

IPR2024-00948
U.S. Patent No. 11,050,097

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ASCEND ELEMENTS, INC.,
Petitioner,

v.

DUESENFELD GMBH,
Patent Owner.

Inter Partes Review No. IPR2024-00948
U.S. Patent No: 11,050,097

PATENT OWNER SUR-REPLY

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**PATENT OWNER'S EXHIBIT LIST
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Ex. 2001	Declaration of Vani Dantam in support of Patent Owner's Preliminary Response to the Petition ("Dantam Declaration")
Ex. 2002	Gao Liu et al., <i>Binder Interactions in the Electrodes of the Lithium-ion Batteries</i> , TFUG Conference, February 17, 2009 ("Gao")
Ex. 2003	DE 102012024876 A1 to Electrocyling GmbH ("Electrocyling") (English)
Ex. 2004	U.S. Patent No. 7,198,865 to Sloop ("Ecobat")
Ex. 2005	WO 2010/149611 A1 to LiMotive Company Ltd. ("LiMotive") (English)
Ex. 2006	WO 2010/149611 A1 to LiMotive Company Ltd. ("LiMotive") (German)
Ex. 2007	DE 102012024876 A1 to Electrocyling GmbH ("Electrocyling") (German)
Ex. 2008	Yang et al., <i>Thermal Stability of LiPF₆ Salt and Li-Ion Battery Electrolytes Containing LiPF₆</i> , Journal of Power Sources 161, 573 (2006) (Preprint) ("Yang")
Ex. 2009	Gnanaraj et al., <i>A Detailed Investigation of the Thermal Reactions of LiPF₆ Solution in Organic Carbonates Using ARC and DSC</i> , Journal of the Electrochemical Society, 150(11), A1533 (2003) ("Gnanaraj")
Ex. 2010	Certification of Translation of the Electrocyling Patent
Ex. 2011	Certification of Translation of the Limotive Patent
Ex. 2012	Duesenfeld GmbH Website – Recycling [https://www.duesenfeld.com/recycling_en.html]
Ex. 2013	Ascend Elements Press Release
Ex. 2014	<i>Ascend Elements, Inc.'s Answer to Complaint</i> , Case No. 1-23-cv-01194 (D. Del.)

Ex. 2015	Scheduling Order in Case No. 23-1194-JFM
Ex. 2016	Email from J.Stiel to J.Ploger (dated Dec. 6, 2023)(German)
Ex. 2017	Email from J.Stiel to J.Ploger (dated Dec. 6, 2023)(English)
Ex. 2018	Certification of Translation of Email from J.Stiel to J.Ploger (dated Dec. 6, 2023) and of Kwade, et al. (Ex. 2020, below)
Ex. 2019	Christian Hanish et al., <i>Recycling von Lithium-Ionen-Batterien – das Projekt LithoRec</i> , Recycling und Rohstoffe, January 2012 (“Kwade, et al.”) (German)
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Ex. 2021	Yang et al., <i>Thermal Stability of LiPF₆ Salt and Li-Ion Battery Electrolytes Containing LiPF₆</i> , Journal of Power Sources 161, 573 (2006)
Ex. 2022	Declaration of Vani Dantam in support of Patent Owner’s Response to the Petition (“Dantam POR Declaration”)
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Ex. 2025	N. Somsuk et al., <i>Design and Development of a Rotary Airlock Valve for using in Continuous Pyrolysis Process to Improve Performance</i> , 2010 International Conference on Manufacturing Science and Technology (ICMST 2010)
Ex. 2026	Water boiling point as function of absolute pressure available at: https://www.engineeringtoolbox.com/water-evacuation-pressure-temperature-d_1686.html
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Ex. 2033	Boiling point for EMC, available at: https://www.msесupplies.com/products/high-purity-ethyl-methyl-carbonate-c-4-h-8-o-3-99-99-4n?srsltid=AfmBOoqUr1g_4hUH5zYLI-kjf8M3Z-cqlnYULkbD2h_WRok0GU30TOI
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Ex. 2035	U.S. Patent No. 5,405,231 (“Kronberg”)
Ex. 2036	Confidential Appendix C to Declaration of Vani Dantam [PROTECTIVE ORDER MATERIAL]
Ex. 2037	Confidential Appendix D to Declaration of Vani Dantam [PROTECTIVE ORDER MATERIAL]
Ex. 2038	Screenshots of YouTube Duesenfeld plant video found at https://www.youtube.com/watch?v=g1Ij4Emz8XQ (“How to recycle lithium-ion batteries? – Closing the loop in e-mobility”, Dec. 6, 2023)
Ex. 2039	Meyer Rotary Valve Basics Video Transcript, available at:

	https://www.youtube.com/watch?v=iwjyRePPIt4
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Ex. 2041	Duesenfeld GmbH Wendeburg plant processing conditions [PROTECTIVE ORDER MATERIAL]
Ex. 2042	German regulations available at https://www.bmuv.de/fileadmin/Daten_BMU/Download_PDF/Abfallwirtschaft/kreislaufwirtschaftsgesetz_en_bf.pdf (English translation)
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Ex. 2052	Press Release: <i>Andritz and Duesenfeld sign cooperation agreement for battery recycling</i> , dated February 10, 2025
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Ex. 2059	Machine Translation of Complaint for Annulment of EP 3 312 922
Ex. 2060	Declaration of Travis K. Waller in Support of Motion for Pro Hac Vice Admission
Ex. 2061	Deposition transcript of Walter van Schalkwijk, dated June 6, 2025

