

Petition for *Inter Partes* Review of U.S. Patent No. 11,050,097

Filed: May 21, 2024

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ASCEND ELEMENTS, INC.,
Petitioner,

v.

DUESENFELD GMBH,
Patent Owner.

Case No. IPR2024-00948

U.S. Patent No. 11,050,097

**PETITION FOR INTER PARTES REVIEW
OF U.S. PATENT NO. 11,050,097**

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LISTING OF EXHIBITS

Exhibit	Description
1001	U.S. Patent No. 11,050,097 ("097 Patent")
1002	Patent Prosecution History for U.S. Patent No. 11,050,097
1003	Declaration of Dr. Walter van Schalkwijk
1004	U.S. Patent No. 9,780,419 ("Hanisch")
1005	U.S. Patent No. 6,447,669 ("Lain")
1006	U.S. Patent No. 9,843,077 ("Hayashi")
1007	PCT Application Publication No. WO 2010/102377 ("Stevens II")
1008	U.S. Patent No. 4,357,215 ("Goodenough")
1009	Dorella G. & Mansur M.B., A study of the separation of cobalt from spent Li-ion battery residues, 170 J. Power Sources 210 (2007) ("Dorella")
1010	U.S. Patent No. 10,396,408 ("Shin")
1011	U.S. Patent No. 5,632,863 ("Meador")
1012	<i>Duesenfeld GMBH v. Ascend Elements, Inc.</i> , Civ. A. No. 1:23-cv-01194-JFM, Scheduling Order, ECF No. 22 (D. Del. Jan. 26, 2024)
1013	Federal Court Management Statistics–Comparison Within Circuit (Dec. 31, 2023), <i>available at</i> https://www.uscourts.gov/statistics/table/na/federal-court-management-statistics/2023/12/31-3
1014	U.S. Patent No. 9,509,025 ("Iida")
1015	U.S. Patent No. 3,671,318 ("Moe")
1016	U.S. Patent No. 4,118,219 ("Elmore")
1017	U.S. Patent No. 6,524,737 ("Tanii")
1018	U.S. Patent No. 9,450,277 ("Dunagan")
1019	U.S. Patent No. 8,210,456 ("Stevens I")

I. INTRODUCTION

Petitioner requests *inter partes* review of claims 1, 2, 3, 7, 8, 9, 10, 12, 13, and 19 of U.S. Patent No. 11,050,097 (the "'097 Patent," EX1001).

The '097 Patent discloses an alleged invention regarding the recycling of used batteries. But as discussed in detail below, the claims challenged in this petition merely recite previously known practices in the art, such as shredding or grinding used batteries, drying out shredded battery material under reduced air pressure to remove electrolyte solvent, and filling containers with the resulting material for transport. *See, e.g.*, EX1001, claims 1 and 12.

While the '097 Patent specification purports to have invented the idea of low-temperature, low-pressure drying, the claims as issued do not reflect or require this *low-temperature* process, leaving the claimed *low-pressure* drying as the only alleged point of novelty recited in the claims. But the lead inventor of the '097 Patent, Christian Hanisch, already disclosed and patented all the allegedly novel claimed features in an earlier patent, U.S. 9,780,419. EX1004 ("Hanisch"). For example, Hanisch discloses crushing battery material and drying it under vacuum conditions to inactivate the electrolyte. Likewise, to the extent Patent Owner ("PO") argues that Hanisch's vacuum drying somehow does not meet the limitations of the '097 Patent, the combination of Hanisch with Meador, Hayashi, and Shin does. As

discussed herein, a POSITA would have been motivated to apply the teachings of those references to Hanisch.

The prior art cited herein, alone or in combination, in view of the knowledge of a POSITA before the effective filing date of the '097 Patent, renders the claims challenged here unpatentable.

II. REQUIREMENTS FOR *INTER PARTES* REVIEW

A. Certification

Pursuant to 37 C.F.R. § 42.104(a), Petitioner certifies that the '097 Patent "is available for *inter partes* review and that Petitioner is not barred or estopped from requesting an *inter partes* review challenging the patent claims on the grounds identified in the petition." 37 C.F.R. § 42.104(a).

B. The Challenged Claims and Relief Requested

Pursuant to 37 C.F.R. § 42.104(b)(1) and 42.2, Petitioner requests that the Board institute IPR and cancel the Challenged Claims (claims 1, 2, 3, 7, 8, 9, 10, 12, 13, & 19 of the '097 patent) as unpatentable. The '097 patent claims priority to a German patent application with an effective filing date of April 28, 2015. Without conceding to the claimed priority date, all the art of record here is prior art to the '097 patent under post-AIA 35 U.S.C. § 102. The prior art forming the Grounds are:

Exhibit	Reference	Prior Art Status
1004	U.S. Patent No. 9,780,419 ("Hanisch")	Post-AIA § 102(a)(2)
1010	U.S. Patent No. 10,396,408 ("Shin")	Post-AIA § 102(a)(2)
1011	U.S. Patent No. 5,632,863 ("Meador")	Post-AIA § 102(a)(1)/ (2)
1006	U.S. Patent No. 9,843,077 ("Hayashi")	Post-AIA § 102(a)(2)
1018	U.S. Patent No. 9,450,277 ("Dunagan")	Post-AIA § 102(a)(2)

The asserted Grounds of unpatentability are:

Ground	Claims	Basis	Prior Art
1	1, 2, 3, 7, 8, 9, 10, 12, 13, and 19	§ 103	Hanisch alone or in combination with Dunagan
2	1, 2, 3, 7, 8, 9, 10, 12, 13, and 19	§ 103	Hanisch in view of Dunagan, Meador, Shin, and/or Hayashi

This petition is supported by the Expert Declaration of Dr. Walter van Schalkwijk ("van Schalkwijk", EX1003).

III. TECHNOLOGY BACKGROUND

The '097 Patent discloses methods and systems for recycling batteries, such as lithium-ion batteries. (*See* EX1001, 1:8-23.) The material composition and chemistry used in lithium-ion batteries have been well known in the art for many years prior to the filing date of the '097 Patent, as have the concerns about hazards and risks associated with recycling such batteries. (EX1003, ¶¶29-71.) The techniques used in such recycling processes are well-known in the prior art. (EX1003, ¶¶64-71.)

A. Lithium-Ion Battery Composition

Lithium-ion batteries rely on the electrochemical properties of various compounds to store and convert chemical energy into electrical energy. The

fundamental component of the battery is the electrochemical cell, consisting of a cathode, an anode, a separator, and an electrolyte. Both the cathode and anode are mounted on substrates linked internally to the cell's casing, allowing for positive and negative connections to other cells within the battery, and eventually to the external circuits that utilize the battery. (EX1003, ¶¶30, 32.)

The cathode typically consists of a lithium-containing transition metal oxide or phosphate, the most common examples being LiCoO_2 (LCO) or LiFePO_4 (LFP). The cathode material is combined with a binder, such as polyvinylidene fluoride (PVDF), and applied to an aluminum substrate. (EX1003, ¶¶33-34.)

The anode is typically made from graphite. The anode material is combined with a binder and then coated onto a copper substrate. (EX1003, ¶¶35-40.)

To prevent short circuits, the anode and cathode are physically divided by a microporous, lithium-permeable film, or "separator." (EX1003, ¶¶41-47.) As of the filing date of the '097 Patent, separators primarily were made using polyethylene and polypropylene. (EX1003, ¶42.)

The electrolyte is a conductive medium that allows lithium ions to travel between the cathode and anode. (EX1003, ¶¶50-51.) As of the filing date of the '097 Patent the predominant electrolyte comprised lithium hexafluorophosphate (" LiPF_6 "), dissolved in a mixture of organic carbonate solvents such as ethylene

carbonate ("EC"), dimethyl carbonate ("DMC"), diethyl carbonate ("DEC"), and/or ethyl methyl carbonate ("EMC"). (EX1003, ¶¶48, 56.)

Such lithium-ion battery compositions are disclosed in Lain, which has an effective filing date of December 3, 1997. (EX1005, 1:5-29, 2:25-39.) Similar designs have been known in the art since the 1980s. (EX1008, 3:25-4:15.) Lithium-ion battery designs using carbon particle anodes and ethylene carbonate solvent were disclosed as early as 1990. (EX1003, ¶31.)

B. Recycling Lithium-ion Batteries and Known Risks

The value of recycling batteries such as lithium-ion batteries, from an economic and environmental perspective has been long understood in the art. (EX1003, ¶64.) Materials such as lithium cobalt oxide and electrolyte salts can be costly to produce, so it was well-recognized in the field that recycling batteries both reduces production costs and conserves natural resources. (EX1009, at 1-2; EX1003, ¶64.) Metals such as cobalt, lithium, nickel, copper, iron, and aluminum, can be recovered, as can electrolyte solutions. (EX1003, ¶64.) For decades prior to the effective filing date of the '097 Patent, it has been a fundamental focus of battery design, including lithium-ion batteries, to allow for the reclamation and reuse of these scarce resources and to understand their anticipated waste streams (EX1003, ¶64.)

The '097 Patent discloses common processing techniques like comminution of battery material and vacuum/low-pressure drying to evaporate volatile compounds. (EX1001, 1:11-12; 3:4-16.) Comminution includes "cutting, cropping, impact, separating and/or compressing" materials into smaller pieces and has been known for decades. (EX1001, 2:57-58, 8:2-5; EX1003, ¶65.) As the '097 Patent acknowledges, comminution results in smaller particles having greater available surface area, facilitating evaporation of, *e.g.*, electrolyte materials from the comminuted material. (*See* EX1001, 2:57-58.) This phenomenon has been understood for at least a century, if not longer. (EX1003, ¶66.) The concept of vacuum/low-pressure drying disclosed in the '097 Patent has also been long understood, where reduced ambient pressure lowers the boiling point of fluids (*e.g.*, the well-known observation that water can boil at near room temperature given a sufficiently low ambient pressure). (EX1017, 26:31-34; EX1003, ¶69.)

