

EXHIBIT 1003

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

URT Umwelt und Recyclingtechnik GmbH,
Petitioner

v.

Duesenfeld GmbH,
Patent Owner

Case No. IPR2024-00887
U.S. Patent 11,050,097

**DECLARATION OF VOLKER SPIES, IN SUPPORT OF PETITION FOR
INTER PARTES REVIEW OF U.S. PATENT 11,050,097**

TABLE OF CONTENTS

	<u>Page</u>
I. INTRODUCTION	1
II. GROUNDS OF UNPATENTABILITY.....	3
III. QUALIFICATIONS.....	4
IV. MATERIALS CONSIDERED	6
V. LEGAL STANDARDS	7
A. My Understanding of Claim Construction.....	8
B. My Understanding of a Person of Ordinary Skill in the Art.....	8
C. My Understanding of Anticipation	9
D. My Understanding of Obviousness.....	10
VI. THE '097 PATENT	14
A. Alleged Problem in the Prior Art	14
B. Overview of the '097 Patent	15
C. Prosecution History	18
D. Level of Ordinary Skill	22
E. Claim Construction.....	23
VII. Overview of the Prior art.....	25
A. Overview of LithoRec	25
B. Overview of Din.....	28
C. Overview of Perry	29
D. Overview of Hanisch.....	29

E.	The Prior Art Is Analogous Art.....	30
VIII.	Ground 1: Claims 1-3, 7, 8, and 10 Are Obvious Over LithoRec in view of Din and Perry	30
A.	Independent Claim 1	31
1.	[1-PRE] “A method for the treatment of used batteries, comprising the steps:”	32
2.	[1-A] “(a) comminuting the batteries such that comminuted material is obtained;”	32
3.	[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”	34
4.	[1C] “(c) filling a transport container with the inactivated comminuted material”	36
5.	[1D] “wherein the inactivating step is performed by drying the comminuted material, and”	37
6.	[1E] “wherein the drying occurs at a maximum pressure of 300 hPa.”	37
B.	Claim 2	40
C.	Claim 3	42
D.	Claim 7	42
1.	No flammable or explosive gas mixture is formable above the comminuted material in the transport container.....	43
2.	the comminuted material is so dry that no flammable or explosive gas mixture is able to emerge in the transport container.....	45
E.	Claim 8	46
F.	Claim 10	47

IX.	Ground 2: Claim 9 Is Obvious Over LithoRec in view of Din and Perry, and further in view of Hanisch	48
A.	The Hanisch Reference	48
B.	Claim 9 Would Have Been Obvious to a POSA.....	49
X.	Ground 3: Claims 12, 13, 15, 16, 18, and 19 Are Anticipated By LithoRec.....	51
A.	Independent Claim 12	51
1.	[12-PRE] “A battery processing installation for treatment of used batteries, comprising:”	52
2.	[12-A] “(a) a comminution unit configured to comminute the batteries such that comminuted material is obtained;”	53
3.	[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”	55
4.	[12-C] “(c) a filling device configured to fill a transport container with the inactivated comminuted material; and”	57
5.	[12-D] “(d) a vacuum installation connected to the drying device and configured to generate a vacuum in the drying device.”.....	59
B.	Claim 13	61
C.	Claim 15	62
1.	“a hard metal detachment device and/or a light fraction detachment device;”	62
2.	a separation device configured to separate active material from a carrier such that an active material fraction and a carrier fraction occur; and.....	64

3.	a second filling device configured to separately fill the active material fraction and the carrier fraction in respective containers.	65
D.	Claim 16	66
E.	Claim 18	66
F.	Claim 19	67
XI.	Ground 4: Claim 17 Is Obvious over LithoRec in view of Hanisch.....	68
A.	The Hanisch Reference	68
B.	Claim 17 Would Have Been Obvious to a POSA.....	69
XII.	Objective Indicia Do Not Support Patentability.....	69
XIII.	CONCLUSION.....	70

I. INTRODUCTION

I, Volker Spies, declare as follows:

1. I am over the age of twenty-one (21) years, of sound mind, and capable of making the statements set forth in this Declaration. I am competent to testify about the matters set forth herein. All facts and statements contained herein within my personal knowledge are true and correct, and I believe those items stated herein on information and belief to be true and correct.

2. I have been retained on behalf of URT Umwelt und Recyclingtechnik GmbH (“Petitioner”) for the above-captioned *inter partes* review proceeding to provide my expert opinions and expert knowledge. I understand that this proceeding involves U.S. Patent No. 11,050,097 (“the '097 patent,” EX1001), which is titled “Method For The Treatment Of Used Batteries, In Particular Rechargeable Batteries, And Battery Processing Installation” and is currently assigned to Duesenfeld GmbH.

3. The '097 patent discloses a system and method “for the treatment of used batteries, in particular lithium batteries, containing the steps: comminuting the batteries such that comminuted material is obtained, inactivating the comminuted material such that inactivated comminuted material is obtained, and filling a transport container with the inactivated comminuted material. The inactivation is performed by drying the comminuted material, and the comminuted material is

dried until an electrolyte content is so low that an electrochemical reaction is not possible.” EX1001, Abstract.

4. I am familiar with the subject matter disclosed in the '097 patent as of its April 28, 2016 filing date and as of April 28, 2015, which I understand is the '097 patent's earliest possible priority date. I have not formed an opinion as to whether the '097 patent is entitled to the April 28, 2015 priority date, but I reserve the right to do so in the future, if necessary. That said, for the purposes of my opinions in this Declaration, I have been asked to treat April 28, 2015, as the time of invention of the '097 patent.

5. I have been asked to provide my independent technical review, analysis, insights, and opinions regarding the '097 patent and the references that form the basis for the grounds of unpatentability for claims 1-3, 7-9, 12, 13, and 15-19 of the '097 patent.

6. I have reviewed and am familiar with the '097 patent and its file history. I have also reviewed and am familiar with the documents I cite in this Declaration. I understand that these documents have been provided as exhibits to the Petition that Petitioner is concurrently submitting. My analysis and opinions will focus on all of the challenged claims, claims 1-3, 7-9, 12, 13, and 15-19 of the '097 patent.

7. I confirm that to the best of my knowledge the accompanying exhibits are true and accurate copies of what they purport to be and that an expert in the field would reasonably rely on them to formulate opinions such as those set forth in this declaration.

8. I am being compensated at my customary rate of \$500 USD per hour for my work on this case. My compensation is not dependent upon my opinions, my testimony, or the outcome of this case.

II. GROUNDS OF UNPATENTABILITY

9. In forming my opinions about the '097 patent, I have considered the following grounds of unpatentability. Based on my review of the prior-art references that form the basis of these grounds, it is my opinion that claims 1-3, 7-9, and 17 of the '097 patent would have been obvious to a person of ordinary skill in the art (“POSA”) as of April 28, 2015. It is also my opinion that claims 12, 13, 15, 16, 18, and 19 are anticipated by the state of the art and common knowledge as of April 28, 2015.

Ground	References	Basis	Challenged Claims
1	LithoRec, Din, and Perry	§103	1-3, 7, and 8
2	LithoRec, Din, Perry, and Hanisch	§103	9
3	LithoRec	§102(a)(1)	12-13, 15-16, 18-19
4	LithoRec and Hanisch	§103	17

10. I have been asked to consider how a POSA would have understood the challenged claims in light of the disclosures of the '097 patent. I also have been asked to consider how a POSA would have understood the prior-art references LithoRec, Din, Perry, and Hanisch. Further, I have been asked to consider and provide my technical review, analysis, insights, and opinions regarding whether a POSA would have understood that the combinations of the prior-art references listed in the table above render obvious claims 1-3, 7-9, and 17 of the '097 patent and whether a POSA would have understood that the LithoRec reference listed in the table above anticipates claims 12, 13, 15, 16, 18, and 19.

III. QUALIFICATIONS

11. In forming the opinions in this Declaration, I have considered and relied on my education, background, and experience. My experience and education are detailed in my *curriculum vitae* (“CV”). See EX1008. My CV lists my publications.

12. I received a Diplom-Ingenieur in chemical engineering from the University of Dortmund in 1988.

13. Currently, I am vice president of sales at BHS-Sonthofen GmbH (“BHS”). I have been with BHS for over six years. BHS specializes in machinery and plant engineering. We focus on filtration, drying, reacting, mixing, shredding and recycling in the area of mechanical, thermal, and chemical process technology.

Among other areas, BHS offers solutions for recovering raw material from lithium-ion batteries in a manner that is safe, e.g., helps avoid dangerous fires. In this regard, we provide different kinds of shredders for shredding batteries, as well as different kinds of dryers for heating crushed/shredded material in batches to evaporate the electrolyte components. I am familiar with the processes and machinery that we provide, including how the processes and machinery are engineered and why they are engineered in those ways. For example, I am familiar with the risks of serious combustibility and how we mitigate those risks, including how and why we evaporate electrolyte components.

14. During my time at Gericke GmbH, we developed special high-temperature gravimetric feeding systems for rotary kilns for CAM (cathode active material), positive pressure pneumatic conveying systems in various applications in battery production.

15. I have been involved in the research and development of battery recycling for years. I have been a technical manager in apparatus and plant engineering. I also have extensive experience in mechanical process engineering focusing on dosing, mixing, sieving, pneumatic conveying, comminution, and thermal process engineering (including drying and reaction). I also have almost thirty years of experience in contact drying, oil and gas, plastics, and pharmaceutical and food industries.

16. I was a named inventor on DE102009032689B3 directed to a screening machine.

IV. MATERIALS CONSIDERED

17. In formulating my opinions, I have relied on my training, knowledge, and experience. Furthermore, I have specifically considered the following documents, in addition to any other documents cited in this Declaration.

Exhibit No.	Document
1001	U.S. Patent No. 11,050,097 to Hanisch <i>et al.</i> (the '097 patent")
1002	Prosecution History of U.S. Patent No. 11,050,097 ("Prosecution History")
1004	Arno Kwade <i>et al.</i> , "LithoRec Recycling of Lithium-Ion Batteries", Culliver Verlag (2012) ("LithoRec")
1006	"Perry's Chemical Engineers' Handbook 7th Edition". New York: McGraw-Hill, 1997. ("Perry")
1007	"Vacuum Technology; Terms and Definitions; General Terms." DIN 28400-1, German Institute for Standards e.V., 1990. ("Din")
1009	U.S. Patent No. 8,210,456
1010	DE 4 424 825
1011	US 2003/0186110
1012	US 5,632,863
1013	WO 2013/023640 ("Hanisch")
1014	U.S. 2016/0043450
1015	CN 102496752

Exhibit No.	Document
1016	English Translation of LithoRec
1018	English Translation of Din
1020	English Translation of Hanisch

V. LEGAL STANDARDS

18. I have also relied upon various legal principles (as explained to me by Petitioner's counsel) in formulating my opinions. My understanding of these principles is summarized below.