I. INTRODUCTION

Ascend has attempted to jettison the most probative prior art reference of record – Meador. Meador confirms that in a continuous battery recycling process only a slight underpressure would be workable. This is because the seals that allow battery material to continually enter and exit the process have only limited ability to maintain a pressure differential. Thus, Meador undercuts Petitioner’s insistence that that it would be “obvious” to a POSITA to operate Hanisch’s continuous system at a vacuum level of 300 hPa or stronger. Nor can the continuous system of Hanisch ’419 be combined with the batch processes of Hayashi or Shin to teach the 300 hPa limitation.

Even were the Board to find that Hanisch ’419 teaches a batch system, a POSITA would still not combine Hanisch ’419 with Hayashi or Shin to teach all the elements of the asserted claims. Regarding the pre-dryer of Hanisch ’419, neither Hayashi nor Shin cure the defect that Hanisch ’419 does not teach inactivating the shredded battery material in the pre-dryer. And the decomposition oven of Hanisch ’419 operates at temperatures above 350°C, which would vaporize all the remaining solvents, such that there would be no motivation to incur the cost and complexity to add the vacuum levels of Hayashi or Shin.

II. CLAIM CONSTRUCTION

Petitioner argues indefiniteness. However, challenges under Section 112 are

inappropriate in an IPR proceeding. 35 U.S.C. § 311(b). It is particularly inapt for Petitioner to argue indefiniteness, when it already had an opportunity to challenge the definiteness of “inactivated” in the district court claim construction proceedings, and never raised the issue. Ex. 1023.

The ’097 patent distinguishes between “drying” and “inactivating.” Ex. 1001 at 8:54-55 (“The drying of comminuted material results in inactivated comminuted material.”). Nonetheless, Petitioner collapses the meaning of these terms.

III. PETITIONER FAILS TO SHOW THAT THE PRE-DRYER OF HANISCH ’419 INACTIVATES THE SHREDDED BATTERY MATERIAL (ELEMENTS 1[B], 1[D], AND 12[B])

A. Petitioner fails to show that the “dry fragments” exiting the pre-dryer constitute inactivated battery material.

Petitioner for the first time points to the zigzag classifier and other optional separators as evidence that the battery material exiting the pre-dryer is inactivated. Reply at 7. Petitioner claims that the presence of these optional components necessitates this understanding because (i) this optional equipment would not work properly if the battery material is still “wet” and (ii) it would be dangerous to pass partially “wet” material through these optional pieces of equipment. Petitioner is wrong.

Petitioner did not raise this supposed evidence of knowledge of a POSITA in the Petition. It should be rejected for this reason alone. *See Consolidated Trial*

Practice Guide (“CTPG”) at 73 (“Petitioner may not submit new evidence or argument in reply that it could have presented earlier”); *Intelligent Bio-Systems, Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1369 (Fed. Cir. 2016).

There is no basis to assume, as Petitioner urges, that the material needs to be inactivated to pass through the classifiers. Dr. van Schalkwijk presents no evidence for this proposition, short of his *ipse dixit* declaration. Dr. van Schalkwijk provides no evidence that the shredded battery material is dried throughout, to the point of inactivation. Petitioner bears the burden, which is not carried by such unsupported evidence. 35 U.S.C. § 316(e); 37 C.F.R. § 42.65(a).

At most, Hanisch ’419 states that “dry cell fragments” exit the pre-dryer and enter the separators. Ex. 1004 at 4:19-24. But “dry” does not mean “inactivated.” Ascend is improperly attempting to collapse the meaning of these two terms, which have distinct meanings in the patent, with inactivation being the **result** of drying. Ex. 1001 at 8:54-55. There are no controls proposed in Hanisch, such as drying times, that would ensure for the material exiting the pre-dryer to be sufficiently dry to quality as “inactivated.” Ex. 2022 at ¶¶83-85. Dr. van Schalkwijk does not dispute that the rate of electrolyte extraction is inversely proportional to the volume of electrolyte extracted, such as that as more electrolyte is extracted in the pre-drying process, it takes longer and longer to extract additional electrolyte. Ex. 2022 at ¶85. There would be no reason to incur the cost and complexity of

inactivating the material in the pre-dryer, because the material is then transferred to the 350°C decomposition oven where all the solvents would be vaporized. Ex. 2022 at ¶81. The description that material is “dry” when it exits the “pre-dryer,” and that it is able to pass through the optional classifiers, does not imply that inactivation is reached. Ex. 2022 at ¶80.