The field of battery recycling has long been aware of the risks associated with recycling lithium-ion batteries. (EX1003, ¶67.) LiPF_6 , a commonly used electrolyte in lithium-ion batteries, has been well-known to undergo hydrolysis in the presence of water to form hydrogen fluoride, a toxic substance. (EX1003, ¶67; EX1006, 1:26-29, 2:7-11.) Organic carbonate solvents, such as EMC and DMC, used in the electrolyte are also volatile and flammable. (EX1003, ¶67; EX1006, 1:26-29, 2:7-11, 4:12-23; EX1007, [0041].)

The field of battery recycling has also long recognized the importance of avoiding conditions that could lead to explosion, combustion, and/or release of toxic compounds when carrying out battery recycling processes, including those for lithium-ion batteries. (EX1003, ¶68.) It has long been known in the art, for example, that it is desirable to use lower temperatures during LiPF_6 evaporation, to reduce the rate of formation of hydrogen fluoride from the electrolyte. (EX1003, ¶68.)

This technique of using reduced atmospheric pressure with reduced drying temperatures has been previously disclosed in the art as applied to recycling batteries, including lithium-ion batteries. (EX1005, 2:57-67; 3:10-14; EX1006, 2:24-28, 3:12-19, 4:1-5, 4:38-5:25; EX1004, 3:65-4:8; EX1003, ¶¶68-70.)

In addition, it has been well-known in the art that comminuted material resulting from the shredding and drying stages of lithium-ion battery recycling contains a mix of substances including lithium, manganese, cobalt, and nickel, among other compounds, many of which can exist in toxic or hazardous forms when present in the comminuted material. (EX1003, ¶71.) Because this comminuted material can often exist in a fine particulate that can enter air circulation if sufficiently disturbed, it has also been well-known in the art that care must be taken to prevent such fine particulate from entering air circulation, given the potential for health risks from inhalation or soft tissue exposure. (EX1003, ¶71.)

IV. THE '097 PATENT

The '097 Patent (EX1001) is titled "Method for the Treatment of Used Batteries, In Particular Rechargeable Batteries, and Battery Processing Installation" and names Christian Hanisch, Bastian Westphal, Wolfgang Haselrieder, and Martin Shoenitz as inventors. It claims priority through a foreign patent application (DE 10 2015 207 843.4) to April 28, 2015, and is thus a post-AIA patent.

A. Patent Summary

The '097 Patent specification acknowledges that heated drying, electrochemical inactivation of battery components, and comminution of battery material were all previously known in the art. (EX1001, 1:27-50.) The '097 Patent explains that the disadvantages of prior art techniques included potential contamination of battery components with plastic degradation products from heated drying and the incomplete inactivation of comminuted material. (EX1001, 1:27-50.) The '097 Patent admits, however, that the German application to which Hanisch claims priority, DE 10 2011 110 083 ("DE '083"), already disclosed a battery recycling process comprising the comminution of batteries followed by a drying stage and that such a process is "well-suited to the efficient recycling of larger amounts of galvanic elements." (EX1001, 1:43-50.) The '097 Patent does not, however, suggest that DE '083's process is itself disadvantageous; rather, the alleged problem was that "for partial load operation, the construction of this installation is

comparatively complex." (EX1001, 1:43-50.) And the claims of the '097 Patent do not recite limitations directed to a "partial load operation."

The purportedly novel solution of the '097 Patent is to inactivate comminuted material at least by drying it. (EX1001, 1:56-58.) The '097 Patent discloses multiple ways of drying the comminuted materials to inactivate it, including "low temperature drying" and "high temperature drying." (EX1001, 5:41-45). In the "low temperature drying" step, the comminuted material is dried long enough to evaporate organic carbonate solvents in the electrolyte, such as DMC and/or EMC, such that electrochemical reaction would be virtually impossible. (EX1001, 1:63-2:27). In "high temperature drying," the comminuted material is dried "at a drying temperature and for a drying time" such that the binder (for example polyvinylidene fluoride) that binds the electrochemically active material in a lithium battery largely decomposes. (EX1001, 5:37-61.) The '097 Patent teaches that these two approaches can be carried out in separate spaces.

The Challenged Claims are generally directed to methods and apparatuses for recycling batteries by comminuting the batteries and drying the comminuted material under reduced pressure to inactivate it. The independent challenged claims (1 and 12) do not specify a limitation on any temperature required for drying.

Independent claim 1 is representative of the challenged method claims:

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.

Independent claim 12 is representative of the challenged apparatus claims:

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.

The challenged dependent claims add limitations such as specifying the temperature at which the drying must occur (claim 9), that the method uses a vacuum when drying the comminuted material (claim 3), that the batteries being treated are lithium batteries (claims 8 and 19), or that the drying reduces electrolyte content in the comminuted material to a level that electrochemical reaction is impossible (claims 2 and 13) or will not form explosive or flammable gas when in a container (claim 7).

B. File History

During prosecution, the Applicant broadened the scope of the challenged independent claims by removing limitations on the type of battery to be treated but further specified that inactivation should occur through the process of drying comminuted material (without imposing temperature restrictions), that inactivation must occur during or after the comminuting step, and the maximum air pressure at which the drying must occur.

In preliminary amendments to independent claims 1 and 7 (which issued as claim 12), the Applicant removed limitations specifying lithium batteries, among other revisions:

1. (currently amended) A method~~Method~~ for the treatment of used batteries, comprising ~~(10), in particular lithium batteries,~~ ~~containing~~ the steps:

- (a) comminuting the batteries ~~(10)~~ such that comminuted material ~~(24)~~ is obtained,
- (b) inactivating the comminuted material ~~(24)~~ such that an inactivated comminuted material ~~(42)~~ is obtained, and
- (c) filling a transport container ~~(46)~~ with the inactivated comminuted material ~~(42)~~

~~Characterized by the fact that~~

- ~~(d)~~ wherein the inactivating step ~~inactivation~~ is performed by drying the comminuted material ~~(24)~~.

7. (currently amended) A battery ~~Battery~~ processing installation for ~~the~~ treatment of used batteries, comprising ~~in particular lithium batteries, with:~~

- (a) a comminution unit ~~(18)~~ for comminuting the batteries ~~(10)~~ such that comminuted material ~~(24)~~ is obtained,
- (b) an inactivation device ~~(26)~~ for inactivating the comminuted material ~~(24)~~ and
- (c) a filling device ~~(44)~~ for filling a transport container ~~(46)~~ with ~~the~~ inactivated comminuted material ~~(24)~~,

~~characterised by the fact that~~ wherein

- ~~(d)~~ the inactivation device comprises a drying device, and

- (e) the battery processing installation has a vacuum installation that is connected to the drying device ~~(26)~~ for the purposes of generating a vacuum in the drying device.

(EX1002, 446-48.)

In response to a non-final rejection based on U.S. Patent No. 8,210,456 (EX1019, "Stevens I") in view of German patent application DE4424825 ("Kellermann") the Applicant amended claim 1 to add limitations that the drying step occurs at a maximum of 300 hPa, and amended claim 7 to specify that the inactivation device was a drying device, and added a limitation requiring that a vacuum installed be connected to the drying device that was configured to generate a vacuum in the drying device. (EX1002, 261-62.)

The amendments to independent claims 1 and 7 were not sufficient for allowance, and the Examiner entered a final rejection of claims 1 and 7 as obvious over Stevens I in view of Kellermann and Chinese Patent Publication CN102496752 ("Zhang"). To obtain allowance, the Applicant made further amendments to claims 1 and 7, requiring that the inactivation be performed during or after the comminution process. (EX1002, 184-85.)

In allowing the claims, the Examiner did not consider several relevant aspects of how U.S. Patent No. 5,632,863 (EX1011, "Meador") and U.S. Patent No. 9,780,419 (EX1004, "Hanisch") disclose the same subject matter as the '097 Patent.

As to Meador, the Examiner rejected then-pending claim 9 (which issued as claim 14)¹ as obvious over Stevens I in view of Kellermann and Meador. (EX1002, 213, 329.) The Applicant traversed this rejection, arguing that Meador disclosed a furnace using temperatures between 350°C and 650°C and that this was different from "drying device" and "drying" as disclosed in one embodiment of the '097 Patent specification. (EX1002, 192, 258.) The Examiner made this rejection twice (EX1002, 213, 329), and the Applicant provided the same traversal both times (EX1002, 192, 258). But neither the Applicant nor the Examiner addressed the embodiment in the '097 Patent specification that, like Meador, teaches the use of a high-temperature process to heat the comminuted material to decompose the binder. (EX1001, 5:37-45.) The Examiner thus did not appear to consider that Meador's disclosure was not distinct from the drying process in the '097 Patent, given that the '097 Patent also teaches an embodiment of drying that uses high temperatures to decompose the binder, and there is no temperature limitation recited in the independent claim from which then pending claim 9 depended.

As to Hanisch, the Examiner rejected pending dependent claims 14 (issued as claim 17) and 18 (issued as claim 5),² directed to the use of an air sieve to separate processed materials, as obvious over Stevens I in view of Kellerman and Hanisch.

¹ This claim is not challenged in this petition.

² These claims are not challenged in this petition.

(EX1002, 213-14, 330 (as with Meador, the Examiner presented this rejection in both office actions).) In making this rejection, the Examiner cited only a single line (column 2, line 6) and one part of a figure (Figure 1, item 50) in Hanisch (in combination with Stevens I and Kellermann). The Applicant traversed this rejection, arguing that Hanisch involved heating to temperatures of 350°C to 800°C, and thus the combination of Stevens I, Kellerman, and Hanisch did not render then-pending claims 14 and 18 obvious. (EX1002, 192, 258.) But as mentioned above, the '097 Patent itself discloses an embodiment that uses high-temperature drying to decompose the binder (EX1001, 5:37-45), and there was no temperature limitation recited in the independent claim from which then-pending claims 14 and 18 depended. The Examiner thus did not appear to consider that Hanisch discloses this embodiment. Further, neither the Applicant nor the Examiner ever addressed the disclosure in Hanisch using lower temperatures such as 80°C or less to dry the comminuted material, as also disclosed in the '097 Patent. (*See, e.g.*, EX1004, 3:67-4:4, 4:55-59, 5:54-63.) And despite traversing these rejections based on temperatures disclosed in the prior art, the Applicant did not amend independent claims 1 or 7 to specify a drying temperature required for inactivation.