19. I have been told the following legal principles apply to analysis of patentability. I also have been told that, in an *inter partes* review proceeding, a patent claim may be deemed unpatentable if it is shown by a preponderance of the evidence that the claim is rendered obvious by one or more prior-art references under 35 U.S.C. § 103 and/or is anticipated by a prior art reference under 35 U.S.C. § 102(a)(1).

20. I understand that documents and materials (such as printed publications or patents) that qualify as prior art can be used to render a patent claim obvious and/or anticipate a patent claim.

21. I understand that, once the claims of a patent have been properly construed, the second step in determining invalidity of a patent claim requires a

comparison of the properly construed claim language to the prior art on a limitation-by- limitation basis.

A. My Understanding of Claim Construction

22. I understand that during an *inter partes* review proceeding, claims are to be construed in light of the specification as would be read by a POSA at the time of the purported priority date. I also understand that claims in an IPR are construed using the same claim construction standard that would be used to construe the claim in a civil action. I understand that claim terms are given their ordinary and customary meaning as would be understood by a POSA in the context of the entire disclosure. A claim term, however, will not receive its ordinary meaning if the patentee acted as his own lexicographer and clearly set forth a definition of the claim term in the specification. In this case, the claim term will receive the definition set forth in the patent.

B. My Understanding of a Person of Ordinary Skill in the Art

23. I understand that a POSA is presumed to be aware of all pertinent art, thinks along conventional wisdom in the art, and is a person of ordinary creativity—not an automaton.

24. I have been asked to consider the level of ordinary skill in the field that someone would have had at the time the alleged invention was made. In deciding the level of ordinary skill, I considered the following:

- the levels of education and experience of persons working in the field;
- the types of problems encountered in the field; and
- the sophistication of the technology.

25. I understand that the relevant time for considering whether a claim would have been obvious to a POSA is at the time of the alleged invention, which I have assumed to be April 28, 2015.

26. Regardless, if I use “I” or “POSA” during my technical analysis below, all of my statements and opinions are to be understood to be based on how a POSA would have understood or read a document at the time of the alleged invention.

C. My Understanding of Anticipation

27. I understand that a patent claim is unpatentable if the claimed invention is anticipated by prior art. To be anticipated by a reference, the disclosure of the reference must teach each and every element (either explicitly or implicitly) that is required by the claimed invention. In order for the reference to implicitly teach a claimed element, the implied element must necessarily flow from the teaching of the reference. In addition, for an implicitly taught element, there must be evidence and/or a rationale that would lead a POSA to a conclusion that the element is implicitly taught by the reference.

D. My Understanding of Obviousness

28. I understand that a patent claim is unpatentable if the claimed invention would have been obvious to a POSA at the time of the alleged invention. I understand that this means that even if all of the elements of the claim cannot be found in a single prior-art reference that would anticipate the claim, the claim can still be unpatentable.

29. It is my understanding that, to obtain a patent, a claimed invention must have been, as of its earliest possible priority date, non-obvious in view of the prior art in the field. I understand that a patent claim is obvious when the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious to a POSA at the time the alleged invention was made.

30. When considering the issues of obviousness, I have been told that I am to do the following:

- Determine the scope and content of the prior art;
- Ascertain the differences between the prior art and the claims at issue;
- Resolve the level of ordinary skill in the art; and
- Consider evidence of secondary indicia of nonobviousness (if available).

31. With respect to determining the proper scope of prior art to examine, I understand that for a prior-art reference to be properly used in an obviousness ground under 35 U.S.C. § 103, the prior-art reference must be analogous art to the claimed invention. I have been told that a reference is analogous art to the claimed invention only if: (1) the reference is from the same field of endeavor as the claimed invention; or (2) the reference is reasonably pertinent to the particular problem solved by the inventor.

32. I understand that factors relevant to determining the proper field of endeavor include the inventor's explanations of the subject matter (including the patent specification) and the claimed invention's structure and function. And I further understand that to be reasonably pertinent to the particular problem solved by the inventor, a prior-art reference must logically commend itself to the inventor's attention in considering his or her problem.

33. I have been told that an analogous reference may be modified or combined with other analogous references or with the POSA's own knowledge if the person would have found the modification or combination obvious. I have also been told that a POSA is presumed to know all relevant, analogous prior art, and the obviousness analysis may take into account the inferences and creative steps that a POSA would employ.

34. In determining whether a prior-art reference would have been combined with another prior-art reference or other information known to a POSA, I have been told that the following principles may be considered:

- A combination of familiar elements according to known methods is likely to be obvious if it yields predictable results;
- The simple substitution of one known element for another is likely to be obvious if it yields predictable results;
- The use of a known technique to improve similar devices, products, or methods in the same way is likely to be obvious if it yields predictable results;
- The application of a known technique to a prior-art reference that is ready for improvement is likely obvious if it yields predictable results;
- Any need or problem known in the field and addressed by the reference can provide a reason for combining the elements in the manner claimed;
- A skilled artisan often will be able to fit the teachings of multiple references together like a puzzle; and
- The proper analysis of obviousness requires a determination of whether a POSA would have a “reasonable expectation of success”—

not “absolute predictability” of success—in achieving the claimed invention by combining prior-art references.

35. I understand that whether a prior-art reference renders a claim unpatentable as obvious is determined from the perspective of a POSA. I have also been told that, while there is no requirement for the prior art to contain an express suggestion to combine known elements to achieve the claimed invention, a suggestion to combine known elements to achieve the claimed invention may come from the prior art as a whole or individually, as filtered through the knowledge of one skilled in the art. In addition, I have been told the inferences and creative steps a POSA would employ are also relevant to the determination of obviousness.

36. I also understand that when a work is available in one field, design alternatives and other market forces can prompt variations of it, either in the same field or in another. I have also been told that if a POSA can implement a predictable variation and would see the benefit of doing so, that variation is likely to be obvious. I have been told that in many fields, there may be little discussion of obvious combinations, and in these fields market demand—not scientific literature—may drive design trends. I have been told that, when there is a design need or market pressure and there are a finite number of predictable solutions, a POSA has good reason to pursue those known options.

37. I have been told there is no rigid rule prescribing that a reference or combination of references must contain a “teaching, suggestion, or motivation” to combine references. But I also have been told that the “teaching, suggestion, or motivation” test can be a useful guide in establishing a rationale for combining elements of the prior art. I have been told this test poses the question as to whether there is an express or implied teaching, suggestion, or motivation to combine prior art elements in a way that realizes the claimed invention, and that it seeks to counter impermissible hindsight analysis.

VI. THE '097 PATENT

A. Alleged Problem in the Prior Art

38. The '097 patent is directed to “a method for the treatment of used batteries, in particular used lithium batteries, such as lithium ion batteries, with the steps (a) comminuting the batteries such that comminuted material is obtained, (b) inactivating of the comminuted material such that an inactive comminuted material is obtained, and (c) filling a transport container with the inactive comminuted material.” EX1001, 1:8-15.

39. Further, the '097 patent states that “the invention refers to a battery processing installation for the treatment of used batteries, in particular for the treatment of used lithium batteries with (a) a comminuting device for comminuting the batteries such that comminuted material is obtained, (b) an inactivation device

for inactivating the comminuted material and (c) a filling device for filling a transport container with the inactivated comminuted material.” EX1001, 1:16-23.

40. The '097 patent contends that previous methods of treating used batteries have the disadvantages of “the remaining components of the batteries may be contaminated with degradation products of the plastic.” EX1001, 1:30-32.

41. According to the '097 patent, another disadvantage of the previous methods is that “the resulting material still poses a comparatively high hazard potential and that the dusting powder [used to prevent electrochemically active material from spontaneously combusting] itself poses a risk of explosion and that the formation of a flammable and explosive atmosphere in the transport container cannot be ruled out.” EX1001, 1:237-42.

42. The '097 patent further contends that the operation, construction, and installation of the previous systems for processing used batteries are “comparatively complex.” EX1001, 1:49-50.

B. Overview of the '097 Patent

43. To solve these alleged deficiencies in treating batteries, the '097 patent discloses comminuting the battery material and then inactivating the comminuted material by removing at least one solvent. The inactivation of the comminuted material is performed by subjecting the comminuted material to a drying process (preferably a vacuum drying process). *Id.*, 1:54-67; 2:1-4.

44. According to the '097 patent, the “advantage of the invention is that . . . an electrochemical reaction is no longer possible, or only to a negligibly small extent . . . no flammable or explosive gas phase forms above the battery fragments, as the organic carbonates of the electrolyte have been removed” from the fragments. *Id.*, 1:54-67; 2:1-22.

45. Figure 1 provides a “flow diagram of a method according to the invention.” *Id.*, 7:46-47. I have provided annotations to identify several of the parts that are discussed in the claims.