Petitioner’s arguments about the hazards of sorting partially wet materials are overstated and wrong. In deposition, Dr. van Schalkwijk discounted the potential hazard of partially wet materials in the classifiers. Ex. 2061 at 20:16-17 (“I didn’t say they would be dangerous.”); *id.* at 25:13-19 (“They’re not likely to generate enough heat to cause this kind of reaction to take place because since they are wet particles, they’re not going to create the static electricity that you would need to generate the heat, the heat.”); *id.* at 33:14-18 (“Generally, even if the material is active because there’s some wet material, there’s not enough to support an electrochemical reaction that would go beyond a few seconds.”).

Nor do eddy-current separators or magnetic separators require that the battery material be inactivated. These devices rely on magnetic fields to separate various metallic items. Ex. 1023, ¶¶12-13. Although Petitioner writes that “damp battery material could [] interfere with the magnetic fields,” there is no support for that argument – Dr. van Schalkwijk is silent on this point. *Compare* Reply at 8 *with* Ex. 1023, ¶¶12-16.

Petitioner's position is even less supportable under the Board's preliminary construction of the term "inactivated" (*i.e.*, "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"). As explained above, Petitioner has failed to show that the material emerging from the pre-dryer is "inactivated," and this failure is all the more apparent if that term were to require that an electrochemical reaction is either no longer possible or only possible to a negligibly small extent. Dr. van Schalkwijk does not even mention this standard. *See* Ex. 1023, ¶¶9-18. Petitioner's Reply attempts to gloss over this absence of evidence. Reply at 9 (asserting, without citation, that "the material must have been rendered electrochemically safe").

B. Petitioner's "waiver" argument is unsupportable

Patent Owner thoroughly explained that the pre-dryer of Hanisch '419 does not result in inactivated comminuted material. POR at 14-17. Patent Owner presented this argument in the context of Claim 1, and reiterated it for Claim 12. POR at 23. Patent Owner did not repeat the same arguments about "inactivating" for Ground 2, because Ground 2 concerns Petitioner's argument that the "300 hPa" limitation is taught in the prior art. Petitioner asserts that this is a "waiver," citing *In re Nuvasive, Inc.* 842 F.3d 1376, 1380 (Fed. Cir. 2016). But in *Nuvasive*,

petitioner deliberately chose not to challenge the public accessibility of prior art.

Id. Here, Patent Owner contested the point about the inactivation of battery material in Hanisch '419, and has simply not burdened the Board with a repetition of the exact same argument for Ground 2. Patent Owner fully presented its arguments, which apply equally to Ground 2.

IV. PETITIONER FAILS TO SHOW THE 300 HPA PRESSURE LIMITATION IS DISCLOSED IN THE PRIOR ART (GROUNDS 1 AND 2, ELEMENT 1[E])

A. As a continuous process, Hanisch '419, in view of a POSITA, does not render obvious the 300 hPa limitation [Ground 1]

Petitioner fails to show it would have been obvious to operate the process of Hanisch '419 at a vacuum level of 300 hPa or lower, either based on Hanisch '419 in view of a POSITA [Ground 1], or in view of secondary references Hayashi or Shin [Ground 2].

1. Meador confirms that the process of Hanisch '419 would not work at 300 hPa [Ground 1]

Petitioner has attempted to bury Meador. Reply at 16 n.6. But Meador is the most probative prior art reference of record. Ex. 1011. Meador discloses a continuous system for recycling battery material. Ex. 1011 at 5:20-24. Meador discloses using vacuum levels of “about one-half to one inch of mercury.” Ex. 1011 at Claim 4; *see also id.* at 5:61-63. Petitioner initially (and erroneously) interpreted these vacuum levels as *absolute* pressures. Petition at 44. But in

deposition, Petitioner's expert acknowledged that the vacuum levels in Meador are *relative to ambient*. Ex. 2024 at 68:15-73:4 & 114:1-13. Thus, Meador taught that the appropriate vacuum level in a continuous process is an underpressure relative to ambient of about one-half inch to one inch of mercury (*i.e.*, an absolute pressure of 979 hPa to 1001 hPa if at sea level). Ex. 2022, ¶¶138-139. This slight underpressure reflects the limited ability of valves to maintain a pressure differential while material continuously enters and exits the process. Ex 2022, ¶¶131-136. Meador disproves Petitioner's arguments that it would supposedly be "obvious" to run a continuously operating system below 300 hPa.

2. Petitioner fails to show that Hanisch '419, in view of a POSITA, would render obvious the 300 hPa limitation [Ground 1]

Petitioner's attempt to argue that a POSITA would have found it obvious to operate the system of Hanisch '419 at 300 hPa fails.