C. Level Ordinary Skill in the Art

A person of ordinary skill in the art ("POSITA") in the field of the '097 Patent would have had at least a master's degree in chemical engineering, mechanical

engineering, materials science/engineering, or a related field, and three to five years of experience in design and implementation of battery recycling processes. (EX1003, ¶15.)

V. CLAIM INTERPRETATION

A claim is construed "using the same claim construction standard that would be used to construe the claim in a civil action," 37 C.F.R. § 42.100(b), which is governed by *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312 (Fed. Cir. 2005). Under the standard set out in *Phillips*, this petition applies the plain and ordinary meaning of the terms in the '097 Patent, which is "the meaning that the term would have to a [POSITA] in question at the time of the invention." *Id.* at 1313.

Drying. The '097 Patent expressly defines "drying" to mean "the removal of at least one solvent in the conducting salt." (EX1001, 2:23-25.)

All other terms should be given their plain and ordinary meaning under *Phillips* and do not need further construction for the purposes of this Petition.

VI. PRIOR ART OVERVIEW

A. Overview of Hanisch (U.S. Patent No. 9,780,419)

Hanisch is a United States Patent entitled "Method for Reclaiming Active Material from a Galvanic Cell, And Active Material Separation Installation, Particularly an Active Metal Separation Installation." (EX1004.) Hanisch claims priority to a German patent application publication, DE 10 2011 110 083, filed August 12, 2011, several years before the effective filing date of the '097 Patent.

This German priority application for Hanisch was among the admitted prior art cited in the '097 Patent, which acknowledges that Hanisch discloses "a method for recovering active material from a galvanic cell." (EX1001, 1:43-50.) Although Hanisch was before the patent office during prosecution of the application that issued as the '097 Patent, as discussed above (*see* Section IV.B) and below (*see* Section IX.B), the Examiner cited only a single line (column 2, line 6) and one part of a figure (Figure 1 item 50) in Hanisch in combination with two other references, for the limited purpose of rejecting dependent claims 14 and 18, directed to the use of an air sieve to separate processed materials. (EX1002, at 213-14, 330.)

Hanisch is analogous art to the '097 Patent. It is in the same field of endeavor and is reasonably pertinent to the problems addressed by the '097 Patent. Like the '097 Patent, Hanisch discloses methods and systems for "retrieving active material, in particular lithium or lithium compounds, from a galvanic cell, which comprises an active material, a support for the active material, a binder for bonding the active material and the support and if necessary an electrolyte." (EX1004, 1:8-12.) Hanisch discloses such a method "with the steps: (a) crushing the cells, in particular under inert gas, so that solid cell fragments are also formed, (b) heating the solid cell fragments up to the decomposition temperature, which is high enough to make the binder decompose and/or evaporate, such that heat treated cell fragments are formed, and (c) classifying the heat treated cell fragments." (EX1004, 1:12-18.)

Hanisch further teaches that the "method preferably comprises the step that, before heating the cell fragments up to the decomposition temperature, the cell fragments are dried at a drying temperature, so that dry cell fragments and drying vapours are formed, whereby the drying vapours are at least partly condensed. This has the advantage that the electrolyte solvent can be retrieved. It is therefore advantageous for the drying temperature to be below 100°C., in particular below 80°C." (EX1004, 3:65-2:5.) According to Hanisch, "a pre-dryer [] is set up in the material flow, behind the cell crushing device and before the oven. The pre-dryer is configured to heat the cell fragments up to the drying temperature." (EX1004, 4:55-59.)

Hanisch's disclosure also includes "heating the solid cell fragments up to the decomposition temperature, which is high enough to make the binder decompose and/or evaporate." (EX1004, 1:14-17.) Hanisch provides additional disclosures of this process in the description accompanying Fig. 1: "An oven 44 is set up in the direction of material flow behind the classifier 42, in which there is a decomposition temperature T_z between 400 and 600°C. The binder, for example polyvinylidene fluoride (PVDF), thus decomposes." (EX1004, 6:8-11.)

B. Overview of Meador (U.S. Patent No. 5,632,863)

Meador is a U.S. Patent entitled "Battery Pyrolysis Process." Meador issued May 27, 1997, approximately eighteen years before the effective filing date of the

'097 Patent. Meador was before the patent office during prosecution of the application that issued as the '097 Patent, but as discussed above (*see* Section IV.B) and below (*see* Section IX.B), the Examiner cited only a small portion of Meador (column 4, lines 36-53) to reject a dependent claim that recited a comminution unit and a drying device being "arranged in a container" in combination with two other references. (EX1002, 213, 329.)

Meador is analogous art to the '097 Patent. It is in the same field of endeavor and is reasonably pertinent to the problems addressed by the '097 Patent. Meador discloses processes and apparatuses for "reclamation of used batteries and recovery of the metals, and organic and inorganic materials," including "lithium batteries." (EX1011, 3:12-23.) Meador teaches that batteries can be transferred "into a crusher or grinder," and that the resulting materials can then be introduced into a pyrolysis chamber in which the batteries are heated to decomposition temperatures, after which the "dry residue containing valuable components of the batteries and other wastes" are transferred to a "hopper or bin." (EX1011, 3:17-37.) Meador further teaches that the pyrolysis chamber can be maintained under a slight vacuum. (EX1011, 3:24-26.)

C. Overview of Hayashi (U.S. Patent No. 9,843,077)

Hayashi is a U.S. Patent entitled "Method for Processing Fluorine-Containing Electrolyte Solution." Hayashi was published on Oct. 2, 2014, as WO/2014/155784,

before the effective filing date of the '097 Patent. Although Hayashi is cited on the face of the patent, it was not relied on or discussed by the Examiner.

Hayashi is analogous art to the '097 Patent. It is in the same field of endeavor and is reasonably pertinent to the problems addressed by the '097 Patent. Hayashi discloses methods of processing electrolyte solutions such as those used in lithium-ion batteries, which include lithium hexafluorophosphate and organic solvents such as dimethyl carbonate and ethyl methyl carbonate. (EX1006, 4:1-23.) Hayashi further discloses processing lithium-ion batteries by, for example, heating the battery containing the electrolyte solution under reduced pressure, such that the organic solvents of the electrolyte are evaporated. (EX1006, 4:33-36.) Hayashi teaches examples in which heating is carried out at pressures "less than or equal to 1 kPa" over temperatures ranging from 80°C to 150°C. (EX1006, 3:20-25.) Hayashi teaches that the organic solvents used in the electrolyte solution of lithium-ion batteries have boiling points of 90°C for dimethyl carbonate and 109°C for ethyl methyl carbonate. (EX1006, 4:38-45.) Hayashi also discloses that reduced pressure in a volume can affect the boiling point of these volatile organic solvents, such that they can be evaporated under controlled conditions. (EX1006, 4:38-67.)

D. Overview of Shin (U.S. Patent No. 10,396,408)

Shin is a U.S. Patent entitled "Waste Battery Treatment Apparatus Using Continuous Heat Treatment, and Method for Recovering Valuable Metals from

Lithium-Based Battery Using Same." Shin issued from a national stage PCT application that claims priority to a Korean application filed February 11, 2015. Shin was not before the patent office during prosecution of the application that issued as the '097 Patent.

Shin is analogous art to the '097 Patent. It is in the same field of endeavor and is reasonably pertinent to the problems addressed by the '097 Patent. Shin discloses methods and an apparatus for treating waste batteries including lithium-ion batteries, where such batteries are heated under a vacuum to evaporate electrolyte gas that is released during the process. (EX1010, 2:65-3:20.) Shin teaches that the use of such a vacuum during a heating step is desirable because it reduces risks of explosions and the release of poisonous gases during lithium battery recycling. (EX1010, 3:42-4:17.) Shin also teaches that an object of lithium battery recycling is to recover valuable materials from such batteries. (EX1010, 1:15-17, 2:65-3:1.)

E. Overview of Dunagan (U.S. Patent No. 9,450,277)

Dunagan is a U.S. Patent entitled "Systems for Recycling Volatile Battery Sources." Dunagan issued from an application filed September 12, 2014, and claims priority to a provisional application filed September 13, 2014. Dunagan was not before the patent office during prosecution of the application that issued as the '097 Patent.

Dunagan is analogous art to the '097 Patent. It is in the same field of endeavor and is reasonably pertinent to the problems addressed by the '097 Patent. Dunagan discloses "systems and methods for the recycling of lithium ion batteries or the like. The system methods include comminution and destruction and destruction of used batteries, controlling the explosive reaction of the battery components during processing, and processing the materials into a suitable form for sampling and recycling." (EX1018, Abstract.)