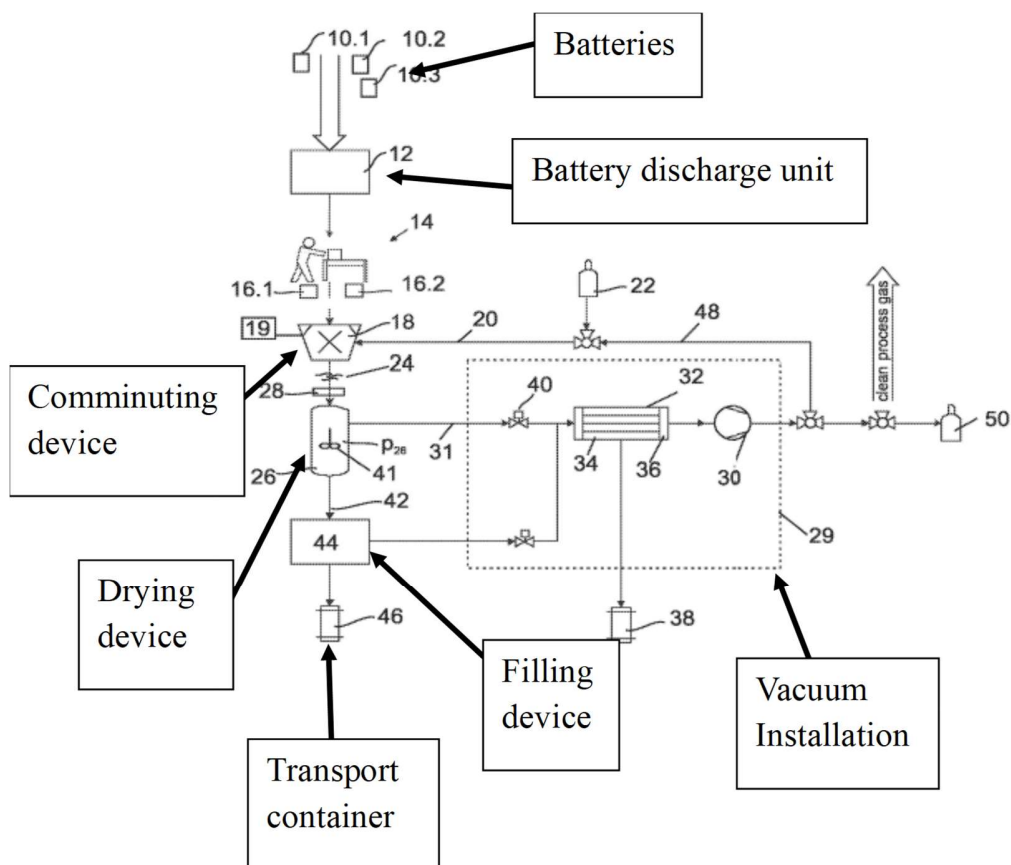


Fig. 1

EX1001, FIG.1

46. “FIG. 1 shows a flow diagram of a method according to the invention. Batteries **10.1, 10.2, . . .**, in particular battery systems made up of several battery modules or battery stacks, which are in turn made up of several battery cells, are initially discharged in a discharge unit **12**. This is followed by the dismantling of the batteries **10** at a dismantling station **14**, if this is necessary because the battery systems cannot otherwise be delivered into the comminution unit for geometric or gravimetric reasons.” EX1001, 7:56-64.

47. “The resulting sub-units (modules/stacks) and/or cells 16.1, 16.2, . . . are fed into a comminution unit **18**, which comprises, for example, a rotary shear with a rotor and a stator or several rotors, or a cutting mill with a rotor and several rotors.” *Id.*, 7:67 and 8:1-5. “The comminution unit **18** comminutes the batteries **10** under shielding gas **20**.” *Id.*, 8:6-7. “Comminuted material **24** is produced during the comminuting; the material is fed into an inactivation device in the form of a drying device **26**. *Id.*, 8:13-15.

48. “The drying device **26** is connected to a vacuum installation **29** that comprises a vacuum pump **30** and creates a vacuum.” *Id.*, 8:19-21. “The drying of the comminuted material results in inactivated comminuted material **42**, which is fed into a filling device **44**. A transport container **46** is then filled with the inactivated comminuted material **42** under vacuum and/or shielding gas.” *Id.*, 8:54-58.

C. Prosecution History

49. The '097 Patent was rejected twice before being allowed. In the first Office Action, the Examiner rejected claims 1, 3, 5, 7, 12-13, and 16-17 (versions of which issued as claims 1, 3-4, 8, 12, and 15-16) under 35 U.S.C. § 103 as being obvious over the combination of US 8,210,456 (EX1009 “Stevens”) and DE 4424825 (EX1010 “Kellerman”); rejected claims 2, 6, and 8 (versions of which issued as claims 2, 7, and 13) under 35 U.S.C. § 103 as being obvious over the combination of Stevens, Kellerman, and US 2003/0186110 (EX1011 “Sloop I”); rejected claim 9 (a version of which issued as claim 14) under 35 U.S.C. § 103 as being obvious over the combination of Stevens, Kellerman, and US 5,632,863 (EX1012 “Meador”); rejected claims 14 and 18 (versions of which issued as claims 5 and 17) under 35 U.S.C. § 103 as being obvious over the combination of Stevens, Kellerman, and WO 2013/023640 (EX1013 “Hanisch”); and rejected claims 15 and 20 (versions of which issued as claims 18 and 20) under 35 U.S.C. § 103 as being obvious over the combination of Stevens, Kellerman, and US 2016/0043450 (EX1014 “Sloop II”). EX1002, pp. 185-192.

50. In addition, the Examiner interpreted and provided definitions for certain terms:

- Inactivation device – vacuum circulation system,
- Filling device – platform of frame (Fig. 2),

- Drying device – vacuum circulation system,
- Hard metal detachment device – magnet or other separator,
- Light fraction detachment device – zigzag separator or air separator,
- Separation device – air jet sieving device or comminuting device,
- Second filling device – platform or frame (Fig. 2).

EX1002, p. 183.

51. The Examiner also asserted that the specification does not support “the active material fraction and the carrier fraction are respectively aluminum and copper foils,” as recited in claim 13. EX1002, 184-185.

52. In the first Response, the Applicant amended independent claim 1 (issued claim 1) to recite “wherein the drying occurs at a maximum pressure of 300 hPa.” EX1002, p. 161.

53. Independent claim 7 (a version of which issued as claim 12) was amended as follows to try to avoid the “means-plus-function” interpretation and to overcome Stevens and Kellerman.

(a) a comminution unit configured to comminute ~~for comminuting~~ the batteries such that comminuted material is obtained;₂

(b) an inactivation device comprising a drying device configured to inactivate ~~for inactivating~~ the comminuted material; and

(c) a filling device ~~for filling~~ 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 inactivation device comprises a drying device, and
the battery processing installation has a vacuum installation that is connected
to the drying device for generating a vacuum in the drying device.~~

EX1002, p. 162

54. In addition, claim 21 (a version of which issued as claim 9) was added. EX1002, p. 165. The remaining amendments were made to correct informalities or to seek to avoid a “means-plus-function” interpretation. EX1002, pp. 153-155, 162-163.

55. In the Remarks section of the first response, the Applicant provided definitions for the following terms:

- Inactivation device – drying device
- Drying device – dryer not limited to vacuum circulation system and can be vacuum dryer, contact dryer, convection dryer, infrared dryer.

56. The Applicant also disputed the interpretation of “filling device”, “separation device”, and “second filling device”. The Applicant did not address

“hard metal detachment device” or “light fraction detachment device”. EX1002, p. 154.

57. In addition, the Applicant argued that the rotary kiln of Stevens cannot form a vacuum, let alone a pressure below 300 hPa, because the rotary kiln of Stevens does not have an airlock. EX1002, p. 156. The Applicant further argued that Kellerman fails to remedy the deficiency of Stevens because Kellerman “voices low concern for gases and vapors from the recycled batteries” and because Kellerman employs inactivation by freezing instead of by drying. EX1002, p. 156.

58. In the second Office Action, the Examiner replaced Sloop I with CN 102496752 (EX1015, “Zhang”) and maintained the obviousness rejections of the previously rejected claims. Zhang was included to teach a drying process that occurs at a maximum pressure of 300 hPa. EX1002, p. 114.

59. The Examiner also agreed with the Applicant’s interpretation of “inactivation device”, “filling device”, “drying device”, “separation device”, and “second filling device”. The Examiner maintained the previous interpretation for the terms “hard metal detachment device” and “light fraction detachment device”.

60. In the second Response, the Applicant amended independent claims 1 and 7 to specify that inactivation occurs prior to or during the comminuting step. The Applicant argued that Zhang does not remedy the deficiency of Stevens and Kellerman because Zhang’s process is applied to a liquid solution and not solids.

The Applicant further stated, “The claim language expressly requires ‘**material**’ which is ‘**comminuted**’. The inactivation/drying is applied to **material**, more specifically ‘**comminuted material**.’ These words are consequential not least because they require solid pieces of battery to be involved in the claimed process.

Zhang does not apply heating inactivation to solid materials; Zhang's inactivation/drying process is applied to a *liquid* solution, not solids.” EX1002, pp. 89-90 (emphases in original).

61. In making this argument, the Applicant did not dispute that a drying process with a maximum pressure of 300 hPa was known at the time of the invention (e.g., from at least Zhang). Furthermore, the Applicant argued that the “timing limitation” added to claims 1 and 7 was logical and must occur when inactivating comminuted material: “**Logically**, to inactivate comminuted material, **you must comminute** either before or during the inactivation, but **in no event can you wait to comminute** until after the inactivation.” EX1002, p. 90 (emphases added). The Examiner nonetheless issued a notice of allowance following the Second Response.

D. Level of Ordinary Skill

62. A person of ordinary skill in the art (“POSA”) at the time of the '097 patent’s “invention” would have had a B.S. degree in electrical engineering, materials science, chemical engineering, or an equivalent field, as well as at least 2

to 3 years of academic or industry in the recycling or processing of lithium-ion batteries.

63. I am well qualified to determine the level of ordinary skill in the art and to provide opinions from the perspective of a POSA. As I explain in Section III and further show in my CV, as of April 28, 2015, I had acquired extensive experience related to recycling and drying technologies. Thus, as of this date, I had more than ordinary skill in the art. Throughout my career and the projects that I have been involved in, I have worked with many people having the qualifications of a POSA identified above.

E. Claim Construction

64. I understand that in an IPR, the words of a claim ‘are generally given their ordinary and customary meaning and that patentee can be his own lexicographer if the specification provides a special definition given to a claim term by the patentee that differs from the meaning it would otherwise possess. In addition, the comments made by the patentee during prosecution regarding the definitions of claim terms can also provide guidance when determining the meaning of claim terms.

65. As explained in greater detail below, it is my opinion that challenged claims 1-3, 7-9, 12, 13, and 15-19 are unpatentable, with the understanding that most of the claim terms are to be given their ordinary and customary meaning. I do

note, however, that there are a few instances where special definitions apply to the terms used in the claims.

66. As discussed in section VI(C), the Applicant and the Examiner provided definitions during prosecution. For example, the Applicant provided definitions for the following terms:

- Inactivation device – drying device
- Drying device – dryer not limited to vacuum circulation system and can be vacuum dryer, contact dryer, convection dryer, infrared dryer. EX1002, p. 154.

67. Based on these definitions, the inactivation and drying devices are to be understood to cover a large amount of machinery.

68. Moreover, the specification of the '097 patent provides lexicographic definitions for many different terms. At least the following lexicographic definitions apply:

Drying: “Within the scope of the present description, the term 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 methyl carbonate is removed.”

Battery: “The battery should be understood especially to mean a lithium battery. A lithium battery is a rechargeable battery whose electrochemical reaction involves lithium and/or lithium ions and/or a lithium compound.”