First, an IPR may be based only on prior art patents or printed publications. 35 U.S.C. §311. General "knowledge of a POSITA" is neither. Petitioner's attempts to combine Hanisch with the opinion of its own expert is not an attempt to interpret the disclosure of the prior art, but impermissibly to fill gaps. *K/S Himpp v. Hear-Wear Techs.*, 751 F.3d 1362, 1365 (Fed. Cir. 2014); *Unified Pats. v. Velos Media*, No. IPR2019-00883, 2019 WL 699079, at *5 (P.T.A.B. Nov. 15, 2019); CTPG at 36.

Second, Petitioner ignores that the claimed 300 hPa pressure level is a far stronger vacuum than what the prior art taught was workable for a continuous system, as confirmed by Meador. Ex. 1011 at 5:61-63. The devices used for maintaining vacuum in a continuous process only allow for a modest underpressure. Ex. 2022, ¶¶151-161. Pressed to explain how a POSITA would structure such a device, Petitioner suggests that a POSITA could string together a series of rotary airlocks. But Dr. van Schalkwijk admitted he was unaware of such an approach in the battery recycling industry. Ex. 2061 at 85:7-89:16, esp. 89:15-16 (“I haven’t seen it done.”).

Nor does Petitioner dispute the fundamental problems of working with rotary airlocks to process irregularly-shaped, jagged, metallic pieces of shredded battery material. Ex. 2022, ¶156. Petitioner does not dispute that rotary airlocks are leaky. Ex. 2025; Ex. 1023, ¶31. And Hanisch ’419 emphasizes the need to conserve energy. Ex. 1004 at 4:51.

Petitioner falls back to argue that it was known that solvents evaporate faster at lower pressures. Reply at 12. But solvent volatility is not the question. Hanisch discloses no mechanism for maintaining a 300 hPa pressure in a continuous system. Ex. 2022, ¶¶91-92. Nor is there a need for such a high pressure differential. Hanisch disclosed a “pre-dryer” for retrieving some quantity of solvent, before the comminuted material enters the 350°C decomposition oven.

Ex. 2022, ¶¶84-85. Hanisch '419 does not teach maximizing solvent recovery in the pre-dryer – there are no controls in place to ensure that the battery material is inactivated. Ex. 2022, ¶83. Rather, maintaining a vacuum of 300 hPa or stronger would be an unnecessary cost. Ex. 2024 at 107:5-19.

Petitioner argues a supposed motivation to run Hanisch's system at a pressure of 300 hPa or lower. Dr. van Schalkwijk posits that if LiCoO_2 is present in the decomposition oven, that it may degrade and release free oxygen molecules that could react with copper, and that running the decomposition oven at 300 hPa or lower would guard against this oxidation. Ex. 1023, ¶¶19-27.

This argument should be stricken because it relies on the supposed knowledge of a POSITA which was not disclosed in the Petition. *Intelligent Bio-Systems*, 821 F.3d at 1369; *Hamilton Techs. LLC v. Tehrani*, IPR2020-01199, 2021 WL 6339598 (P.T.A.B. Dec. 28, 2021).

Furthermore, as he acknowledges, there should be no LiCoO_2 in the decomposition oven. Ex. 1023, ¶22. He notes that when a battery is discharged, the LiCoO_2 is thermally stable. *Id.* He explains that LiCoO_2 becomes thermally labile only when batteries are not discharged. *Id.* Dr. van Schalkwijk testified that a person of skill in the art would know that batteries must be discharged before being processed as in Hanisch '419. Ex. 2061 at 15:3-8. Thus, this concern of the degradation of LiCoO_2 is a strawman.

Dr. van Schalkwijk ignores that a weaker vacuum level, of about 17 hPa relative to ambient, would be sufficient to ventilate the oven and avoid the buildup of byproducts like oxygen. Indeed, he testified that an underpressure of a half-inch of mercury (*i.e.*, about 17 hPa) would be enough to generate “a considerable breeze.” Ex. 2024 at 70:15-19. He explained that this slight pressure differential would be “enough to move a lot of air, push it out of the system, without intense use of the vacuum pump,” and that with this airflow “everything that’s generated is moved on out of the – out of the chamber after the pyrolysis has occurred.” Ex. 2024 at 70:5-14. And he testified that it is undesirable to have a higher vacuum than necessary, because “it takes a lot of energy to maintain an intense vacuum,” and that an intense vacuum would mobilize particulate matter that cause “abrasion that will damage your equipment.” Ex. 2024 at 107:5-19 (“So you want to have a vacuum that moves air but not particles.”). His Reply Declaration ignores his own testimony that running the Hanisch system at a negative pressure of 17 hPa would be sufficient, and that a POSITA would avoid operating the system at stronger vacuum levels. Indeed, a negative pressure of 17 hPa was sufficient to ventilate the pyrolysis chamber in Meador. Ex. 1011 at 5:61-63.

