits the pre-dryer, it enters a decomposition furnace, which operates at temperatures of 400°C to 600°C,

which would destroy any solvent and render moot any need to dry the material to remove any solvent or otherwise achieve inactivation in the pre-dryer. Ex. 2025, ¶146.1. Nor does Hanisch provide any details relating to an inactivation process including disclosure of necessary pressure, how to measure achieving inactivation, or drying conditions necessary for various solvents. *Id.* Because the pre-dryer of Hansich does not inactivate the battery material, a POSITA would not be motivated to combine Hanisch with LithoRec to arrive at Claim 9, because there is no showing that this would inactivate the battery material. *Id.*

X. Secondary Considerations Compel a Finding of Non-Obviousness

A. Objective Indicia of Nonobviousness Support Patentability

Even where the teachings of the prior art "point in the direction of" the claimed subject matter, objective evidence of nonobviousness may lead to a conclusion that the challenged claims would not have been obvious. *In re Piasecki*, 745 F.2d 1468, 1474–75 (Fed. Cir. 1984); *Transocean Offshore Deepwater Drilling, Inc. v. Maersk Drilling USA, Inc.*, 699 F.3d 1340, 1349 (Fed. Cir. 2012).

Here, secondary indicia of non-obviousness, including long-felt need, unexpected results, commercial success, and licensing, also confirm patentability. Ex. 2025, ¶¶171-179; Ex. 2040, ¶¶2-12.

B. Long-Felt but Unmet Need and Unexpected Results

Prior to the ’097 invention, many companies tried and failed to develop a process for inactivating depleted rechargeable batteries for safe storage and transport. Companies proposed mixing various additional chemicals with the comminuted material to mitigate known hazards relating to the comminuted material, including: flame retardants (Ex. 2008 at 7-8); aqueous solution or a deactivating powder (Ex. 2004 at 5:[0034]-[0035]); mineral acids (Ex. 2001); brine solutions (Ex. 2002); and pressurized solvents (Ex. 2011); *see also* Ex. 2025, ¶172. However, adding foreign substances to the comminuted battery material had deleterious effects on the recycling process. *See* Ex. 1001 at 2:6-12; Ex. 2025, ¶172. Moreover, given that treatment with aqueous solutions can cause partial electrolysis and produce toxic gases, the need for safe battery processing in such conditions was well recognized. Ex. 2001, 1:26-29; Ex. 2025, ¶172. LithoRec noted the costs associated with neutralizing the HF that it anticipated would be generated in its process. Ex. 1016 at 190 (describing costs of sodium hydroxide (NaOH) for washing hydrofluoric acid, and associated disposal costs); *see also* Ex. 2025, ¶172.

The ’097 patent addresses these long-standing needs by offering an elegant solution that allows batteries to be comminuted directly, and then inactivated by drying at a pressure below 300 hPa. Ex. 2025, ¶¶173-174. Preferably, and as

recited in Claim 9, the drying is done at temperatures below 80ºC, which has the advantage of avoiding the creation of toxic gases such as hydrogen fluoride. *Id.* By avoiding the need to add foreign substances, the claims of the ’097 patent beneficially eliminate contaminants from the recycling process. *See, e.g.,* Ex. 1001, 1:63-2:4, 2:5-12. By safely inactivating electrolytes and associated solvents without forming hydrogen fluoride, the ’097 patent achieved a safer and more efficient way of recovering spent battery material with high purity and rendering it safe for transport. Ex. 2025, ¶¶173-174.

The ’097 invention also provided unexpected results. As discussed above, prior battery recycling approaches added foreign substances or high temperatures that introduced serious hazards, *e.g.*, freezing, incineration, melting, adding reactants, and shredding in water. *See also* Ex. 2025, ¶¶51-57, 174. The ’097 patent took a completely different and unexpected approach to preventing these hazards—avoiding creating the hazards in the first place. Ex. 2025, ¶¶173-174. The advantages and benefits of vacuum drying at pressures below 300 hPa without treating with foreign substances were superior because solvents can be recovered at a purity of over 99%, the energy requirement is low, the drying time is short, no waste gas scrubbing is necessary, no toxic filter materials have to be disposed of, no chemicals are needed, and the lithium is present in the black mass as $LiPF_6$ and not as a breakdown product. *Id.* at ¶174.