Battery Processing Installation: “A battery processing installation should also be understood particularly to mean a rechargeable battery processing installation for processing rechargeable batteries.”

Transport Container: “The transport container should also be understood particularly to mean transport packaging. The transport packaging is preferably sealed by way of a vacuum seal.

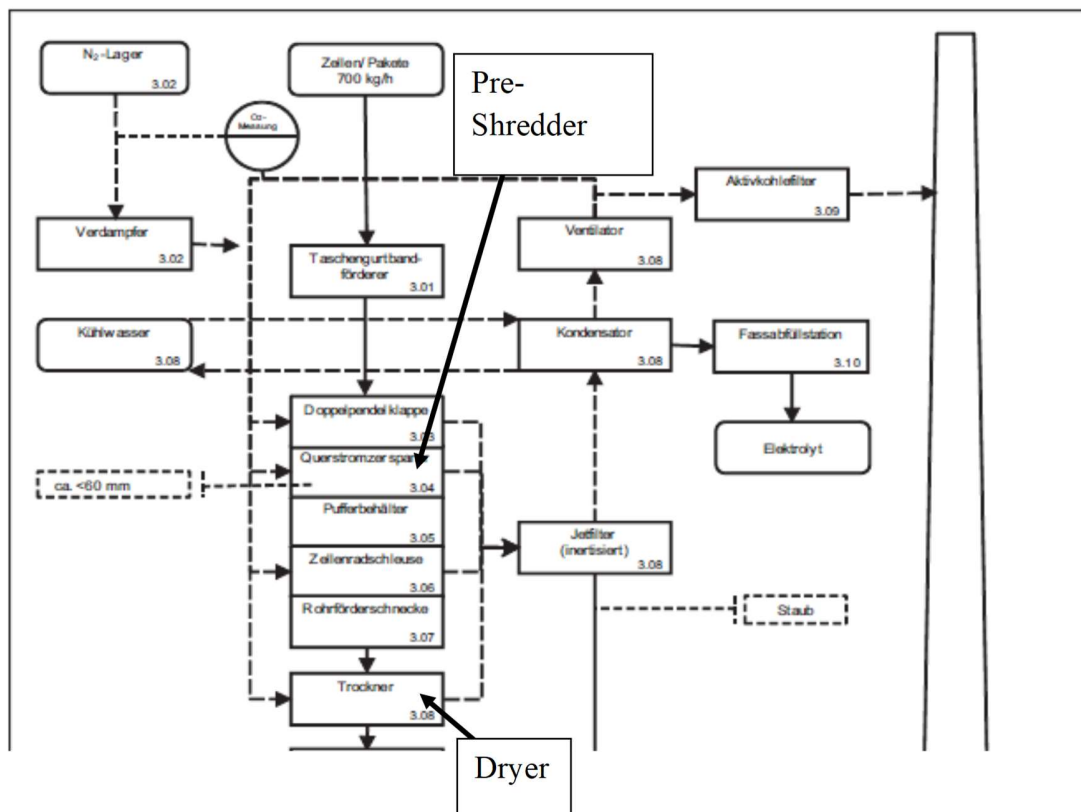
EX1001, 2:23-39.

VII. OVERVIEW OF THE PRIOR ART

A. Overview of LithoRec

69. “LithoRec Recycling of Lithium-Ion Batteries” (EX1004 and EX1016– “LithoRec”) is a LithoRec is a research paper published by Cuvillier Verlag investigating methods and systems for recycling lithium-ion batteries. EX1004, p. 5. LithoRec is prior art because it was publicly available and accessible by April 28, 2015 or earlier. Ex1005, ¶¶51-56.

70. The process begins when battery material is conveyed to a pre-shredder 3.01 where the battery material is comminuted. Once comminuted by the pre-shredder 3.01, the battery material is conveyed to a dryer 3.08. EX1016, p. 227 and Fig. G-1 (see partial figure G-1 below).



71. LithoRec discloses that the pre-shredder 3.01 can be a rotor shredder or a cross-shredder. LithoRec further discloses that the dryer 3.08 is operated to evaporate volatile electrolytes in the comminuted battery material that is susceptible to combustion and/or explosion. In addition, the dryer 3.08 is operated

under vacuum to lower the drying temperature and reduce the likelihood of the volatile electrolytes from combusting or exploding during the drying process.

EX1016, p.226.

72. After the comminuted battery material has been dried by the dryer 3.08, it is passed through an overbelt magnetic separator 3.13 to remove magnetizable metal components from the rest of the comminuted battery material, which is conveyed to a cross-flow separator 3.14 where the remaining heavy parts (housing parts, bridges, nuts, bolts, and the like) are separated from the light fraction, which largely consists of foils (copper, aluminum, plastic) and the active mass to be recovered as a powder. EX1016, p. 227.

73. The light fraction material and the active mass are further comminuted in a granulator 3.16, which removes the active mass as completely as possible from the metal foils without comminuting the foils too finely. The active mass is then fed to a drum filler with a palletizing device 3.20 and packaged. EX1016, p. 225 and Fig. G-1 (see partial figure G-1 below).

75. Din teaches the conditions that define a vacuum according to the international standard ISO 3529-1: 1981 that was issued by the International Organization for Standardization (ISO). One of the conditions that meets the international standard ISO 3529-1: 1981 for a vacuum is that the pressure is between 0 and 300 millibars (i.e., between 0 and 300 hPa). EX1007, 1.1.

C. Overview of Perry

76. Perry is an engineering reference manual published by McGraw-Hill. EX1006. Perry is prior art because it was publicly available and accessible by April 28, 2015 or earlier. EX1005, ¶¶ 44-50.

77. Perry includes a section on vacuum dryers and teaches a specific range of pressures at which commercial vacuum dryers operate. In addition, Perry teaches an operating pressure range for an exemplary type of vacuum dryer. “Shelf vacuum dryers operate in the range of 1 to 25 mmHg pressure” (1.33 to 33.33 hPa). EX1006, p. 12-45, col.1, 1st paragraph. Thus, Perry provides a concrete example of a vacuum dryer operating within the range of claim 1 (for example).

D. Overview of Hanisch

78. WO 2013/023640 (EX1013 - “Hanisch”) is directed to a “method for reclaiming active material from a galvanic cell, and an active material separation installation, particularly an active metal separation installation.” EX1013, Title. Hanisch describes an invention that concerns a method for retrieving active

material by crushing battery cell fragments, heating the cell fragments, classifying the heat treated cell fragments whereby the classifying relies on jet sieving that is carried out in such a way that the active material is separated from the support. EX1013, Abstract.

E. The Prior Art Is Analogous Art

79. LithoRec and Hanisch are in the same field of endeavor as the '097 patent and would have also been reasonably pertinent to problems faced by the inventor of the '097 patent. As described above, the '097 patent and LithoRec and Hanisch are all in the same field of endeavor, dealing with the recycling of batteries. In addition, as was also described above, the '097 patent and LithoRec and Hanisch are concerned with removing volatile materials from battery material.

80. Although Din and Perry are not in the field of battery recycling, they are pertinent to the particular problem faced by the inventors – creating a vacuum to lower the drying temperature of a dryer to avoid the combustion or explosion of the volatile materials during the drying process. Din is concerned with what constitutes a vacuum, while Perry is concerned with vacuum drying. Accordingly, it is my opinion that LithoRec, Din, Perry, and Hanisch are analogous prior art.

VIII. GROUND 1: CLAIMS 1-3, 7, 8, AND 10 ARE OBVIOUS OVER LITHOREC IN VIEW OF DIN AND PERRY

81. It is my opinion that the combination of LithoRec, Din, and Perry teaches, suggests, or renders obvious every limitation of claims 1-3, 7, 8, and 10,

that a POSA would have been motivated to combine these prior-art references, and that a POSA would have had a reasonable expectation of success in combining these prior-art references. Accordingly, in my opinion, claims 1-3, 7, 8, and 10 would have been obvious to a POSA in view of the LithoRec, Din, and Perry combination.

A. Independent Claim 1

82. As demonstrated below, it is my opinion that the LithoRec, DIN, and Perry combination renders claim 1 obvious. I reproduce claim 1 below and assign the elements of claim 1 labels, such as [1-pre], [1A], [1B], *etc.*

Element	Claim Language
[1-PRE]	1. A method for the treatment of used batteries, comprising the steps:
[1A]	(a) comminuting the batteries such that comminuted material is obtained;
[1B]	(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
[1C]	(c) filling a transport container with the inactivated comminuted material;
[1D]	wherein the inactivating step is performed by drying the comminuted material, and

[1E]	wherein the drying occurs at a maximum pressure of 300 hPa.
------	---

1. [1-PRE] “A method for the treatment of used batteries, comprising the steps:”

83. LithoRec discloses a method for the treatment of used batteries.

LithoRec specifically processes Li-ion batteries. For example, LithoRec discloses, “In the ‘LithoRec – Recycling of lithium-ion batteries’ project, several processes for recycling traction batteries were evaluated...A conclusive concept was developed for separating the battery systems down to the level of the cathodic active material powder used.” EX1016, p. 1: 1-13.

84. LithoRec further discloses “a possible recycling pilot plant was conceptualized...In order to be able to design the overall system, the following framework conditions had to be defined for the design of the system...Battery types to be processed are Li-ion accumulators in the form of traction batteries, hybrid batteries and plug-in batteries.” EX1016, p. 222: 25-33 and Fig. G-1.

85. In my opinion, the repeated discussions of recycling batteries clearly discloses the claimed treatment of used batteries.

2. [1-A] “(a) comminuting the batteries such that comminuted material is obtained;”

86. LithoRec discloses comminuting the batteries to obtain comminuted material. In particular, LithoRec discloses the “dismantling of the battery system

follows the primary goal of freeing the cells for further processing. Other recyclable materials, such as copper cables and circuit boards, are also collected as separate fractions for further recycling. This is followed by mechanical comminution and separation of the cell and preparation of the active material.”

EX1016, p. 223: 6-9. In addition, “The pre-shredding should cause the cell housings...to break open and ideally already lead to an extensive separation of the active mass from the arrester foils.” EX1016, p. 226: 12-13. “Active mass” and/or “active material” therefore is comminuted material according to LithoRec.

Moreover, in my view, one skilled in the art would understand “active mass” and/or “active material” to be comminuted material in this context.