3. Petitioner fails to show that Hanisch '419 could be combined with Hayashi to teach the 300 hPa limitation [Ground 2]

Petitioner does not dispute the structural problems to attempting to combine Hanisch '419 with Hayashi. Hanisch '419 discloses a continuous process. Ex. 1004 at 3:27-28 & Fig. 1. Hayashi discloses a batch process, whereby a single battery unit is placed in a chamber, with its safety seal removed, and then water is poured into the battery to hydrolyze the LiPF_6 and drive evaporation of the solvents. Ex. 1006 at 4:24-47; Ex. 2022, ¶162. The vacuum levels in Hayashi are quite strong – as low as 1 hPa, which would not be achievable in the continuous system taught by Hanisch '419. Ex. 1006 at 3:20-25; Ex. 2022, ¶¶162-172.

The most that Petitioner can say about Hayashi is that it teaches that lower pressures could be used to facilitate evaporation of electrolytes. Reply at 20. But Petitioner does not explain how this teaching would be combined in the context of the Hanisch '419 process. To the contrary, Meador confirms that a person of ordinary skill would understand that only a slight underpressure could be maintained in a continuous system like Hanisch '419. Ex. 2022 at ¶¶139, 143, 146-147; Ex. 1011 at 5:61-63. Moreover, regarding the decomposition furnace of Hanisch '419, the point of this device is to break down the binders in the battery material, which depends on temperature and not on vacuum. Ex. 2022, ¶68. There would be no need to resort to low pressures to facilitate the evaporation of

solvents, because the temperatures in excess of 350°C would drive off the solvent without need for high vacuum levels. Ex. 2022, ¶164.

4. Petitioner fails to show that Shin could be combined with Hanisch '419 to teach the 300 hPa limitation [Ground 2]

Petitioner does not dispute that Shin discloses purging oxygen from the chamber at an extreme vacuum level (10^{-4} torr), and then filling the chamber with nitrogen gas, and then processing the batteries; thus, the processing is not done at vacuum. Ex. 1010 at 8:4-22; Ex. 2022 at ¶¶173-179. Petitioner pivots to the language of Shin's Claim 1. Reply at 20. But Petitioner fails to explain how Shin's process could be performed "by continuously inputting waste batteries into a reaction reservoir" if the chamber was at such an extreme vacuum level – plainly, the chamber is flooded with nitrogen in order to function. Ex. 1010 at 2:3-7; Ex. 2022 at ¶¶175-176. And Petitioner nowhere attempts to explain how Shin's system could be combined with Hanisch, or why there would be any motivation to operate Hanisch's system at the extreme vacuum level of 10^{-4} torr, or any suggestion that such an extreme vacuum level could be achieved with the Hanisch '419 system.

B. Even if interpreted to show a batch process, Hanisch '419 would not be combined with Hayashi or Shin

1. Hanisch '419 does not disclose a batch process

For the first time on Reply, Petitioner now says that Hanisch '419 actually teaches a batch system. Reply at 17. This new argument is improper. CTPG at 73.

More, there is no such disclosure. To the contrary, Hanisch '419 expressly recommends using a continuous system, and **not** a batch system. Ex. 1004 at 3:27-28 (“The method according to invention is preferably performed as continual process and **not in batches.**”) (emphasis supplied). Aside from the statement saying that the process should be performed “not in batches,” there is nothing in Hanisch '419 that suggests that it discloses a batch process. Ex. 2061 at 103:25-104:24.

In attempting to say that Hanisch’s disclosure (“preferably performed ... not in batches”) actually teaches batch processing, Petitioner cites three claim construction cases, and none stands for the proposition that a prior art reference teaches what it says not to do. *Thorner v. Sony Computer Entertainment America*, 669 F.3d 1362, 1366 (Fed. Cir. 2012) says that when interpreting a claim term, the plain meaning controls absent a clear disavowal, and that a mere criticism of an embodiment may not rise to that threshold. In *Spine Solutions v. Medtronic Sofamor Danek USA*, 620 F.3d 1305, 1315 (Fed. Cir. 201), the Federal Circuit held that the standard for “express disavowal” in claim construction was not met by a patent disparaging the prior art. In *Continental Circuits LLC v. Intel*, 915 F.3d 788, 797 (Fed. Cir. 2019), the Federal Circuit reiterated that to disavow claim scope, the specification must contain “expressions of manifest exclusion,” and that disclosing a single embodiment did not rise to this standard. None of these cases suggest that

Hanisch '419 teaches batch processing, when it says “preferably performed ... not in batches.” Ex. 1004 at 3:27-28.

Hanisch '419 teaches away from a batch system. *See Pozen Inc. v. Par Pharm., Inc.*, 696 F.3d 1151, 1164–65 (Fed. Cir. 2012) (“A reference teaches away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant.”) (citation omitted); *see also Santarus, Inc. v. Par Pharmaceutical*, 694 F.3d 1344, 1354-55 (Fed. Cir. 2012) (“A reference ‘teaches away’ when it ‘suggests that the line of development flowing from the reference’s disclosure is unlikely to be productive of the result sought by the applicant.’”). By teaching that the process should be “preferably performed as continual process and ***not in batches***,” Hanisch '419 discourages pursuing a batch process.