C. Duesenfeld's Battery Recycling Processes Practice the Challenged Claims

Duesenfeld operates a battery comminution facility at its Wendeburg Plant. Ex. 2040, ¶¶6-8. The Wendeburg Plant practices the '097 claimed invention. Ex. 2025, ¶¶176-178; Ex. 2036 (claim chart). Indeed, the Wendeburg Plant represents one of the preferred embodiments disclosed in the '097 patent. Ex. 1001, 3:4-12 ("According to a preferred embodiment, the drying occurs under vacuum. The size of the vacuum is preferably selected such that the vapour pressure of dimethyl carbonate at 80°C., especially at 70°C., is not reached. It is beneficial if the drying occurs at a maximum pressure of 300 hPa, in particular a maximum of 100 hPa. At such low pressures, considerable parts of most electrolytes vaporise, especially dimethyl carbonate and ethyl methyl carbonate, and do so at temperatures of less than 80°C."); Ex. 2025, ¶177.

D. Duesenfeld's Battery Recycling Processes Have Been Commercially Successful

Duesenfeld's battery recycling processes have been commercially successful. Ex. 2040, ¶¶9-12. For example, [redacted]

[redacted]

and all batteries processed were shredded and then were dried at conditions of a temperature of less than 80°C and at a pressure of less than 300 hPa, after which the black mass was shipped in transport containers to customers. Ex. 2040, ¶9.

Duesenfeld has also successfully licensed the claimed technology. Ex. 2040, ¶¶10-11. Specifically, [redacted] Ex. 2051 (June 11, 2024 Seval S.r.l. and RiPlastic S.p.A. press release). Seval touts in its press release that "Thanks to this process, the treatment of lithium-ion batteries is carried out at a low temperature in complete safety, with emissions largely below the most stringent thresholds and no hydrogen fluoride release, producing a black mass with an excellent level of purity, rich in nickel, cobalt and lithium, as well as noble metals like aluminum, copper, iron. The technology also allows us to achieve a very high recovery rate as

required by the new European Regulation 2023/1542." *Id.* [redacted]

In addition, Duesenfeld's consulting business is on a growth trajectory, having recently entered into a cooperation agreement with Andritz AG, one of the largest plant manufacturers in the world. Ex. 2040, ¶12; Ex. 2052. Pursuant to this cooperation agreement, Duesenfeld is disclosing its technology to ANDRITZ, which will build a new reference plant for Duesenfeld, which will expand Duesenfeld's throughput and permit Duesenfeld to showcase its technology. Ex. 2040, ¶12.

E. Rebuttable Presumption of Nexus

To be accorded substantial weight, the evidence of the secondary considerations must include a showing of nexus. *In re GPAC Inc.*, 57 F.3d 1573, 1580 (Fed. Cir. 1995). There is a rebuttable presumption of nexus when the patentee shows that the asserted objective evidence is tied to a specific product and that product is the invention disclosed and claimed in the patent. *WBIP, LLC v. Kohler Co.*, 829 F.3d 1317, 1329 (Fed. Cir. 2016); *SightSound Techs., LLC v. Apple*, Inc., 809 F.3d 1307, 1319 (Fed. Cir. 2015) ("If a product both embodies the claimed features and is coextensive with the claims at issue, a nexus is

presumed."); *see also Teva Pharms. USA, Inc. v. Sandoz, Inc.*, 723 F.3d 1363, 1372 (Fed. Cir. 2013) (there is a "presumption of a nexus" when a product is "coextensive" with a patent claim).