87. In my opinion, a POSA would have understood that the dismantling of the batteries and the “pre-shredding” taught by LithoRec falls within the scope of “comminuting the batteries,” as recited in claim 1 of the '097 patent. LithoRec uses the term “comminution” to describe the “pre-shredding” process. This terminology also is consistent with how those skilled in the art describe comminuting processes. Indeed, at BHS, we oftentimes talk about comminution in terms of pre-shredding and shredding. I do not see anything in the '097 patent that sets forth a specific structure of the comminuted material. Therefore, the '097 patent fails to describe the comminuted material in any way that would exclude the “comminuted” material processed by the “pre-shredder” of LithoRec.

3. **[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”**

88. LithoRec discloses drying an active mass that has been comminuted to evaporate electrolytes from the comminuted active mass. In particular, LithoRec discloses, “The electrolytes need to be evaporated for the subsequent dry treatment process, which are primarily aimed at extracting the active mass. On the one hand, this step eliminates the potential hazard of flammable solvents and, on the other hand, converts the active mass into the dry powder form required for dry processing.” EX1016, p. 226: 30-33. The '097 patent repeatedly refers to using a drying process to remove dimethyl carbonate. EX1001, col. 2:25-27; col. 3:4-12; col. 4:37-40 & 61-63; col. 6:43-49. LithoRec discloses that dimethyl carbonate is an electrolyte found in the batteries that are to be processed, and that is consistent with my experience with comminuting Li-ion batteries. EX1016, p. 100: 1-7. A POSA thus would understand that LithoRec teaches drying the active mass to remove dimethyl carbonate, which inactivates the active mass that has already been comminuted (e.g., in this case pre-shredded).

89. A POSA would understand that the electrolyte evaporating process of LithoRec teaches “inactivating the comminuted material such that an inactivated comminuted material is obtained,” as recited in claim 1 based on the disclosure of the '097 patent.

90. The '097 patent discloses that the “inactivation device” is “in the form of a drying device 26.” EX1001, 8: 14-15. In addition, “the drying of the comminuted material results in inactivated comminuted material 42.” EX1001, 8: 54-55. The '097 patent further discloses that “[w]ithin the scope of the present description, the term 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 methyl carbonate is removed.” EX1001, 2:23-27. Thus, a POSA would understand that according to the '097 patent, the comminuted material is considered inactivated when at least one solvent in a conducting salt (e.g., dimethyl carbonate and/or ethyl methyl carbonate) is removed by way of a drying process. LithoRec clearly does this.

91. In terms of the “timing requirement” of this limitation, the then-Applicant admitted that when inactivating comminuted material, “[l]ogically, . . . you must comminute either before or during the inactivation.” EX1002, p. 90. I agree that there is nothing new or inventive about this timing language in claim 1. Furthermore, LithoRec discloses evaporating the electrolyte from the active mass (inactivating the active mass) after performing the comminuting step. That is, LithoRec discloses “The electrolytes need to be evaporated for the subsequent dry treatment processes, which are primarily aimed at extracting the active mass” (emphasis added). EX1016, p. 226: 30-31. Thus, the drying in LithoRec is

performed after the comminuting, which is apparent because LithoRec refers to its drying as “subsequent dry treatment processes” on p. 226 following the pre-shredding comminuting on page 226. A POSA would read this subsequent language and understand the timing of the dry treatment process to match with the language in claim 1.

4. **[1C] “(c) filling a transport container with the inactivated comminuted material”**

92. The '097 Patent defines “transport container” as a “transport packaging.” EX1001, 2: 35-36. LithoRec discloses that after the active mass has been inactivated (the active mass has been dried and the electrolytes have been removed from the active mass), the active mass is recovered as powder and then fed to a drum filler with a palletizing device and packaged. LithoRec discloses “The pre-shredded and dried battery cells...are fed directly from the dryer onto a conveyor belt...The second sorting step is intended for the rough separation of heavy parts...The light fraction largely consists of foils...and the active mass to be recovered as powder...The sieve underflow, active mass in powder form, is fed by means of a suitable screw conveyor (3.19) to a drum filler with [a] palletizing device (3.20) and packaged.” EX1016, p. 227:44-45; p. 228: 6-8, 31-32; and Fig. G-1.

93. LithoRec thus fills a transport container (drum / pallet / package) with the inactivated comminuted material (active mass) for transport. A POSA would be

well aware that the inactivated comminuted material should be packaged and, for example, put into a transport container. It cannot be left alone; it must go somewhere. That is the point of battery recycling.

5. **[1D] “wherein the inactivating step is performed by drying the comminuted material, and”**

94. LithoRec teaches inactivating the active mass (comminuted material) via drying: “The electrolytes need to be evaporated for the subsequent dry treatment processes, which are primarily aimed at extracting the active mass, it is necessary to evaporate the electrolytes.” EX1016, p. 226: 30-31.

6. **[1E] “wherein the drying occurs at a maximum pressure of 300 hPa.”**

95. LithoRec discloses general conditions at which drying should occur, including keeping pressures low in order accommodate the evaporation of highly flammable solvents. LithoRec recognizes the potential for combustion or explosions, and it is for that reason it implements low pressures. “As some of the liquids to be vaporized are highly flammable solvents, the drying temperature should probably be severely restricted. This in turn speaks in favor of drying under vacuum, as the drying temperature can be kept low.” EX1016, p. 226: 36-38.

96. LithoRec does not explicitly teach a specific vacuum pressure to be used. Instead, LithoRec teaches that dryer manufacturers should determine optimum drying pressure to keep the temperature low to prevent explosions from

the highly flammable solvents. EX1016, p. 226: 36-38. This is similar to the reason provided by the '097 patent. In particular, the '097 patent discloses that the temperature within the dryer is kept low to avoid a potential chemical reaction with the solvents being evaporated that would be hazardous. EX1001, 3: 4-17. In addition, one of the solvents with which the '097 patent is concerned is dimethyl carbonate, which also is a concern in LithoRec. EX1001, 2: 23-27 and 3: 5-17; EX1016, p. 100: 1-7 and p. 226: 1-7.

97. Din 28400 teaches the conditions that define a vacuum according to the international standard ISO 3529-1: 1981, issued by the International Organization for Standardization (ISO). One of the conditions that meets the international standard ISO 3529-1: 1981 for a vacuum is that the pressure is between 0 and 300 millibars (i.e., between 0 and 300 hPa). EX1018, 1.1. This is the exact same range as is claimed. Accordingly, prior to the time the invention of the '097 patent was made, the claimed pressure range was well known for producing a vacuum. Indeed, it was part of the international standard. In my experience, a POSA would have been aware of relevant international standards including those set by the ISO. And relevant international standards would include pressure ranges. A POSA would have been well aware of this range, as it was a part of an international standard, and a POSA certainly would have been used by a POSA who already knew to implement a dryer with a vacuum from LithoRec.

98. In addition, Perry discusses vacuum dryers and discloses an operating pressure range for an example vacuum dryer. “Shelf vacuum dryers operate in the range of 1 to 25 mmHg pressure” (1.33 to 33.33 hPa). EX1006, p. 12-45, col.1, 1st paragraph. Thus, Perry provides a concrete example of a vacuum dryer operating within the claimed range.

99. From my experience, I can confirm that both Din and Perry are in line with how typical vacuum dryers operated at the time of the art. Given that one of the conditions that meets the international standard for the presence of a vacuum is the claimed pressure range, Perry provides a concrete example of a vacuum dryer operating within the claimed range, and LithoRec teaches using a vacuum dryer to keep the drying temperature low to prevent a combustion or explosion (which is similar to the reason provided by the '097 patent), a POSA would have been motivated to select a vacuum pressure for the dryer of LithoRec within the claimed range to operate the dryer at the optimum pressure to lower the drying temperature and prevent a combustion or explosion.

100. My understanding is that a claimed range that overlaps or falls within a range disclosed in the prior art is considered to be obviousness. Here, there is no evidence available to show criticality of the claimed range (i.e., there is no evidence the claimed range achieves an unexpected result relative to the prior art range). A POSA would not have found it inventive to discover optimum or

workable ranges by routine experimentation, particularly when Din and Perry already disclosed workable ranges either matching or within those that are claimed.

101. The '097 patent does not teach any unexpected results associated with the claimed pressure. It merely discloses “According to a preferred embodiment, the drying occurs under vacuum. The size of the vacuum is preferably selected such that the vapour pressure of dimethyl carbonate at 80° C., especially at 70° C., is not reached. It is beneficial if the drying occurs at a maximum pressure of 300 hPa.” EX1001, 3:4-8. In other words, the '097 Patent discloses that the “300 hPa” upper limit for the pressure in the vacuum chamber was chosen merely in connection with the vapour pressure of dimethyl carbonate at 80° C and could easily be found by looking up a chart or through routine experimentation. Indeed, the claimed range matches the relevant international standard, about which a POSA certainly would have known. There simply would not have been anything surprising or unexpected to a POSA about implementing this agreed-upon international standard. This subject matter would have been obvious to a POSA from LithoRec, especially when considering Din and Perry.

B. Claim 2

102. Claim 2 depends from claim 1 and recites “wherein the comminuted material is dried until an electrolyte content in the comminuted material is so low that an electrochemical reaction is impossible.”

103. LithoRec teaches “The electrolytes need to be evaporated for the subsequent dry treatment processes, which are primarily aimed at extracting the active mass. On the one hand, this step eliminates the potential hazard of flammable solvents and, on the other hand, converts the active mass into the dry powder form required for dry processing.” EX1016, p. 226: 30-33. LithoRec thus teaches “eliminating” the potential hazard of flammable solvents by evaporating electrolytes in the solvents. A POSA would understand that, as a result, the electrolyte content in the comminuted material is so low that an electrochemical reaction is impossible.

104. LithoRec further discloses “If it is assumed that all volatile, highly flammable solvents have been removed during the drying process, no explosion protection is required.” EX1016, p. 229: 21-22. In other words, LithoRec contemplates either removing all electrolytes or providing explosion protection. The former corresponds to a scenario in which all volatile, highly flammable solvents are removed, making the electrolyte content in the comminuted material so low that an electrochemical reaction is impossible, and thus obviating the need for explosion protection. In my view, a POSA reading LithoRec would understand (both from context and the entirety of LithoRec) that LithoRec is favoring the former option. A POSA would recognize the advantages that would flow from being able to avoid extensive explosion protection (including cost advantages,

space savings, design simplicity, etc.) and therefore would select known option that avoids it.