In its Preliminary Guidance, the Board preliminarily ruled that Hanisch '419 does disclose a batch system, citing to *Intel Corp. v. Qualcomm Inc.*, 21 F.4th 784, 800 (Fed. Cir. 2021) and *PAR Pharm., Inc. v. TWI Pharms., Inc.*, 773 F.3d 1186, 1197-98 (Fed. Cir. 2014). However, neither *Intel* nor *PAR* addressed a situation where the prior art said that the disclosed subject matter is “not” performed a certain way, as here (*i.e.*, “***not in batches***”).

A person of ordinary skill would understand Hanisch's discouragement against using a batch system. Petitioner does not rebut Patent Owner's evidence that a continuous system was beneficial to avoid the accumulation of hazardous material. Ex. 2022 at ¶79. There is no disclosure in Hanisch '419 about how to perform a batch system and manage the hazards inherent to accumulated shredded battery material that is still wet with electrolyte solvents. Ex. 1023 at ¶16 (“[W]et battery material still containing volatile organic solvents from the electrolyte (e.g., EC, DEC, DMC) can vaporize and ignite under friction or heat.”); *see also id.* (“Similarly, as a POSITA would have understood, if lithium metal (or lithiated graphite) is still present and exposed to moisture or air, it reacts violently – producing heat and hydrogen gas, which can cause thermal runaway.”). In deposition, Dr. van Schalkwijk reiterated these hazards. Ex. 2061 at 32:2-15 (noting that before shredded battery material is dried, “[i]f wet electrolyte is coming through, but you have moisture, like water moisture, then you could create some HF”); 140:3-19 (explaining hazards of even a “relatively minimal amount” of hydrogen fluoride); 163:5-10 (testifying that HF is “very corrosive, very toxic”). A continuous system minimizes these hazards by drying away the solvent immediately. Ex. 2022 at ¶79.

2. Even if Hanisch '419 discloses a batch system, combining it with Hayashi or Shin would not cure the defect that Hanisch's pre-dryer does not inactivate the shredded material

Even if the Board were to find that Hanisch '419 teaches a batch system, a POSITA nonetheless would not combine Hanisch '419 with Hayashi or Shin to arrive at the claimed invention. Petitioner wrongly conflates the pre-dryer and the decomposition oven. Reply at 17. However, the question is whether there would be any motivation to combine Hayashi or Shin with the particular instrumentalities of Hanisch '419, and whether those combinations would teach the claimed process. *In re Van Os*, 844 F.3d 1359, 1361 (Fed. Cir. 2017) (requiring proposed combinations to be “seeking to solve the problem at hand”); *ActiveVideo Networks, Inc. v. Verizon Commc'ns, Inc.*, 694 F.3d 1312, 1328 (Fed. Cir. 2012) (affirming JMOL striking obviousness defense as the evidence on motivation to combine had “no relation to any specific combination of prior art elements” and “fail[ed] to explain why a [POSITA] would have combined elements from specific references in the way the claimed invention does”).

Petitioner only relies on Hayashi and Shin to teach the 300 hPa limitation (*i.e.*, Claim 1[e]) and the “vacuum installation” requirement of Claim 12 (*i.e.*, Claim 12[d]). Petition at 43 & 49. Petitioner does not rely on Hayashi or Shin to teach the “inactivating” limitations of Claim 1[b] or 1[d] or Claim 12[b]. Petition

at 42-43 & 48. Therefore, Petitioner cannot use Hayashi or Shin to cure its failure to show that the pre-dryer of Hanisch '419 results in inactivating the comminuted battery material. *See supra* § III.A; *Kerry Grp. Servs. Int'l v. Fla. Food Prods., LLC*, 2025 WL 582881, at *4 (Fed. Cir. Feb. 24, 2025) (“To the extent the Board found the challenged claims to be unpatentable based on an obviousness ground that was not presented in the petition, this was error.”).

Nor would there be any motivation to combine the pre-dryer of Hanisch '419 with Hayashi or Shin. Ex. 2022 at ¶¶ 81, 83-85 & 163-172. As explained above, the function of the pre-dryer is to recover some amount of electrolyte solvent before the battery material is passed to the decomposition oven. Ex. 1004 at 3:65-4:2 (explaining that the pre-dryer allows vapors to be “at least partly condensed”). It would introduce unnecessary cost and complexity to structure the pre-dryer to inactivate the battery material, especially considering that the material is passed thereafter to the decomposition oven, where the solvents are vaporized at an excess of 350°C. Ex. 2022 at ¶¶ 81 & 84-85; Ex. 1004 at 4:25-27; 6:7-9.