VII. GROUND 1 – THE CHALLENGED CLAIMS ARE RENDERED OBVIOUS BY HANISCH ALONE OR IN COMBINATION WITH DUNAGAN AND IN VIEW OF THE KNOWLEDGE OF A POSITA

A. Claim 1

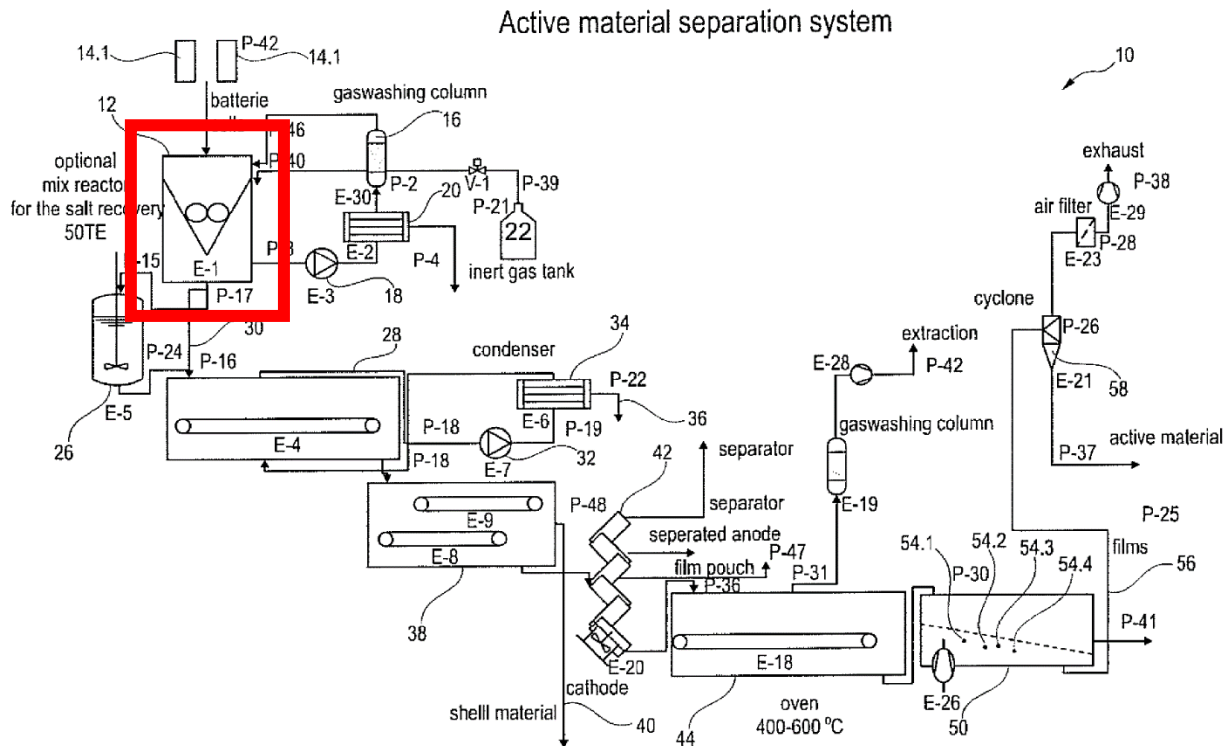
1. Claim 1 [pre]: "A method for the treatment of used batteries, comprising the steps:"

Hanisch discloses methods for treatment of used batteries. Specifically, Hanisch teaches that "[t]he invention concerns a method for retrieving active material, in particular lithium or lithium compounds, from a galvanic cell. . ." (*see* EX1004, 1:8-10) and "the object of the invention is to improve the retrieval of lithium or lithium compounds, from old batteries or accumulators." (*See* EX1004, 1:42-45.)

2. Claim 1[a]: "(a) comminuting the batteries such that comminuted material is obtained;"

Hanisch discloses this limitation. As noted previously, the '097 Patent itself admits that Hanisch teaches a method in which "galvanic cells are initially mechanically comminuted." (*See* EX1001, 1:43-45.)

Hanisch discloses at Fig. 1 an example of comminuting batteries: "FIG. 1 shows a flow chart of the active material separation system 10 according to the invention, which possesses a cell crushing device 12, to which galvanic cells 14.1, 14.2, . . . are supplied." (EX1004, 5:37-40.) Hanisch explains that "the crushing of cells is understood in particular to mean cutting, shattering, chaffing or squashing." (EX1004, 2:65-67.)



(EX1004, Fig. 1 (annotated with box to show comminution stage)). Hanisch also discloses examples of the comminuting machinery that could be used. (EX1004, 5:14-22.)

- 3. Claim 1[b]: "(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"**

Hanisch discloses this limitation. In particular, Hanisch discloses the use of a "pre-dryer" that heats the comminuted material to a "drying temperature, so that dry cell fragments and drying vapours are formed, whereby the drying vapours are at least partly condensed. This has the advantage that the electrolyte solvent can be

retrieved." (EX1004, 3:65-4:4.) In addition, Hanisch discloses "heating the solid cell fragments up to the decomposition temperature, which is high enough to make the binder decompose and/or evaporate". (EX1004, 1:14-17.)

a) Hanisch's Pre-Dryer Discloses the Inactivating Limitation

A POSITA would have understood that Hanisch's pre-dryer discloses this limitation at least because, like the '097 patent, Hanisch's pre-dryer evaporates the electrolyte and solvent from the comminuted material after the comminution step. (EX1003, ¶¶74-75, 87-93.) For example, the '097 Patent teaches that "drying should be understood particularly to mean the removal of at least one solvent in the conducting salt. In particular, the drying is executed such that dimethyl carbonate and/or ethyl carbonate is removed." (EX1001, 2:24-27.) A POSITA would have understood that term "conducting salt" had the same meaning as the term "electrolyte" mentioned in the '097 Patent. (EX1003, ¶90.) The '097 Patent further discloses that the "amount of electrolyte that can be obtained from the comminuted material through drying is such that an electrochemical reaction is no longer possible, or only to a negligibly small extent." (EX1001, 1:63-66.) A POSITA would therefore have understood that this limitation could include inactivating the comminuted material by the evaporation of sufficient portions of the electrolyte, such as organic carbonate solvents like dimethyl carbonate and/or ethyl carbonate. (EX1003, ¶91.) This is precisely what Hanisch's pre-dryer does.

Hanisch teaches that the system "preferably possesses a pre-dryer which is set up in the material flow, behind the cell crushing device [*i.e.*, after comminution] and before the oven. The pre-dryer is configured to heat the cell fragments up to the drying temperature." (EX1004, 4:55-59.) Hanisch also discloses this limitation in the description of Fig. 1: "A pre-dryer 28 is set up in the direction of material flow behind the cell crushing device 12, which is connected to the cell crushing device 12 via a pipe 30. During crushing of the galvanic cells 14, resulting cell fragments arrive at the pre-dryer 28 via the pipe 30. Here there is a dry temperature T_t of preferably $T_t=80^{\circ}\text{C}$. The pre-dryer 28 comprises a circulation pump 32 and a condenser 34 for condensing electrolyte, which can be removed via the pipe 36. The pre-dryer 28 is designed to be gas-proof and is flushed with inert gas by the circulation pump 32." (EX1004, 5:54-63; Fig. 1). Hanisch also claims this limitation in dependent claim 5, "The method according to claim 1, further comprising the steps of: drying the solid cell fragments at a drying temperature to form dry cell fragments and drying vapours and at least partly condensing the drying vapours to retrieve electrolyte solvents before heating the solid cell fragments up to the decomposition temperature." (EX1004, claim 5.)

b) Hanisch's High-Temperature Drying Discloses the Inactivating Limitation

A POSITA would have understood that Hanisch's high-temperature drying discloses this limitation at least because, like the '097 patent, Hanisch's high-

temperature drying results in the decomposition of the electrolyte binder. (EX1003, ¶¶94-102.) Further, a POSITA would have understood that the cited temperatures of "between 400 and 600°C" exceed the boiling points of DMC and EMC, (around 90°C-109°C) which would cause them to evaporate. (EX1003, ¶103.)

Specifically, Hanisch discloses "[a]n oven 44 is set up in . . . in which there is a decomposition temperature T_z between 400 and 600° C. The binder, for example polyvinylidene fluoride (PVDF), thus decomposes." (EX1004, 6:8-11). This is similar to the '097 Patent's disclosure of "drying at a drying temperature and for a drying time that have been selected such that the binder which binds the active material of the lithium battery to a carrier at least largely decomposes." (EX1001, 5:38-41.) And because a POSITA would understand that the temperatures cited would cause the evaporation of the organic solvents from the electrolyte, a POSITA would also understand that this disclosure would have the same result as the '097 Patent's disclosure, where the application of heat would cause the evaporation of the electrolyte solvents. (EX1001, 2:24-27; EX1003, ¶103.)

4. Claim 1[c]: "(c) filling a transport container with the inactivated comminuted material;"

Hanisch renders this limitation obvious in view of the general knowledge of a POSITA. *Koninklijke Philips N.V. v. Google LLC*, 948 F.3d 1330, 1337-38 (Fed. Cir. Jan. 30, 2020) (permissible for the Board to rely on expert evidence to conclude that limitation is "within the general knowledge of a skilled artisan"). In particular,

Hanisch teaches "a method for retrieving active material, in particular lithium or lithium compounds, from a galvanic cell" (EX1004, 1:8-10) and a POSITA would have understood that such retrieval generally would have required some form of transport container to allow the retrieved materials to be reused by other battery manufacturers. (EX1003, ¶104.)

As was well known to a POSITA as of the priority date of the '097 Patent, the principal purpose of **recycling** used batteries is the recovery **and reuse** of rare and often costly substances, such as lithium, copper, nickel, and/or cobalt. (EX1003, ¶¶104-05.) Once these materials are recovered from a recycled battery, they can then be reused in downstream activities such as battery and/or battery component manufacturing. (EX1003, ¶¶104-05.) Insofar as reusing the recovered materials for many downstream activities requires transporting them to other locations, such as battery and/or battery component manufacturing plants, or other facilities that would process and use the recovered materials, a POSITA would have found it obvious to place the recovered materials—including the inactivated material—into a transport container. (EX1003, ¶106.)

Further, even if Hanisch alone does not render obvious this limitation, a POSITA would have found it obvious over Hanisch in view of the teachings of Dunagan that processed recycling material may be "disposed in super sacks or suitable carrier, weighed, labeled and transported for end users to reclaim the

valuable metals and other materials from the recycled materials." (EX1018, 6:33-37.) A POSITA would have been motivated and would have found it obvious, straightforward, and advantageous to apply Dunagan's teachings to Hanisch. EX1003, ¶106.) For example, Hanisch discloses "a method for retrieving active material, in particular lithium or lithium compounds, from a galvanic cell." (EX1004, 1:8-10). Further, Hanisch specifies that its invention may be used "for retrieving active materials, in particular lithium and/or lithium bonds, for example from used batteries." (EX1004, 5:24-26.) Similarly, Dunagan's teachings are "employed to safely and economically recover valuable materials from Li-ion or like batteries or power source." (EX1018, 6:10-12.) A POSITA would have recognized that Dunagan's teaching of safely packaging recovered materials into shipping containers would have advantageously allowed for the safe and economical recovery of valuable materials from used batteries, as taught by both Hanisch and Dunagan, and would have allowed for the reuse of such recovered materials. (EX1003, ¶106.)