105. In my opinion, a POSA would understand that LithoRec teaches that the electrolyte content in the active mass (comminuted material) is so low that an electrochemical reaction (e.g., explosion) is impossible. A POSA would have used the drying process to ensure that the electrolyte content in the comminuted material is so low that an electrochemical reaction is impossible because that is exactly what LithoRec teaches, and why. In my view, a POSA would be motivated to do so because that implementation advantageously would mitigate the need for explosion protection, as taught by LithoRec.

C. Claim 3

106. Claim 3 depends from claim 1 and recites “wherein the drying occurs under vacuum.”

107. As discussed above for [1E], LithoRec teaches “As some of the liquids to be vaporized are highly flammable solvents, the drying temperature should probably be severely restricted. This in turn speaks in favor of drying under vacuum, as the drying temperature could be kept low.” EX1016, p. 226: 36-38. Thus, a POSA would understand that LithoRec teaches drying under vacuum.

D. Claim 7

108. Claim 7 depends from claim 1. The language of claim 7 requires only one of two listed conditions. However, as shown below, LithoRec teaches drying the comminuted material (active mass) under both conditions.

Claim Language
Option 1: No flammable or explosive gas mixture is formable above the comminuted material in the transport container
Option 2: the comminuted material is so dry that no flammable or explosive gas mixture is able to emerge in the transport container

1. No flammable or explosive gas mixture is formable above the comminuted material in the transport container

109. The '097 patent states “The property that the drying is completed if, after the completion of the drying process, no flammable or explosive gas mixture can form above the comminuted material that has been filled [in the container] should be understood particularly to mean that, within the space of one 60 week at 50° C. and 1013 hPa, no flammable gas mixture forms in a transport container in the form of a 50 litre container that has been half-filled (relative to its volume) with the comminuted material.” EX1001, 3:56-64.

110. LithoRec teaches drying a comminuted material (active mass) to evaporate flammable or explosive gas and to remove the potential hazard of flammable solvents. In particular, LithoRec discloses “The electrolytes need to be

evaporated for the subsequent dry treatment processes, which are primarily aimed at extracting the active mass. On the one hand, this step eliminates the potential hazard of flammable solvents and, on the other hand, converts the active mass into the dry powder form required for dry processing.” EX1016, p. 226: 30-33.

111. If the parameters disclosed by the '097 patent for “completed drying” are deemed to have a limiting effect on claim 7, LithoRec also discloses that the volatile and flammable solvents are completely evaporated once the drying process is complete, as LithoRec discloses “If it is assumed that all volatile, highly flammable solvents have been removed during the drying process, no explosion protection is required for the dedusting of the sorting plant from the dryer discharge. EX1016, p. 229: 21-22. In my view, a POSA would understand that LithoRec is teaching complete evaporation and, thus, is teaching completely avoiding formation of a flammable or explosive gas mixture.

112. LithoRec further teaches that after the drying process has been completed, the active mass is sorted and then directed to a transport container. In particular, LithoRec discloses “The pre-shredded and dried battery cells...are fed directly from the dryer onto a conveyor belt...The second sorting step is intended for the rough separation of heavy parts...The light fraction largely consists of foils...and the active mass to be recovered as powder...The sieve underflow, active mass in powder form, is fed by means of a suitable screw conveyor (3.19) to a

drum filler with [a] palletizing device (3.20) and packaged.” EX1016, p. 227:44-45; p. 228: 6-8, 31-32; and Fig. G-1.

113. Since LithoRec teaches that all of the flammable or explosive gas has been evaporated in the drying step, a POSA in my opinion would understand that there is no flammable or explosive gas mixture that is formable above the active mass when the active mass is delivered to the transport container. In my opinion, if all volatile, highly flammable solvents are removed, a POSA would understand that all of the conditions discussed in col. 3, lines 56-64 of the '097 patent are met.

2. the comminuted material is so dry that no flammable or explosive gas mixture is able to emerge in the transport container

114. LithoRec teaches drying a comminuted material (active mass) to evaporate flammable or explosive gas. LithoRec discloses “The electrolytes need to be evaporated for the subsequent dry treatment processes, which are primarily aimed at extracting the active mass. On the one hand, this step eliminates the potential hazard of flammable solvents and, on the other hand, converts the active mass into the dry powder form required for dry processing.” EX1016, p. 226: 30-33.

115. In addition, LithoRec discloses that the volatile and flammable solvents are completely evaporated, when LithoRec discloses “If it is assumed that all volatile, highly flammable solvents have been removed during the drying

process, no explosion protection is required for the dedusting of the sorting plant from the dryer discharge.” EX1016, p. 229: 21-22.

116. Also, the active mass of LithoRec is completely devoid of flammable or explosive gas by the time it is conveyed to the transport container. In particular, LithoRec teaches “The pre-shredded and dried battery cells...are fed directly from the dryer onto a conveyor belt...The second sorting step is intended for the rough separation of heavy parts...The light fraction largely consists of foils...and the active mass to be recovered as powder...The sieve underflow, active mass in powder form, is fed by means of a suitable screw conveyor (3.19) to a drum filler with [a] palletizing device (3.20) and packaged.” EX1016, p. 227:44-45; p. 228: 6-8, 31-32; and Fig. G-1.

117. Since all of the flammable or explosive gas has been evaporated in the drying step, a POSA would understand that there is no flammable or explosive gas mixture in the packaging (transport container) that could conceivably emerge. The active mass (comminuted material) is in an inactivated powder form at this point. In my view, a POSA would understand that the comminuted material is so dry that no flammable or explosive gas mixture is able to emerge in the transport container.

E. Claim 8

118. Claim 8 depends from claim 1 and recites “wherein the batteries are lithium batteries.”

119. The '097 patent describes Li-ion batteries as being lithium batteries. EX1001, 2:28-31. As discussed above with respect to [1-PRE], LithoRec discloses, "In the 'LithoRec – Recycling of lithium-ion batteries' project, several processes for recycling traction batteries were evaluated...A conclusive concept was developed for separating the battery systems down to the level of the cathodic active material powder used." EX1016, p. 1: 1-13. LithoRec also discloses "Battery types to be processed are Li-ion accumulators in the form of traction batteries, hybrid batteries and plug-in batteries." EX1016, p. 230: 11-12. In my view, a POSA would understand that a Li-ion battery is a lithium battery. In my experience, this is consistent with the terminology used in the art. Therefore, LithoRec discloses that the batteries are lithium batteries as claimed.

F. Claim 10

120. Claim 10 depends from claim 1 and recites "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."

121. I have worked in this industry, and we routinely sealed off the containers to prevent spillage or contamination. In my opinion, a POSA would have either interpreted LithoRec as sealing off the transport containers to prevent spillage and/or contamination or would have thought it to be obvious that the transport containers of LithoRec are sealed off to prevent spillage and/or

contamination. Such a seal would also be dust-tight to prevent contamination due to dust infiltration from or into the transport container.

IX. GROUND 2: CLAIM 9 IS OBVIOUS OVER LITHOREC IN VIEW OF DIN AND PERRY, AND FURTHER IN VIEW OF HANISCH

122. Claim 9 recites “wherein drying occurs at a temperature of less than 80° C.”

A. The Hanisch Reference

123. Hanisch was used in combination with Stevens and Kellerman to reject claims 14 and 18 during the prosecution of the ‘097 patent. Hanisch was relied upon as teaching “a separation device for an active material and a carrier wherein the separation device is an air jet sieving device (Air jet sieve: Fig. 1, #50) in order to separate materials with a high degree of purity” as was recited in application claims 14 and 18 (versions of which issued as claims 5 and 17 in the ‘097 patent). EX1002, pp. 92, 113-114, 158, and 191.

124. The Applicant did not address the Examiner’s characterization of Hanisch, instead arguing that Hanisch teaches heating to an extremely high temperature that is 350 to 800°C. EX1002, pp. 92 and 158. The fragmented material of Hanisch is heated at 350 to 800°C to decompose a binder in the battery fragments and allow the active material to be separated from the binder. EX1020, p. 5: 27-28. The air jet sieve is used for an additional separation step. EX1020, p. 3: 18-23. Accordingly, the focus seemingly was on only narrow aspects of the “separation” disclosed in Hanisch.

125. A POSA reading Hanisch would understand that it discloses drying the battery fragments prior to heating the battery fragments to the decomposition temperature (350 to 800°C). The drying step is intended to retrieve electrolytes from the battery fragments prior to exposing the battery fragments to the high temperature range of 350 to 800°C. In addition, the battery fragments are dried at a temperature below 80°C. EX1020, p. 5: 10-15. A POSA would find these teachings relevant, notwithstanding any alleged inapplicability with the high temperatures used in decomposing the binder in a different step.

126. The '097 patent teaches that the “below 80°C” feature is intended to evaporate volatile electrolytes. EX1001, 3: 4-40. Accordingly, a POSA would understand the portion of Hanisch disclosing the “below 80°C” temperature range to be relevant to the patentability of the '097 patent. However, this aspect of Hanisch was not considered during the original prosecution leading to the '097 patent. Therefore, even though Hanisch was applied against the '097 patent during prosecution, Hanisch is being relied upon here with respect to its “drying” aspect—and in combination with LithoRec, Din, and Perry.

B. Claim 9 Would Have Been Obvious to a POSA

127. Claim 9 depends from claim 1 and recites “wherein drying occurs at a temperature of less than 80° C.”

128. LithoRec discloses general conditions at which drying should occur,

including keeping temperatures low to account for the evaporation of highly flammable solvents. LithoRec uses low temperatures because it recognizes the potential for explosions. “As some of the liquids to be vaporized are highly flammable solvents, the drying temperature should probably be severely restricted. This in turn speaks in favor of drying under vacuum, as the drying temperature could be kept low.” EX1016, p. 226: 36-38. However, LithoRec does not describe any specific temperature or temperature range at which drying should occur.

129. Hanisch discloses “The method preferably comprises the step whereby, before the cell fragments are heated to the decomposition temperature, the cell fragments are dried at a drying temperature, in such a way that dry cell fragments and drying vapours arise, at least part of the drying vapours being condensed. This has the advantage that the electrolyte solvent can be reclaimed. In this context, it is advantageous for the drying temperature to be below 100 °C, in particular below 80 °C.” EX1020, p. 5: 10-15. Hanisch also discloses “The pre-dryer 28 comprises a circulation pump 32 and a capacitor 34 for condensing electrolyte.” EX1020, p. 8: 8-9.

130. Perry discloses “Vacuum is used in conjunction with drying or other chemical operations when low solids temperatures must be maintained because heat will cause damage to the product or change its nature, when air combines with the product as it is heated, causing oxidation or an explosive condition, when

solvent recovery is required, and when materials must be dried to extremely low moisture levels.” EX1006, p. 20-65: 6th paragraph to p.20-66: 1st paragraph.