Here, Duesenfeld is entitled to the rebuttable presumption of a nexus between the objective evidence of nonobviousness and the Challenged Claims because the evidence is tied to a specific process, Duesenfeld's battery recycling process at its Wendeburg Plant, and that process is the invention disclosed and claimed in the Challenged Claims. Ex. 2040; Ex. 2025, ¶¶176-177; & Ex. 2036 (Confidential Appx. D).

Even if Petitioner could somehow rebut the presumption of a nexus, "the patent owner is still afforded an opportunity to prove nexus by showing that the evidence of secondary considerations is the 'direct result of the unique characteristics of the claimed invention.'" *Volvo Penta of the Ams., LLC v. Brunswick Corp.*, 81 F.4th 1202, 1210 (Fed. Cir. 2023) (*citing Fox Factory, Inc. v. SRAM, LLC*, 944 F.3d 1366, 1373–74 (Fed. Cir. 2019) (*quoting In re Huang*, 100 F.3d 135, 140 (Fed. Cir. 1996))). A nexus analysis is not confined to the claimed novel features. *Id.* (*citing WBIP*, 829 F.3d at 1330 (stating that "proof of nexus is not limited to only when objective evidence is tied to the supposedly 'new' feature(s)")). Instead, "the invention as a whole" should be considered, rather than on a "limitation-by limitation" basis. *Id.* (*citing Chemours, Co. FC v. Daikin*

Indus., 4 F.4th 1370, 1377 (Fed. Cir. 2021); *Yita LLC v. MacNeil IP LLC*, 69 F.4th 1356, 1364 (Fed. Cir. 2023) (discussing *WBIP*)).

The evidence shows that the "unique characteristics of the claimed invention" of the '097 patent are driving the commercial success of Duesenfeld's battery recycling processes. *Volvo*, 81 F.4th at 1210. Advertisements for Duesenfeld's battery recycling processes tout the benefits of the patented '097 "vacuum drying" technology. Ex. 2053 (Duesenfeld Brochure), 3 ("we have developed and licensed processes that do not require melting down or high-temperature treatment of batteries"), 3 ("Patent: Drying below 80 degrees Celsius is only possible with the Duesenfeld patented process"); 5 ("During mechanical shredding and inactivation of the batteries, the drying process takes place below 80°C and at a low vacuum; Only under these conditions is no exhaust gas scrubbing necessary. Only in this temperature range can also the solvents of the electrolyte, the graphite and the lithium be recovered in a purity so that they can be reused. Through this technology, Duesenfeld combines environmental friendliness with maximum economic efficiency."); Ex. 2012 (Duesenfeld website https://www.duesenfeld.com/recycling_en.html) (". . . A low process temperature prevents the formation of toxic gases, so no exhaust gas scrubbing is necessary. The separated solvent has a very high purity level because the production of hydrogen fluoride from reaction products is avoided.").

"Th[is] prominence of the patented technology in … advertising creates an inference that links the … invention to this success." *Gambro Lundia AB v. Baxter Healthcare Corp.*, 110 F.3d 1573, 1579 (Fed. Cir. 1997). Thus, there is a strong nexus between the '097 patent and the success of Duesenfeld's battery recycling processes.

XI. CONCLUSION

For the foregoing reasons, the Petition fails to establish by a preponderance of the evidence that the Challenged Claims are unpatentable. Accordingly, the Challenged Claims should be confirmed under 35 U.S.C. § 316.

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Respectfully submitted,

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WORD COUNT CERTIFICATION

Pursuant to 37 C.F.R. § 42.24(d), Patent Owner certifies that this Patent Owner Response has a total of 13,891 words as counted by Microsoft Word, exclusive of the cover page, table of contents, table of authorities, mandatory notices under § 42.8, certificate of service, word count, appendix of exhibits or claim listing, and signature block (37 C.F.R. § 42.24(a)). The word count includes all other text, including headings, footnotes, and quotations. This is within the 14,000-word limit allowed under § 42.24(a)(1)(i).

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CERTIFICATE OF SERVICE

I hereby certify that on February 12, 2025, a true and correct copy of this Patent Owner Response, including all accompanying attachments, and exhibits, has been served in its entirety via e-mail upon the following:

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