5. Claim 1[d]: "wherein the inactivating step is performed by drying the comminuted material, and"

Hanisch discloses this limitation for the same reasons as discussed in element 1[b]. *See supra* Section VII.A.3. Hanisch discloses both high-temperature and low-temperature drying. (EX1004, 1:14-17, 2:32-42, 3:67-4:4, 6:7-13.) Claim 1 does not limit itself to a specific drying temperature and, accordingly, both of Hanisch's drying processes disclose this limitation. (EX1003, ¶108.) Further, a POSITA would

have understood that each of Hanisch's high-temperature and low-temperature drying processes result in the removal of at least one solvent in the conducting salt. (EX1003, ¶¶108-09.)

6. Claim 1[e]: "wherein the drying occurs at a maximum pressure of 300 hPa."

Hanisch discloses this claim limitation because it teaches that "[i]n particular, the heating up takes place under inert gas or in a vacuum." (EX1004, 3:6-8.) A POSITA would have understood that the pressure of a "vacuum" is below 300 hPa. (EX1003, ¶110.) Hanisch does not limit this teaching to either of its high-temperature or low-temperature processes and a POSITA would have understood that vacuum drying could be applied to either approach. (EX1003, ¶¶111-16.)

With respect to Hanisch's low-temperature "pre-dryer" embodiment, Hanisch teaches that "the heating up takes place under inert gas or in a vacuum" (EX1004, 3:6-8), and the pre-dryer is "configured to heat the cell fragments up to the drying temperature" (EX1004, 4:55-59). Further, Hanisch teaches that the "pre-dryer" "is designed to be gas-proof" (EX1004, 5:62-63) and that such gas-proof containers can be used with inert gas or vacuum (EX1004, 3:4-9).

With respect to Hanisch's high-temperature drying, Hanisch teaches that "heating of cell fragments up to the decomposition temperature is preferably carried out under inert gas or in a vacuum." (EX1004, 4:6-8.) Hanisch also recites the use of a vacuum for this process in dependent claim 6: "The method according to claim

1, wherein the heating of the solid cell fragments up to the decomposition temperature takes place under inert gas or in a vacuum." (EX1004, claim 6.)

To the extent that Hanisch does not explicitly disclose this claim limitation, it would have been obvious in view of the common knowledge of a POSITA before the effective filing date of the '097 Patent that using pressures at or below 300hPA when drying the comminuted material would be desirable, and that doing so would have likely been successful. (EX1003, ¶¶113-16.) For example, it has been well-known for decades, if not longer, that the evaporation of gases, including volatile compounds and gases formed during drying, can be facilitated at lower temperatures when ambient pressure is reduced from normal pressure, because of the reduction in boiling point that occurs. (EX1003, ¶¶68-70, 114.) In addition, the boiling point of organic carbonate solvents such as dimethyl carbonate or ethyl methyl carbonate over ranges of ambient pressures and temperatures was well-known in the art for many years before the effective filing date of the '097 Patent. (EX1003, ¶114.) A POSITA would also have understood that the formation of toxic hydrogen fluoride during hydrolysis of LiPF_6 is reduced at lower temperatures, because the reaction is endothermic, such that the use of reduced pressure to allow for lower temperatures when drying comminuted material would be desirable. (EX1003, ¶114.) The potential for reduction in energy utilization in a recycling system stemming from

reduced temperatures for drying (facilitated by using reduced pressure) would also have been attractive. (EX1003, ¶115.)

A POSITA also would have had a reasonable expectation of success in applying pressures at or below 300hPA during either the electrolyte evaporation approach or the decomposition heating approach, where Hanisch teaches that the devices used when drying comminuted material to evaporate electrolyte is gas-proof, and thus capable of maintaining reduced ambient pressures, such as those below 300hPA. (EX1003, ¶116.)

B. 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 that an electrochemical reaction is impossible."

Hanisch discloses this limitation for the same reasons as disclosed above regarding the use of drying to inactivate comminuted material. *See supra* Sections VII.A.3 & A.5. Alternatively, this limitation would have been obvious to a POSITA from Hanisch in view of common knowledge in the field at the time.

The '097 Patent explains that by reducing the electrolyte content to a sufficiently low amount, "the battery contains so little electrolyte that, to a good approximation, an electrochemical reaction is no longer possible." (EX1001, 4:5-18.) The '097 Patent also discloses that the duration of drying is long enough that, for example, "the electrolyte content of organic components that are volatile at 80°C. has a maximum value of 3% by weight, in particular a maximum of 2% by weight,

especially preferably a maximum of 1.5% by weight." (EX1001, 4:28-32). The '097 Patent also discloses embodiments of this claim in which the "drying step shall be performed, for example, for a pre-determined period of time." (EX1001, 6:32-37).

A POSITA, in view of the common knowledge in the field regarding the boiling point and other physical/chemical characteristics of the organic carbonate solvents used in the electrolyte of lithium-ion batteries, would have understood the relationship between the organic carbonate concentration in the electrolyte and the likelihood of electrochemical reactions. (EX1003, ¶120.) This is at least because this relationship was already well-known (before the effective filing date of the '097 Patent) from the knowledge gleaned during the design of such battery compositions. (EX1003, ¶120.) And further, a POSITA would have understood before the effective filing date of the '097 Patent the duration of evaporative temperature and pressure conditions that would be expected to result in a given reduction of organic solvent content in the electrolyte. (EX1003, ¶121.)

Given that Hanisch teaches embodiments in which drying to evaporate electrolyte solvents is carried out "below 100°C., in particular below 80°C," (EX1004, 3:65-4:5), the same temperature range used to evaporate electrolyte solvents in embodiments of the '097 Patent (EX1001, 4:28-32), a POSITA would have understood the duration of drying and pressure ranges required to evaporate the organic solvents in the electrolyte to a point that, as disclosed by the '097 Patent, "to

a good approximation, an electrochemical reaction is no longer possible." (EX1003, ¶121.) In view of the knowledge of a POSITA regarding the risks of combustion, explosion, and the formation of toxic gases associated with potential electrochemical reactions in comminuted material, a POSITA would consider it desirable to ensure that such reactions were avoided in the comminuted material. (EX1003, ¶¶67-68, 121.)

In view of these disclosures, and the knowledge of a POSITA, it would have been obvious to a POSITA to carry out the drying processes disclosed in Hanisch, (as in the '097 Patent), out for a pre-determined amount of time until the electrolyte content in the comminuted material was reduced to a concentration low enough that "an electrochemical chemical reaction is impossible," as that phrase is used in the '097 Patent. (EX1003, ¶121.)

C. Claim 3: "The method according to claim 1, wherein the drying occurs under vacuum."

Hanisch discloses this limitation because it teaches drying to inactivate the comminuted material, either by heating to evaporate the electrolyte or by heating to a decomposition temperature, under vacuum. *See supra* Section VII.A.6.

- D. 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."**

Hanisch discloses and/or renders obvious this limitation for the same reasons as that discussed above regarding the use of drying to inactivate comminuted material (*see supra* Sections VII.A.3 & A.5) and (alone or in combination with Dunagan) as to filling a transport container with the inactivated comminuted material (*see supra* Sections VII.A.4). Alternatively, this claim limitation would have been obvious to a POSITA from Hanisch and Dunagan in view of the common knowledge in the field at the time.

For example, a POSITA, in view of the common knowledge in the field before the effective filing date of the '097 patent, would have understood the potential for flammable or explosive gas mixtures to develop during recycling of lithium-ion batteries. (EX1003, ¶¶67-68, 124.) Further, a POSITA would have understood that flammable or explosive gases in the transportation container would represent an undue safety risk that would frustrate the purpose of reusing the materials recovered during the recycling process. (EX1003, ¶124.) A POSITA would have known before the effective filing date of the '097 patent how to determine the appropriate drying conditions, such as the temperature, pressure, and duration, required to

prevent flammable or explosive gasses from developing in the transport container.

(EX1003, ¶125 ; *see also supra* Sections VII.A.4-5, VII.B.)

E. Claim 8: "The method according to claim 1 wherein the batteries are lithium batteries."

Hanisch discloses this limitation, where it teaches that the "[t]he invention concerns a method for retrieving active material, in particular lithium or lithium compounds, from a galvanic cell. . ." (EX1004, 1:8-10.)

F. Claim 9: "The method according to claim 1 wherein drying occurs at a temperature of less than 80° C."

Hanisch discloses this limitation because it teaches that the disclosed "method preferably comprises the step that, before heating the cell fragments up to the decomposition temperature, the cell fragments are dried at a drying temperature, so that dry cell fragments and drying vapours are formed, whereby the drying vapours are at least partly condensed. This has the advantage that the electrolyte solvent can be retrieved. It is therefore advantageous for the drying temperature to be below 100° C., in particular below 80°C." (EX1004, 3:65-4:5.) A POSITA would have understood that "cell fragments" as used in this description refers to comminuted material. (EX1003, ¶¶85-86.) A POSITA would, therefore, have understood this disclosure from Hanisch as teaching the drying of comminuted material to evaporate electrolyte and solvent from the comminuted material at temperatures less than 80°C, which is what this limitation requires. (EX1003, ¶¶127-28.)

This conclusion is further reinforced by Hanisch's description of the drying stage depicted in Figure 1, which teaches that such a drying stage follows the comminution stage and uses temperatures of less than 80°C to remove electrolyte from the comminuted material. "A pre-dryer 28 is set up in the direction of material flow behind the cell crushing device 12, which is connected to the cell crushing device 12 via a pipe 30. During crushing of the galvanic cells 14, resulting cell fragments arrive at the pre-dryer 28 via the pipe 30. Here there is a dry temperature T_t of preferably $T_t=80^{\circ}\text{C}$. The pre-dryer 28 comprises a circulation pump 32 and a condenser 34 for condensing electrolyte, which can be removed via the pipe 36. The pre-dryer 28 is designed to be gas-proof and is flushed with inert gas by the circulation pump 32." (EX1004, 5:54-63.)

G. Claim 10: "The method according to claim 1 further comprising a step of sealing the transport container so as to be dust-tight after the step of filling with the inactivated comminuted material."