131. Given the guidance provided by LithoRec, Perry, and Hanisch, regarding the drying temperature for combustible or explosive materials such as electrolytes, a POSA would have selected a low temperature for drying an electrolyte of a processed lithium ion battery typically and, more particularly, a POSA would have used a temperature no higher than 80° C as specifically taught by Hanisch. A POSA would have done so because the references all teach using low temperatures to avoid combustion and explosion for electrolytes including those specifically mentioned in the '097 patent.

X. GROUND 3: CLAIMS 12, 13, 15, 16, 18, AND 19 ARE ANTICIPATED BY LITHOREC

A. Independent Claim 12

132. As demonstrated below, it is my opinion that LithoRec anticipates each and every element recited in claim 12. I reproduce claim 12 below and assign the elements of claim 12 labels, such as [12-pre], [12A], [12B], *etc.*

Element	Claim Language
[12-PRE]	12. A battery processing installation for treatment of used batteries, comprising:
[12A]	(a) a comminution unit configured to comminute the batteries such that

	comminuted material is obtained;
[12B]	(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;
[12C]	(c) a filling device configured to fill a transport container with the inactivated comminuted material; and
[12D]	(d) a vacuum installation connected to the drying device and configured to generate a vacuum in the drying device.

1. [12-PRE] “A battery processing installation for treatment of used batteries, comprising:”

133. LithoRec discloses a battery processing plant for the treatment of used batteries. LithoRec specifically processes Li-ion batteries. For example, LithoRec discloses “a possible recycling pilot plant was conceptualized...Battery types to be process are Li-ion accumulators in the form of traction batteries, hybrid batteries and plug-in batteries...A conclusive concept was developed for separating the battery systems down to the level of the cathodic active material powder used” EX1016, p. 1: 1-13.

134. LithoRec further discloses “a possible recycling pilot plant was conceptualized...In order to be able to design the overall system, the following

framework conditions had to be defined for the design of the system...Battery types to be processed are Li-ion accumulators in the form of traction batteries, hybrid batteries and plug-in batteries.” EX1016, p.222: 25-33 and Fig. G-1.

135. The repeated discussions of recycling batteries clearly discloses the claimed processing installation for the treatment of used batteries.

2. **[12-A] “(a) a comminution unit configured to comminute the batteries such that comminuted material is obtained;”**

136. LithoRec discloses comminuting the batteries to obtain comminuted material. In particular, LithoRec discloses the “dismantling of the battery system follows the primary goal of freeing the cells for further processing. Other recyclable materials, such as copper cables and circuit boards, are also collected as separate fractions for further recycling. This is followed by mechanical comminution and separation of the cell and preparation of the active material.” EX1016, p. 223: 6-9. In addition, “The pre-shredding should cause the cell housings...to break open and ideally already lead to an extensive separation of the active mass from the arrester foils.” EX1016, p. 226: 12-13. “Active mass” and/or “active material” therefore is comminuted material according to LithoRec. Moreover, in my view, one skilled in the art would understand “active mass” and/or “active material” to be comminuted material in this context.

137. In my opinion, a POSA would have understood that the dismantling of the batteries and the “pre-shredding” taught by LithoRec falls within the scope of

“comminute the batteries,” as recited in claim 12 of the '097 patent. In particular, LithoRec uses the term “comminution” to describe the “pre-shredding” process. This terminology also is consistent with how those skilled in the art describe comminuting processes. Indeed, at BHS, we oftentimes talk about comminution in terms of pre-shredding and shredding. I do not see anything in the '097 patent that sets forth a specific structure of the comminuted material. Therefore, the '097 patent fails to describe the comminuted material in any way that would exclude the “comminuted” material processed by the “pre-shredder” of LithoRec.

138. In addition, LithoRec identifies rotor shredders and cross-flow shredders as candidates for comminuting batteries to produce a comminuted “active mass”. LithoRec discloses in the “Machine selection Pre-shredding” section, “In principle, various types of shredding machines that have become established in the field of shredding metallic secondary raw materials can be used for pre-shredding....The pre-shredding should cause the cell housings...to break open and ideally already lead to an extensive separation of the active mass from the arrester foils...With conventional rotor rippers, the degree of digestion can only be influenced by selecting a suitable grate that limits the size of the discharge unit...Whereas conventional rotor shredders only work continuously in throughput, the cross-flow shredders are operated in sets.” EX1016, p. 225: 8-17. LithoRec also discloses using rotary shears to dismantle the batteries. EX1016, p. 100: 12.

139. The '097 patent discloses exemplary forms of the comminution unit 18. Among the exemplary forms are “a rotary shear with a rotor and a stator or several rotors, or a cutting mill with a rotor and several rotors.” The rotary shear and the cutting mill are examples of rotary shredders. In addition, LithoRec explicitly discloses using a rotary shear. Thus, LithoRec teaches various comminution unit structures, including the same structures as disclosed in the '097 patent. And the structures present in LithoRec ensure that comminuted material is obtained, e.g., in the form of active mass.

3. **[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”**

140. LithoRec discloses a dryer that dries an active mass that has been comminuted in order to evaporate electrolytes from the comminuted active mass. In particular, LithoRec discloses “The electrolytes need to be evaporated for the subsequent dry treatment process, which are primarily aimed at extracting the active mass. On the one hand, this step eliminates the potential hazard of flammable solvents and, on the other hand, converts the active mass into the dry powder form required for dry processing.” EX1016, p. 226: 30-33. The '097 patent repeatedly refers to using a drying process to remove dimethyl carbonate. EX1001, col. 2: 25-27; col. 3: 4-12; col. 4: 37-40 and 61-63; col. 6: 43-49. LithoRec

discloses that dimethyl carbonate is an electrolyte found in the batteries that are to be processed, and that is consistent with my experience with comminuting Li-ion batteries. EX1016, p. 100: 1-7. A POSA would understand that LithoRec teaches a drying device that dries the active mass to remove dimethyl carbonate, which inactivates the active mass that has already been comminuted (e.g., in this case pre-shredded).

141. In my view, a POSA would understand that the electrolyte evaporating process of LithoRec teaches “a drying device configured to inactivate the comminuted material,” as recited in claim 12 based on the disclosure of the '097 patent.

142. The '097 patent discloses that the “inactivation device” is “in the form of a drying device 26.” EX1001, 8: 14-15. In addition, “the drying of the comminuted material results in inactivated comminuted material 42.” EX1001, 8: 54-55. The '097 patent further discloses that “[w]ithin the scope of the present description, the term 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 methyl carbonate is removed.” EX1001, 2:23-27. Thus, a POSA would understand that according to the '097 patent, the comminuted material is considered to be inactivated when at least one solvent in a

conducting salt (e.g., dimethyl carbonate and/or ethyl methyl carbonate) is removed by way of a drying process. LithoRec clearly does this.

143. In terms of the “timing requirement” of this limitation, the then-Applicant admitted that when inactivating comminuted material, “[l]ogically, . . . you must comminute either before or during the inactivation.” EX1002, p. 90. I agree that there is nothing new or inventive about this timing language in claim 1. Furthermore, LithoRec also evaporating the electrolyte from the active mass (inactivating the active mass) after performing the comminuting step. That is, LithoRec discloses “The electrolytes need to be evaporated for the subsequent dry treatment processes, which are primarily aimed at extracting the active mass” (emphasis added). EX1016, p. 226: 30-31. Thus, the drying in LithoRec is performed after the comminuting, which is apparent because LithoRec refers to its drying as a “subsequent dry treatment processes” on p. 226 following the pre-shredding comminuting on page 226. A POSA would read this subsequent language and understand the timing of the dry treatment process to match with the language in claim 1.

144. LithoRec therefore discloses the same structure being used in the same way for the same purpose and with the same timing as in the '097 patent. See also the [1-B] and [1-D] discussions above.

4. **[12-C] “(c) a filling device configured to fill a transport container with the inactivated comminuted material; and”**

145. The '097 Patent defines “transport container” as a “transport packaging”. EX1001, 2: 35-36. LithoRec discloses that after the active mass has been inactivated (the active mass has been dried and the electrolytes have been removed from the active mass), the active mass is recovered as powder and then fed to a drum filler with a palletizing device and packaged. LithoRec discloses “The pre-shredded and dried battery cells...are fed directly from the dryer onto a conveyor belt...The second sorting step is used for the rough separation of heavy parts...The light fraction largely consists of foils...and the active mass to be recovered as powder...The sieve underflow, active mass in powder form, is fed by means of a suitable screw conveyor (3.19) to a drum filler with [a] palletizing device (3.20) and packaged.” EX1016, p. 227:44-45; p. 228: 6-8, 31-32; and Fig. G-1.

146. LithoRec thus fills a transport container (drum/pallet/package) with the inactivated comminuted material (active mass) for transport. Accordingly, a POSA would understand that once packaged, the active mass is in condition for transport and that the packaged active mass is in a transport container. Thus, a POSA would understand that LithoRec’s drum filler is a filling device within the meaning of the '097 patent.

147. See also the [1-C] discussion above.

5. **[12-D] “(d) a vacuum installation connected to the drying device and configured to generate a vacuum in the drying device.”**

148. LithoRec discloses general conditions at which drying should occur, including keeping pressures low by generating a vacuum within the dryer to accommodate the evaporation of highly flammable solvents. LithoRec uses low pressures because it recognizes the potential for combustion or explosions. “As some of the liquids to be evaporated are highly flammable solvents, the drying temperature is likely to be severely restricted. This in turn speaks in favor of drying under vacuum, as the drying temperature could be kept low.” EX1016, p. 260: 14-16.

149. A POSA would understand that the battery processing installation of LithoRec includes the “vacuum installation” recited in claim 12.

150. In particular, claim 12 does not recite any specific structure associated with the “vacuum installation”. Instead, the only structural requirement recited in claim 12 is that the “vacuum installation” is configured to be “connected to the drying device” and is “configured to generate a vacuum in the drying device.”

151. In order to generate a vacuum in a drying device, there must be a source of the vacuum (i.e., a vacuum installation). In addition, in order for the vacuum installation to generate a vacuum in the dryer, the vacuum installation must be connected to the dryer. Thus, the mere existence of a vacuum dryer (such

as the one disclosed in LithoRec (EX1016, p.226: 37-38)) means that a vacuum installation to the extent recited in claim 12 will be present with that vacuum dryer.