3. Even if Hanisch '419 discloses a batch system, there would be no motivation to combine Hayashi with Hanisch's decomposition oven

As to Hanisch's decomposition oven, there would be no motivation to combine it with Hayashi or Shin. The decomposition oven operates at a temperature in excess of 350°C. Ex. 1004 at 4:25-27; 6:7-9. That high heat will

vaporize all the solvents from the battery material. Ex. 1003 at ¶88; Ex. 2022 at ¶81. Given the extreme heat of the decomposition oven, there is no need to add the vacuum levels taught by Hayashi or Shin to facilitate the evaporation of the electrolyte solvents. Ex. 2022 at ¶164.

Hanisch '419 teaches that vacuum can be used in the decomposition oven to reduce oxidation of the electrode material. Ex. 1004 at 4:6-8. But as Dr. van Schalkwijk testified, a slight negative pressure would be a “considerable breeze” that would be enough to move the air out of the chamber after the pyrolysis has occurred.” Ex. 2024 at 70:15-19 & 70:5-14. And he testified that it is undesirable and potentially damaging to have a higher vacuum than necessary. Ex. 2024 at 107:5-19. Thus, Dr. van Schalkwijk confirms that a slight underpressure would be sufficient to ventilate the oven, and that stronger vacuum levels may be deleterious.

In its Reply for the first time, Petitioner invokes the knowledge of a POSITA regarding the thermal decomposition of LiCoO_2 as a means to justify the applying a vacuum level of 300 hPa. Reply at 15 (citing Ex. 1023 at ¶¶19-27). As set forth above, this argument should be stricken as untimely, and it is not credible. *See supra* § IV.A.2. This argument also ignores Dr. van Schalkwijk’s testimony that a slight underpressure would be sufficient to ventilate the system.

C. Optimization is the wrong test

In the context of the Motion to Amend, the Board preliminarily determined that it would be obvious to “optimize” the claimed pressure range. Paper No. 37 at 12-14. However, this “optimization” argument is not found in the Petition, and thus cannot be the basis of the Board’s ruling on the Petition. *Kerry*, 2025 WL 582881, at *4.

This is not a case where “the general conditions of a claim are disclosed in the prior art.” *E.I. DuPont de Nemours & Co. v Synvina C.V.*, 904 F.3d 996 (Fed. Cir. 2018). Rather, the prior art uniformly taught away from the claimed approach, by using additives to neutralize the hazards, or by removing the hazards, before comminuting the batteries. Ex. 2022 at ¶¶51-57. The prior art did not recognize that shredded battery material could be inactivated by vacuum drying alone. *Id.* Nor was there any such recognition in Hanisch ’419, which relied on a decomposition oven to break down the binders, as a way to separate the active components from the supports. Ex. 2022 at ¶¶67-68; Ex. 1004 at 2:31-42. Thus, the “general conditions” of Patent Owner’s claim are not in the prior art – Patent Owner’s approach represents a fundamental break from what came before, demonstrating long-felt need and unexpected results. Ex. 2022 at ¶¶185-187. There is no prior art “range” of vacuum drying pressures, following comminution of the batteries, being optimized here. *ModernaTx, Inc. v. Arbutus Biopharma*

Corp., 18 F.4th 1364, 1370 (Fed. Cir. 2021) (“The Board correctly recognized that we have never before applied the presumption of obviousness for overlapping ranges in a case in which the prior art does not contain the express disclosure of a range.”); *Teva Pharms. V. Corcept Therapeutics*, 18 F.4th 1377, 1382 (Fed. Cir. 2021); *Regeneron Pharms. v. Mylan Pharms.*, 714 F.Supp.3d 652, 744 (N.D.W. Va. 2024).

V. SECONDARY CONSIDERATIONS

A. Duesenfeld properly presented evidence of commercial success

Petitioner’s Reply inappropriately attempts to graft new legal requirements onto the secondary considerations analysis. Duesenfeld enjoyed commercial profitability in the years 2021-2022. In subsequent years, the market for recycled goods changed, and Duesenfeld did not have the same success. However, the fact remains that Duesenfeld established a profitable business based on commercializing the patented invention. This is commercial success based on the patented claims, and the legal authority relied on by Petitioner does not detract from this. *Two Moms and a Toy, LLC v Int’l Playthings, LLC*, 2012 U.S. Dist. LEXIS 152840 (D. Colo.), relied on by Petitioners, says nothing to require that a business must be continuously profitable for commercial success to hold. Rather, the Federal Circuit emphasizes that a “court must *always* consider any objective

evidence of nonobviousness presented in a case.” *Transocean Offshore Deepwater Drilling, Inc. v. Maersk Contractors USA*, 617 F.3d 1296, 1305 (Fed. Cir. 2010).

There is no requirement that Patent Owner attest to its share of the market. First, market share is *not* the metric of success for Duesenfeld, which develops technology and then licenses it to third parties. Ex. 2040 at ¶3. The cited profitability figures are from Duesenfeld’s own plant which is used as a laboratory and pilot plant. *Id.* Duesenfeld is not a traditional recycler whose success is defined by market share. *Id.* Moreover, even with its pilot plant, Duesenfeld has achieved commercial success. Ex. 2040 at ¶9.