Hanisch, alone or in combination with Dunagan discloses and/or renders obvious this limitation for substantially the same reasons as those discussed above regarding claim limitation 1[c] and claim 7 (*see supra* Sections VII.A.4, VII.D.). And even if this limitation is not expressly disclosed in Hanisch or Dunagan, using a dust-tight container for transporting inactivated comminuted material would have been obvious to a POSITA in view of the well-understood properties of the inactivated comminuted material, which contain fine particulate matter (including

metals and other compounds) that represented a potential safety risk from inhalation or soft tissue exposure during storage and/or transport. (EX1003, ¶¶104-06, 123-25, 129.) A POSITA would have thus considered it obvious to use a dust-tight container to ensure that fine particulate matter is prevented from escaping the container. EX1003, ¶129.)

H. Claim 12

1. **Claim 12[pre]: "A battery processing installation for treatment of used batteries, comprising:"**

Hanisch discloses this claim preamble for the same reasons discussed previously as to the preamble of claim 1. *See supra* Section VII.A.1.

2. **Claim 12[a]: "(a) a comminution unit configured to comminute the batteries such that comminuted material is obtained;"**

Hanisch discloses this claim limitation for the same reasons discussed previously as to claim limitation 1[a]. *See supra* Section VII.A.2.

3. **Claim 12[b]: "(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;"**

Hanisch discloses this claim limitation for the same reasons discussed previously as to claim limitations 1[b] and 1[d]. *See supra* Sections VII.A.3 & A.5.

4. Claim 12[c]: "(c) a filling device configured to fill a transport container with the inactivated comminuted material; and"

Hanisch, alone or in combination with Dunagan, discloses or renders obvious this claim limitation for the same reasons discussed previously as to claim limitation 1[c]. *See supra* Section VII.A.4.

5. Claim 12[d]: "(d) a vacuum installation connected to the drying device and configured to generate a vacuum in the drying device."

Hanisch discloses this claim limitation for at least the same reasons discussed previously as to claim limitation 1[e]. *See supra* Section VII.A.6. Hanisch also discloses this limitation for other reasons.

For example, Hanisch teaches the same "drying device" as one disclosed in the '097 Patent, a "pre-dryer" that "is configured to heat the cell fragments up to the drying temperature" (EX1004, 4:55-59.) Hanisch also discloses that the cell fragments are preferably heated up in a "gas-proof container" (EX1004, 3:4-5) and that "heating up takes place under inert gas or vacuum" (EX1004, 3:6-8, 4:6-8.) A POSITA would have understood from this disclosure that a vacuum installation connected to the drying device of Hanisch would be needed to allow heating up to occur under a vacuum. (EX1003, ¶135.) Hanisch also teaches that the "pre-dryer 28 comprises a circulation pump 32 and a condenser 34 for condensing electrolyte, which can be removed via the pipe 36." (EX1004, 5:59-61.) A POSITA would have understood the circulation pump and condenser disclosed in Hanisch to be

"connected" to the pre-dryer, given the "comprising" language used to modify "pre-dryer." (EX1003, ¶136.) Further, a POSITA would have understood the circulation pump and condenser of Hanisch to be a "vacuum installation." (EX1003, ¶137.) This understanding would follow where the '097 Patent discloses that a "vacuum pump should be understood particularly generally to mean a device that creates a vacuum," (EX1001, 8:23-25), a "vacuum pump is a compressor which sucks in and compresses gas 31 that is present in the drying device 26," (EX1001, 8:29-31), that the "vacuum installation comprises a condenser . . . arranged in the direction of material flow in front of a vacuum pump, by means of which the dryer is evacuated," (EX1001, 6:44-51), and that the "vacuum installation comprises an injector or venturi pump, i.e. a jet pump with a pump liquid that is used to generate negative pressure." (EX1001, 7:4-6; EX1003, ¶136.)

A POSITA would have understood from these disclosures that, where both Hanisch and the '097 Patent describe a "drying device" from which electrolyte gasses and vapors are evaporated and drawn by a vacuum pump through a condenser, i.e. a "vacuum installation," that is connected to the drying device and generates a "vacuum in the drying device", that Hanisch discloses this limitation. (EX1003, ¶136-37.)

- I. Claim 13: "The battery processing installation according to claim 12 wherein the comminuted material is dried until an electrolyte content in the comminuted material is so low that an electrochemical reaction is impossible."**

Hanisch discloses this limitation for the same reasons as that discussed above regarding claim 2. *See supra* Section VII.B.

- J. Claim 19: "The battery processing installation of claim 12 wherein the batteries are lithium batteries."**

Hanisch discloses this limitation for the same reasons as that discussed above regarding claim 8. *See supra* Section VII.E.

VIII. GROUND 2 – THE CHALLENGED CLAIMS ARE RENDERED OBVIOUS BY HANISCH IN VIEW OF DUNAGAN AND HAYASHI, MEADOR, OR SHIN

A. Claim 1

- 1. Claim 1 [pre]: "A method for the treatment of used batteries, comprising the steps:"**

Hanisch discloses the preamble of claim 1 for the same reasons discussed above in Ground 1. *See supra* Section VII.A.1.

- 2. Claim 1[a]: "(a) comminuting the batteries such that comminuted material is obtained;"**

Hanisch discloses this claim limitation for the same reasons discussed above in Ground 1. *See supra* Section VII.A.2.

3. **Claim 1[b]: "(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"**

Hanisch discloses this claim limitation for the same reasons discussed above in Ground 1. *See supra* Section VII.A.3.

4. **Claim 1[c]: "(c) filling a transport container with the inactivated comminuted material;"**

Hanisch discloses this claim limitation for the same reasons discussed above in Ground 1. *See supra* Section VII.A.4.

Further, even if Hanisch alone does not expressly disclose or render obvious this limitation, a POSITA would have found it obvious over Hanisch in view of the teachings of Dunagan that processed recycling material may be "disposed in super sacks or suitable carrier, weighed, labeled and transported for end users to reclaim the valuable metals and other materials from the recycled materials." (EX1018, 6:33-37.) A POSITA would have been motivated and would have found it obvious, straightforward, and advantageous to apply Dunagan's teachings to Hanisch. EX1003, ¶143.) For example, Hanisch discloses "a method for retrieving active material, in particular lithium or lithium compounds, from a galvanic cell." (EX1004, 1:8-10). Further, Hanisch specifies that its invention may be used "for retrieving active materials, in particular lithium and/or lithium bonds, for example from used batteries." (EX1004, 5:24-26.) Similarly, Dunagan's teachings are

"employed to safely and economically recover valuable materials from Li-ion or like batteries or power source." (EX1018, 6:10-12.) A POSITA would have recognized that Dunagan's teaching of safely packaging recovered materials into shipping containers would have advantageously allowed for the safe and economical recovery of valuable materials from used batteries, as taught by both Hanisch and Dunagan, and would have allowed for the reuse of such recovered materials. (EX1003, ¶143.)

5. Claim 1[d]: "wherein the inactivating step is performed by drying the comminuted material, and"

Hanisch discloses this claim limitation for the same reasons discussed above in Ground 1. *See supra* Section VII.A.5.

6. Claim 1[e]: "wherein the drying occurs at a maximum pressure of 300 hPa."

Hanisch discloses this claim limitation for the same reasons discussed above in Ground 1. *See supra* Section VII.A.6. But even if Hanisch alone does not expressly disclose this limitation, each of Meador, Shin, and Hayashi teach the use of pressures at or below 300 hPa, including a vacuum, in connection with heating comminuted material to inactivate it, and a POSITA would have been motivated and would have found it straightforward, obvious, and advantageous to apply those teachings to Hanisch. (EX1003, ¶¶150-52.)

For example, Meador teaches that comminuted materials can be introduced into a pyrolysis chamber and heated to decomposition temperatures, after which the

"dry residue containing valuable components of the batteries and other wastes" are transferred to a "hopper or bin." (EX1011, 3:17-37.) Meador further teaches that the pyrolysis chamber can be maintained under slight vacuum (EX1011, 3:24-25), such as "approximately one-half inch of mercury," (EX1011, 5:59-60) or "about one-half to one inch of mercury," (EX1011, claims 3, 4), which a POSITA would have understood to be the mathematical equivalent of pressures ranging from approximately 16 to 33 hPa, pressures that are below a "maximum of 300 hPa." (EX1003, ¶146.) Meador explains that the vacuum is applied to a "pyrolysis chamber sufficient to remove vapors during said decomposition" and "condensing said vapors in a heat exchanger to obtain liquid and gaseous material," (EX1011, claim 1), which a POSITA would have understood to mean that the heating evaporates materials in the comminuted material, which would include evaporating volatile organic solvents such as those in the electrolyte of lithium-ion batteries. (EX1003, ¶146.)

Similarly, Shin discloses methods and an apparatus for treating waste batteries including lithium-ion batteries, where such batteries are heated under a vacuum to evaporate gas that is released during the process. (EX1010, 2:65-3:20.) Shin teaches that the use of such a vacuum during a heating step is desirable because it reduces risks of explosions and the release of poisonous gases during lithium battery recycling. (EX1010, 3:42-4:17.)

As another example, Hayashi discloses processing lithium-ion batteries by heating the battery containing the electrolyte solution under reduced pressure, such that the organic solvents of the electrolyte are evaporated. (EX1006, 4:33-36.) Hayashi teaches examples in which heating is carried out at a pressure "less than or equal to 1 kPa" (i.e., less than or equal to 10 hPa) over temperatures ranging from 80°C to 150°C. (EX1006, 3:20-25.) Hayashi teaches that the organic solvents used in the electrolyte solution of lithium-ion batteries have boiling points of 90°C for dimethyl carbonate and 109°C for ethyl methyl carbonate. (EX1006, 4:38-45.) Hayashi also discloses that reduced pressure in a volume can affect the boiling point of these volatile organic solvents, such that they can be evaporated under controlled conditions. (EX1006, 4:43-67, and Table 1.) Although Hayashi does not disclose comminuting the battery before using heat and reduced pressure to evaporate electrolyte, it teaches that electrolyte in a battery is exposed to reduced pressure during the heating and the evaporated electrolyte can via a release valve connected to a pipe. (EX1006, 3:12-55; 4:24-36.) This disclosure is also found in the '097 Patent, which describes as a preferred embodiment "that the batteries are exposed to a vacuum when in an uncomminuted state such that at least parts of the electrolyte vaporise, wherein the resulting gas . . . escapes through a safety valve in the rechargeable battery." (EX1001, 2:41-46.)

A POSITA would have been motivated to implement Hanisch using the teachings of either Meador, Shin, or Hayashi that comminuted material or electrolyte could be inactivated under a vacuum. (EX1003, ¶¶150-52.) A POSITA would have been so motivated at least because of the advantages of improved electrolyte evaporation at a given temperature when lower ambient pressures are used (EX1006, 4:43-67, Table 1; EX1003, ¶¶69-70, 151), the attenuation of toxic hydrogen fluoride production during the heating process (EX1003, ¶¶68, 151), and the control over potentially flammable compounds and gasses generated during such heating stages (EX1011, claim 1; EX1010, 2:65-3:20; 3:42-4:17; EX1006, 4:12-36; EX1003, ¶¶67-68, 71, 151.)

A POSITA would also have had a reasonable expectation of success in applying the teachings of Meador, Shin, or Hayashi to Hanisch because these references concern battery recycling using heat to inactivate exposed electrolyte (EX1006, 4:12-67) or material that has been comminuted (EX1011, 3:17-37; EX1010, 2:65-3:6), each recognizes the advantages of using reduced air pressures during heating of the battery material (EX1011, 4:1-8, claim 1; EX1010, 2:65-3:20; 3:42-4:17; EX1006, 4:43-67, Table 1), and each discloses the use of gas-proof or otherwise vacuum-compatible vessels for such heating (EX1011, 3:25-40; EX1010, 3:3-11; EX1006, 3:31-40, 4:24-36), which a POSITA would have understood to be compatible with the use of reduced air pressures under 300 hPa. (EX1003, ¶152.)

- B. 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 that an electrochemical reaction is impossible."**

Hanisch discloses and/or renders obvious this claim limitation for the same reasons discussed above in Ground 1. *See supra* Section VII.B.

- C. Claim 3: "The method according to claim 1, wherein the drying occurs under vacuum."**

Hanisch discloses this claim limitation for the same reasons discussed above in Ground 1. *See supra* Section VII.C.

- D. 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."**

Hanisch discloses this claim limitation for the same reasons discussed above in Ground 1. *See supra* Section VII.D.

- E. Claim 8: "The method according to claim 1 wherein the batteries are lithium batteries."**

Hanisch discloses this claim limitation for the same reasons discussed above in Ground 1. *See supra* Section VII.E.

- F. Claim 9: "The method according to claim 1 wherein drying occurs at a temperature of less than 80°C."**

Hanisch discloses this claim limitation for the same reasons discussed above in Ground 1. *See supra* Sections VIII.A.3 & A.5.

G. Claim 10: "The method according to claim 1 further comprising a step of sealing the transport container so as to be dust-tight after the step of filling with the inactivated comminuted material."

Hanisch discloses this claim limitation for the same reasons discussed above in Ground 1. *See supra* Section VII.G.

H. Claim 12

1. Claim 12[pre]: "A battery processing installation for treatment of used batteries, comprising:"

Hanisch discloses this claim limitation for the same reasons discussed above in Ground 1. *See supra* Section VII.H.1.

2. Claim 12[a]: "(a) a comminution unit configured to comminute the batteries such that comminuted material is obtained;"

Hanisch discloses this claim limitation for the same reasons discussed above in Ground 1. *See supra* Section VII.H.2.

3. Claim 12[b]: "(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;"

Hanisch discloses this claim limitation for the same reasons discussed above in Ground 1. *See supra* Section VII.H.3.

4. Claim 12[c]: "(c) a filling device configured to fill a transport container with the inactivated comminuted material; and"

Hanisch, alone or in combination with Dunagan, discloses or renders obvious this claim limitation for the same reasons discussed above in Ground 1. *See supra* Section VII.H.4.

5. Claim 12[d]: "(d) a vacuum installation connected to the drying device and configured to generate a vacuum in the drying device."

Hanisch discloses this claim limitation for the same reasons discussed above in Ground 1 (*see supra* Section VII.H.5) and claim 1[e] (*see supra* Section VIII.A.6). But even if Hanisch alone does not disclose this limitation, each of Meador, Shin, and Hayashi teach the use of a vacuum in connection with heating comminuted material or exposed electrolyte to inactivate it.

For example, Meador teaches that comminuted materials can be introduced into a pyrolysis chamber and heated to decomposition temperatures, after which the "dry residue containing valuable components of the batteries and other wastes" are transferred to a "hopper or bin." (EX1011, 3:17-37.) Meador further teaches that the pyrolysis chamber can be maintained under slight vacuum (EX1011, 3:24-25), such as "approximately one-half inch of mercury," (EX1011, 5:59-60), or "about one-half to one inch of mercury," (EX1011, claims 3, 4), which a POSITA would have understood to be the mathematical equivalent of pressures ranging from approximately 16 to 33 hPa. (EX1003, ¶164.) A POSITA would have understood

this to include the "vacuum installation. . . configured to generate a vacuum in the drying device." (EX1003, ¶¶164-65.)

Similarly, Shin discloses methods and an apparatus for treating waste batteries including lithium-ion batteries, where such batteries are heated under a vacuum to evaporate electrolyte gas that is released during the process. (EX1010, 2:65-3:20.) Shin teaches that the use of such a vacuum during a heating step is desirable because it reduces risks of explosions and the release of poisonous gasses during lithium battery recycling. (EX1010, 3:42-4:17.)

Hayashi discloses processing lithium-ion batteries by heating the battery containing the electrolyte solution under reduced pressure, such that the organic solvents of the electrolyte are evaporated. (EX1006, 4:33-36.) Hayashi teaches examples in which heating is carried out at a pressure "less than or equal to 1 kPa" (i.e., less than or equal to 10 hPa) over temperatures ranging from 80°C to 150°C. (EX1006, 3:20-25.) Hayashi teaches that the organic solvents used in the electrolyte solution of lithium-ion batteries have boiling points of 90°C for dimethyl carbonate and 109°C for ethyl methyl carbonate. (EX1006, 4:38-45.) Hayashi also discloses that reduced pressure in a volume can affect the boiling point of these volatile organic solvents, such that they can be evaporated under controlled conditions. (EX1006, 4:43-67, and Table 1.) Although Hayashi does not disclose comminuting the battery before using heat and reduced pressure to evaporate electrolyte, it teaches

that electrolyte in a battery is exposed to reduced pressure during the heating and the evaporated electrolyte can be removed via a release valve connected to a pipe. (EX1006, 3:12-55; 4:24-36.) This disclosure is also found in the '097 Patent, which describes as a preferred embodiment "that the batteries are exposed to a vacuum when in an uncomminuted state such that at least parts of the electrolyte vaporise, wherein the resulting gas . . . escapes through a safety valve in the rechargeable battery." (EX1001, 2:41-46.)

A POSITA would have been motivated and would have found it straightforward, obvious, and advantageous to implement Hanisch using the teachings of either Meador, Shin, or Hayashi that comminuted material or electrolyte could be inactivated under a vacuum. (EX1003, ¶168). A POSITA would have been so motivated at least because of the advantages of improved electrolyte evaporation at a given temperature when lower ambient pressures are used (EX1006, 4:43-67, Table 1; EX1003, ¶¶69-70, 168), the attenuation of toxic hydrogen fluoride production during the heating process (EX1003, ¶¶67-68, 168), and the control over potentially flammable compounds and gasses generated during such heating stages. (EX1011, claim 1; EX1010, 2:65-3:20; 3:42-4:17; EX1006, 4:12-36; EX1003, ¶¶67-68, 71, 168.)

A POSITA would also have had a reasonable expectation of success in applying the teachings of Meador, Shin, or Hayashi to Hanisch because these

references concern battery recycling using heat to inactivate exposed electrolyte (EX1006, 4:12-67) or material that has been comminuted (EX1011, 3:17-37; EX1010, 2:65-3:6), each recognizes the advantages of using reduced air pressures during heating of the battery material (EX1011, 4:1-8, claim 1; EX1010, 2:65-3:20; 3:42-4:17; EX1006, 4:43-67, Table 1), and each discloses the use of gas-proof or otherwise vacuum-compatible vessels for such heating, (EX1011, 3:25-40; EX1010, 3:3-11; EX1006, 3:31-40, 4:24-36) which a POSITA would have understood to be compatible with the use of reduced air pressures such as that provided by a vacuum installation. (EX1003, ¶169.)

I. Claim 13: "The battery processing installation according to claim 12 wherein the comminuted material is dried until an electrolyte content in the comminuted material is so low that an electrochemical reaction is impossible."

Hanisch discloses this limitation for the same reasons as that discussed above in Ground 1 regarding claim 2. *See supra* Section VII.B.

J. Claim 19: "The battery processing installation of claim 12 wherein the batteries are lithium batteries."

Hanisch discloses this limitation for the same reasons as that discussed above in Ground 1 regarding claim 8. *See supra* Section VII.E.

IX. DISCRETIONARY DENIAL IS NOT WARRANTED

A. *Fintiv* Factors

Petitioner respectfully submits that consistent with the Board's precedential decision in *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 (PTAB Mar. 20,

2020), and the Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation (June 21, 2022) ("Interim *Fintiv* Procedure"), this Petition should not be denied pursuant to the Board's discretionary authority. While there is a parallel district court action involving the challenged claims, discretionary denial would not be appropriate at least because of (i) Petitioner's *Sotera* stipulation, which is dispositive on the question of discretionary denial; (ii) the compelling evidence of unpatentability, which is separately and independently dispositive on this question; and (iii) the lack of a trial date and relatively nascent stage in the parallel district court proceedings.

1. Whether the Court Granted a Stay or Evidence Exists That One May be Granted If a Proceeding Is Instituted

The '097 Patent is asserted in a parallel district court proceeding: *Duesenfeld GMBH v. Ascend Elements, Inc.*, Case No. Case 1:23-cv-01194-JFM (D. Del.) ("the Parallel Proceeding"). If this proceeding is instituted, a stay is likely to be granted in the Parallel Proceeding. The District of Delaware has granted at least 69 motions to stay pending IPR filed since January 1, 2022, whereas it has denied approximately 15 such motions filed during the same period. This factor weighs against discretionary denial.