B. Duesenfeld’s licensing practices are probative of non-obviousness

Duesenfeld showed that it has entered into multiple license agreements with recycling companies over its vacuum drying patents. Petitioner attempts to disparage this evidence with the conjecture that the licenses were only executed under threat of litigation. Reply at 23. Petitioner has no such evidence and declined to seek it, asking not one question about these supposed threats. *See generally*, Ex. 1025. To the contrary, Patent Owner has presented a press release from licensees Seval and Riplastic dated June 11, 2024, saying that “almost two years of joint work” had undergirded the licenses, confirming that these agreements were not prompted as a consequence of the district court litigation,

which was filed on October 20, 2023. Ex. 2051. Expressly, the license is “for the exploitation of patents necessary to the technological process chosen by Seval and Riplastic,” with the treatment performed “at a low temperature in complete safety,” for producing “black mass with an exceptional level of purity.” *Id.* Plainly, these licensees were not the result of a threat. The press release with Andritz similarly confirms that Duesenfeld’s licensing program is based on commercial motivations, not litigation. Ex. 2052.

Duesenfeld’s licensees are in Europe, and accordingly those license agreements grant rights under the patents within those respective jurisdictions. *R.H. Murphy Co. v. Illinois Tool Works, Inc.*, 409 F.Supp.2d 53, 75-76 (D. Mass. 2006) does not require that the licenses be domestic licenses. Rather, in *R.H. Murphy*, the court discounted the evidence of commercial success because the patentee did not “offer evidence of the number of its foreign licenses, the volume of business they represent, or their reasons for licensing” the patent in suit. *Id.* at 75. Here, Duesenfeld has provided the Board with the three licenses executed to-date, and provided the press releases from Seval, Riplastic, and Andritz confirming the commercial basis of its licensing program. Exs. 2051 & 2052. Furthermore, the press release from Seval and Riplastic confirms that the license is for low-temperature drying to generate high-purity black mass, confirming that they are practicing at least independent Claim 1 and dependent Claim 9 of the ’097 patent.

C. Duesenfeld properly established nexus

Customers bring their batteries to Duesenfeld for recycling. Ex. 2040 at ¶6. All these batteries are processed pursuant to the claims of the '097 patent, which Petitioner does not contest. Ex. 2022 at ¶¶188-191; Ex. 2040 at ¶¶6-8. Yes, the batteries must be discharged first before they are processed. But Duesenfeld's commercial success is properly anchored with a nexus to the patent because every battery supplied to Duesenfeld for recycling is processed according to the '097 patent. Ex. 2040 at ¶¶6-8. *PPC Broadband, Inc. v. Iancu*, 739 F. App'x 615, 624–25 (Fed. Cir. 2018) (“Moreover, if a patentee in an IPR can demonstrate commercial success—often shown by significant sales in a relevant market—and that the successful product is the invention disclosed and claimed in the patent, it is presumed that the commercial success is due to the patented invention.”).

Petitioner's arguments about hydrometallurgical processing are inapposite. Duesenfeld sells black mass. Ex. 2040 at ¶¶5 & 8. Petitioner's assertion that Duesenfeld's revenues are due in part to hydrometallurgical processing are simply unsupported and wrong.

D. Duesenfeld presented objective evidence of long-felt need and unexpected results

Duesenfeld properly established the long-felt need for its invention, as well as the unexpected results. Duesenfeld presented a long line of prior art references that were premised on the assumption that lithium-ion batteries needed to be

detoxified, with the addition of extraneous contaminants, before they could be shredded. Ex. 2022 at ¶¶51-57 & 185. Objectively, these additives acted as contaminants and complicated the recycling process. Ex. 2022 at ¶¶57 & 187. The commercial success that Patent Owner has enjoyed, including the positive press releases lauding its approach, confirm the long-felt need for Patent Owner's technology, and the unexpected nature of the discovery that batteries could be recycling without first detoxifying them. Ex. 2022 at ¶¶186-187.

VI. CONCLUSION

For the foregoing reasons, as well as those submitted by Patent Owner in its Patent Owner Response, the Challenged Claims should be confirmed under 35 U.S.C. § 316.

Date: June 20, 2025

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WORD COUNT CERTIFICATION

Pursuant to 37 C.F.R. § 42.24(d), Patent Owner certifies that this Patent Owner Sur-Reply has a total of 5,519 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 5,600-word limit allowed under § 42.24(c)(4).

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CERTIFICATE OF SERVICE

I hereby certify that on June 20, 2025, a copy of this Patent Owner Sur-Reply, including all accompanying attachments, appendices, and exhibits, has been served in its entirety via e-mail on Attorneys for Petitioner at the following e-mail addresses:

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