2. Proximity of the Court's Trial Date to the Board's Projected Statutory Deadline for a Final Written Decision

If this Petition is instituted, the Statutory Deadline for a Final Written Decision is likely to be roughly 18 months from the date that it was filed—i.e., roughly September 2025. In contrast, no trial date has been set in the Parallel Proceeding, and according to the most recently available statistics from Dec. 2023, the average time-to-trial for civil cases in the District of Delaware is 38.8 months. (EX1013, at 3.) That means that a trial would likely be held at some point in late 2026 or early 2027, nearly a year after the statutory deadline that would apply to these proceedings. This factor therefore weighs strongly against discretionary denial.

3. Investment in the Parallel Proceeding by the Court and the Parties

As of the date of filing, the parties have engaged in very little discovery, no *Markman* briefs have been filed, a *Markman* hearing has been scheduled only for December 2024, the close of fact discovery is approximately one year away on March 31, 2025, and expert discovery is not scheduled to close until July 2, 2025. (EX1012.) This factor thus weighs strongly against discretionary denial.

4. Overlap between Issues Raised in the Petition and in the Parallel Proceeding

The challenged claims and the prior art cited in this Petition overlap with those in the Parallel Proceeding. However, Petitioner hereby stipulates that if an IPR is instituted on the grounds set forth in this Petition, it will not pursue in the Parallel

Proceeding the specific grounds asserted in the Petition against the challenged claims, or any other ground that could have been reasonably raised in the Petition against the challenged claims. *See Sotera Wireless, Inc. v. Masimo Corp.*, IPR2020-01019, Paper 12 at 13-14, 18-19 (PTAB Dec. 1, 2020). This stipulation dispositively establishes that discretionary denial is not appropriate in this case. *See Interim Fintiv Procedure* at 3, 7-8.

5. Whether the Petitioner and the Defendant in the Parallel Proceeding are the Same Party

Petitioner is the Defendant in the Parallel Proceeding. While this factor weighs slightly in favor of denial, it is overcome by the other factors. *See, e.g., Interim Fintiv Procedure* at 4 ("[C]ompelling, meritorious challenges will be allowed to proceed at the PTAB even where district court litigation is proceeding in parallel. ").

6. Other Circumstances That Impact the Board's Exercise of Discretion, Including the Merits

Petitioner submits that the Grounds presented in this petition are compelling theories of obviousness that, "if unrebutted in trial, would plainly lead to a conclusion that one or more claims are unpatentable by a preponderance of the evidence." *See Interim Fintiv Procedure* at 3, 7-8. The merits of the petition thus favor institution.

B. 35 U.S.C. §325(d)

Discretionary denial under 35 U.S.C. §325(d) is not warranted. The analysis under §325(d) is two-pronged and considers (a) whether the prior art and arguments presented in the petition are the same or substantially the same as those previously presented to the Office; and (2) if so, whether the petitioner has demonstrated a material error by the Office in its prior consideration of the prior art and arguments. *See Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6 at 8 (PTAB Feb. 13, 2020). In evaluating whether the same or substantially the same prior art or arguments were previously presented to the Office, the Board considers several factors as identified in *Becton, Dickinson & Co. v. B. Braun Melsungen AG*, IPR2017-01586, Paper 8 at 17–18 (PTAB Dec. 15, 2017) (precedential as to § III.C.5, first paragraph):

- (a) the similarities and material differences between the asserted art and the prior art involved during examination;
- (b) the cumulative nature of the asserted art and the prior art evaluated during examination;
- (c) the extent to which the asserted art was evaluated during examination, including whether the prior art was the basis for rejection;

- (d) the extent of the overlap between the arguments made during examination and the manner in which Petitioner relies on the prior art or Patent Owner distinguishes the prior art;
- (e) whether Petitioner has pointed out sufficiently how the Examiner erred in its evaluation of the asserted prior art; and
- (f) the extent to which additional evidence and facts presented in the Petition warrant reconsideration of the prior art or arguments.

Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH, IPR2019-01469, Paper 6 at 8 (PTAB Feb. 13, 2020) (precedential). Factors (a), (b), and (d) relate to the first prong of the analysis under *Advanced Bionics*, and factors (c), (e), and (f) relate to the second prong. *Advanced Bionics*, Paper 6 at 10.

Discretionary denial is not warranted here because the Office has not previously considered the arguments herein based on Hanisch alone or in combination with Dunagan (Ground 1), the combination of Hanisch with any of Meador, Shin, Dunagan or Hayashi (Ground 2). As detailed *supra* in Section IV.B, during prosecution the Office only considered a single line (column 2, line 6) and only one part of a figure (Figure 1 item 50) of Hanisch in combination with two other references Stevens and Kellermann (neither of which is relied on this petition), and only for the limited purpose of rejecting dependent claims 14 and 18, directed to the use of an air sieve to separate processed materials. (EX1002, at 213-14, 330.) The

Office did not cite or appear to appreciate the many other disclosures in Hanisch that, in view of the knowledge of a POSITA, would anticipate and/or render obvious every element of the challenged claims.

Similarly, as detailed *supra* in Section IV.B, the Office only cited a small excerpt from Meador ("frame of the device" and column 4, lines 36-53) in combination with Stevens and Kellermann in rejecting dependent claim 9, directed to a comminution device and drying device arranged in a container. (EX1002, at 213, 329.) The Office did not consider the arguments presented herein regarding Meador's disclosure of heating comminuted material under reduced air pressure in combination with Hanisch, as to the patentability of any of the challenged claims.

The Office did not consider the Grounds presented herein nor the accompanying arguments as to any of the challenged claims. Moreover, the Office did not have the benefit of the additional evidence and facts presented in this petition, including the van Schalkwijk Declaration (EX1003) and supporting references, that explain the state of the prior art, the knowledge and understanding of a POSITA, and why the challenged claims are unpatentable as anticipated and/or obvious in view of Hanisch alone or in combination with Dunagan (Ground 1), or obvious in view of Hanisch in combination with the other art cited in Ground 2. *Becton* factors (b)-(d) therefore favor institution. And as to *Becton* factor (a), the Board grants institution when a petition sets forth obviousness theories that were not considered during

prosecution, even when the prior art overlaps with record references. *See, e.g., Nvidia Corp. v. Invensas Corp.*, IPR2020-00602, Paper 11, at 15-20 (PTAB Sep. 3, 2020). Discretionary denial is thus unwarranted because the first prong of the *Advanced Bionics* test is not met.

Even if the first prong were met, the Office committed material error in failing to consider numerous aspects of the disclosures in at least Hanisch and Meador, such that discretionary denial is not warranted. The Board has made clear that "[i]f the record of the Office's previous consideration of the art is not well-developed or silent, then a petitioner may show the Office erred by overlooking something persuasive" *Advanced Bionics*, Paper 6 at 10.

As discussed above, the Office did not discuss Hanisch or Meador as to any of the challenged claims in this petition, and even then, only cited a single line and one item in a single figure of Hanisch, and only a short excerpt from Meador. As explained previously in this petition, Hanisch alone or in combination with Dunagan (in view of the knowledge of a POSITA) explicitly discloses and/or renders obvious every element recited in the challenged claims, such as the comminution of batteries (including lithium batteries), the inactivation of the comminuted material through drying at lower temperatures (such as temperatures at or below 80°C) and/or heating to decomposition temperatures, carrying out the inactivation under pressures at or below 300 hPa, and filling a transport container with inactivated comminuted

material. *See supra* Section VII. As also explained above, Meador teaches the use of reduced pressures under vacuum when using heat to inactivate comminuted material, including that from lithium batteries. *See supra* Section VIII.A.5. The disclosures in Hanisch and Meador references as they apply to the elements of the challenged claims were not discussed in any meaningful regard during prosecution. (EX1002, at 213-14, 329-330.) Hayashi was not discussed at all, and neither Dunagan nor Shin was before the Office during prosecution.

X. MANDATORY NOTICES

A. Real Party-in-Interest

Petitioner Ascend Elements, Inc. is the real party-in-interest.

B. Related Proceedings

The '097 Patent has been asserted by Duesenfeld in the district court proceeding *Duesenfeld GMBH v. Ascend Elements, Inc.*, Case No. Case 1:23-cv-01194-JFM (D. Del. Oct. 20, 2023).

The '097 Patent is the subject of another petition for *inter partes* review in URT Umwelt und Recyclingtechnik GmbH v. Duesenfeld GmbH, IPR2024-00887 (filed May 1, 2024).

C. Counsel Information

Petitioner designates the following counsel:

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D. Electronic Service

Petitioner consents to email service at the email addresses above.

XI. FEES

The required fee is being paid electronically through P-TACTS.

XII. CONCLUSION

Petitioner respectfully requests institution and a final written decision finding the Challenged Claims unpatentable.

Petition for *Inter Partes* Review of U.S. Patent No. 11,050,097
Filed: May 21, 2024

Respectfully submitted,

Dated: May 21, 2024

/s/ Andrew D. Gish
Andrew D. Gish (Reg. # 67,562)

CERTIFICATE OF WORD COUNT

The undersigned certifies that the foregoing Petition with the word count limits set forth in 37 C.F.R. §42.24(a)(1)(i). Excluding the parts of the Petition exempted by 37 C.F.R. §42.24(a)(1), this Petition contains 12,906 words as determined using the word count feature in Microsoft Word, which was used to prepare this Petition.

Dated: May 21, 2024

/s/ Andrew Gish
Andrew D. Gish (Reg. # 67,562)

CERTIFICATE OF SERVICE

The undersigned hereby confirms that on May 21, 2024 the foregoing Petition for Inter Partes Review and associated exhibits were caused to be served, via overnight courier on the Patent Owner at the correspondence address of record for U.S. Pat. No. 11,050,097.

Courtesy copies were also served via email on Patent Owner's counsel of record in a related district court action styled *Duesenfeld GMBH v. Ascend Elements, Inc.*, Case No. Case 1:23-cv-01194-JFM (D. Del. Oct. 20, 2023):

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