152. This conclusion is supported by the then-Applicant's arguments during prosecution. When arguing against the rejection of application claim 7 (a version of which issued as claim 12) over Stevens and Kellerman, the then-Applicant asserted that "the apparatuses of Stevens and Kellermann are not designed to be capable of generating anything that might qualify as a 'vacuum' according to the ordinary meaning of that word. A pump that draws air may cause displacement of air but does not alone produce anything that may be qualify as a 'vacuum.'"

153. Based on the then-Applicant's arguments, a POSA would understand that the only requirement for the "vacuum installation" is that it be able to produce a vacuum in the dryer. A vacuum dryer requires a device that generates the vacuum in the dryer and in order to do so, the device must be connected to the dryer. Therefore, because LithoRec discloses a vacuum dryer, LithoRec also discloses the "vacuum installation" of the type recited in claim 12. This much would be understood by a POSA. From my experience, a "vacuum installation" would have to be present in a commercial vacuum dryer such as those implicated by LithoRec. Thus, in my view, a POSA would understand LithoRec as disclosing a vacuum installation of the sort called for in claim 12.

B. Claim 13

154. Claim 13 depends from claim 12 and recites “wherein the drying device is configured to dry the comminuted material until an electrolyte content in the comminuted material is so low that an electrochemical reaction is impossible.”

155. LithoRec teaches “The electrolytes need to be evaporated for the subsequent dry treatment processes, which are primarily aimed at extracting the active mass. On the one hand, this step eliminates the potential hazard of flammable solvents and, on the other hand, converts the active mass into the dry powder form required for dry processing.” EX 025, p. 266: 30-33.

156. LithoRec thus teaches “eliminating” the potential hazard of flammable solvents by evaporating electrolytes in the solvents. As a result, the electrolyte content in the comminuted material is so low that an electrochemical reaction is impossible.

157. LithoRec further discloses “If it is assumed that all volatile, highly flammable solvents have been removed during the drying process, no explosion protection is required.” EX1016, p. 229: 21-22. In other words, LithoRec contemplates either removing all electrolytes or providing explosion protection. The former corresponds to a scenario in which all volatile, highly flammable solvents are removed, making the electrolyte content in the comminuted material

so low that an electrochemical reaction is impossible, and thus obviating the need for explosion protection.

158. A POSA thus would understand that LithoRec teaches that the electrolyte content in the active mass (comminuted material) is so low that an electrochemical reaction (e.g., explosion) is impossible.

C. Claim 15

Claim Language
a hard metal detachment device and/or a light fraction detachment device;
a separation device configured to separate active material from a carrier such that an active material fraction and a carrier fraction occur; and
a second filling device configured to separately fill the active material fraction and the carrier fraction in respective containers.

1. “a hard metal detachment device and/or a light fraction detachment device;”

159. Claim 15, which depends from claim 12, requires only one of a hard metal detachment device and a light fraction detachment device. LithoRec discloses both, including the hard metal detachment device and light fraction detachment device structures used in the '097 patent. To the extent that “hard metal

detachment device” requires: “a device for detaching fragments of peripheral components of the operating system, the battery cell casing and the electrical contacts,” (EX1001, 7: 17-25) LithoRec discloses this limitation. The '097 patent states that, “[f]or example, the hard metal detachment device has a magnet separation device and/or a separator, in particular a cross-flow separator and/or a zigzag separator. The separation device should be understood particularly to mean a device for detaching the separator foil.” (The '097 Patent col. 7, lines 17-25).

160. LithoRec discloses a magnetic separator and a cross-flow separator. LithoRec discloses “The pre-shredded and dried battery cells...are fed directly from the dryer onto a conveyor belt...The second sorting step is intended for the rough separation of heavy parts (housing parts bridges, nuts, bolts and the like). The light fraction largely consists of foils (copper, aluminum, plastic) and the active mass to be recovered as powder. So-called Cross-flow separators are a simple unit for such separation process.” EX1016, p. 227:44-45; p. 228: 6-8, 31-32.

161. To the extent that “light fraction detachment device” requires: “The light fraction separation device preferably has a zigzag separator and/or an air separator, wherein it is favourable if the air is conducted within a circuit,” LithoRec discloses a separator for light fraction that is an air separator.

162. “The light fraction largely consists of foils...and the active mass to be recovered as powder...The material to be sorted is scattered into an almost

horizontal air stream.” EX1016, p. 228: 7-9. LithoRec therefore discloses this part of claim 15.

2. **a separation device configured to separate active material from a carrier such that an active material fraction and a carrier fraction occur; and**

163. The '097 Patent discloses that “[t]he separation device should be understood particularly to mean a device for detaching the separator foil.” EX1001, 7: 23-25. In addition, the '097 patent discloses the “carrier fraction” comprises carrier foils which can be made of aluminum and copper. In particular, the '097 patent discloses “A light fraction with a separator foil and fine coating material, and a heavy material fraction with carrier foils (aluminium and copper).” EX1001, 9: 46-48.

164. LithoRec discloses “The light fraction largely consists of foils (copper, aluminum, plastic)...The disintegration shredding process should remove the active mass as completely as possible from the metal foils without shredding these foils too finely....Due to the large differences in the particle sizes of the components to be separated, sieving at e.g. 1 mm sieve mesh width is suitable for separating the active mass from the granulator's comminution product. Experience has shown that with this screen mesh size, the pulverized active mass can be separated very reliably from the films.” EX1016, p. 228: 7, 22-27.

165. The sieve mesh of LithoRec separates the active mass (active material) from the metal foils (carrier fraction). A POSA would understand that the sieve mesh of LithoRec is a “separation device” as recited in claim 15. LithoRec therefore discloses this part of claim 15.

3. **a second filling device configured to separately fill the active material fraction and the carrier fraction in respective containers.**

166. LithoRec '097 patent does not identify any specific structures for the second filling device. Nonetheless, LithoRec teaches a device that separates the active mass from foils and separately fills drums and packages accordingly. In particular, LithoRec discloses “The sieve underflow, active mass in powder form, is fed by means of a suitable screw conveyor (3.19) to a drum filler with palletizing device (3.20) and packaged. The screen overflow, a mixture of copper and aluminum foil sections contaminated with plastic, is also fed onto an air oven (3.22), also known as a separating table, by means of a screw conveyor (3.21)...The metal foils (foil thickness approx. 20 μm) have bulk weights of between 150 kg/t and 300 kg/t in the as-collected state and could therefore neither be transported effectively nor used in melting operations. To do this, they must be pressed into briquettes of the appropriate density.” EX1016, p. 228: 31-34; p. 229: 2-5.

167. LithoRec further discloses two “buffer containers (3.24) [that] must be installed between the separating table and the briquette press, which can hold at least one day’s production...of the corresponding film fraction. EX1016, p.229: 10-12. In addition, Fig. G-1 of LithoRec shows a “day silo for copper” 3.24-1 and a “day silo for aluminum” 3.24-2.

168. As discussed above, LithoRec discloses conveying the active mass in powder form to a drum filler, while the copper and aluminum foil are directed to different storage containers so that the copper and aluminum foil can be later processed and pressed into briquettes for transport. A POSA would understand that the copper and the aluminum foil must be filled in the separate containers by a “second filling device” because the copper and aluminum foils and the active mass are sent to different storage containers. Therefore, LithoRec discloses the second filling device of claim 15. LithoRec therefore discloses this part of claim 15, as well.

D. Claim 16

169. Claim 16 depends from claim 15 and recites “wherein the carrier fraction are aluminum and copper foils.” LithoRec discloses “The light fraction largely consists of foil (copper, aluminum, plastic).” EX1016, p. 227: 7. LithoRec therefore discloses this limitation.

E. Claim 18

170. Claim 18 depends from claim 15 and recites “wherein the separation device is a second comminution device.”

171. LithoRec discloses “Digestion comminution...The light fraction from the cross-flow classifier can contain large aggregates of active mass in addition to considerable proportions of incompletely broken down composites of arrester films and active mass. In order to achieve the desired high yield of the active mass, the light classifier material produced must be subjected to a further pulping process. A MEWA UG600 granulator (3.16) was selected for this disintegration comminution. The degree of digestion can be adjusted with this machine by selecting a suitable sieve grate. The disintegration shredding process should remove the active mass as completely as possible from the metal foils without shredding these foils too finely.” EX1016, p. 228: 16-23. LithoRec thus explicitly links its light classifier separation device to digestion comminution, which is a second comminution device following the first comminution device (i.e., the pre-shredder).

F. Claim 19

172. Claim 19 depends from claim 12 and recites “wherein the batteries are lithium batteries.”

173. LithoRec discloses, “In the ‘LithoRec – Recycling of lithium-ion batteries’ project, several procedures for recycling traction batteries were evaluated...A conclusive concept was developed for separating the battery systems

down to the level of the cathodic active material powder used.” EX1016, p. 1: 1-13. LithoRec also discloses “Battery types to be processed are Li-ion accumulators in the form of traction batteries, hybrid batteries and plug-in batteries.” EX1016, p. 222: 32-33. See also the claim 8 discussion above.

XI. GROUND 4: CLAIM 17 IS OBVIOUS OVER LITHOREC IN VIEW OF HANISCH

A. The Hanisch Reference

174. As discussed above, Hanisch was used in combination with Stevens and Kellerman to reject claims 14 and 18 during the prosecution of the ‘097 patent. Hanisch was relied upon to teach “a separation device for an active material and a carrier wherein the separation device is an air jet sieving device (air jet sieve: Fig. 1, #50) in order to separate materials with a high degree of purity” as was recited in application claims 14 and 18 (renumbered as claims 5 and 17 in the ‘097 patent). EX1002, pp. 92, 113-114, 158, and 191.

175. The Applicant’s responses did not address the Examiner’s characterization of Hanisch. Instead, the Applicant asserted that Hanisch teaches heating to an extremely high temperature that is 350 to 800°C. EX1002, pp. 92 and 158. Accordingly, during prosecution, the Applicant did not rebut the Examiner’s finding that the air jet sieving device of Hanisch discloses the “air jet sieving device” of claim 17. In my view, a POSA would understand Hanisch to be relevant to at least claim 17 in view of Hanisch's air jet sieving device related disclosure,

notwithstanding any alleged differences regarding temperatures used in other processes. Indeed, the Applicant did not disagree with the relevance of Hanisch in this respect.

B. Claim 17 Would Have Been Obvious to a POSA

176. Claim 17 depends from claim 15 and recites “wherein the separation device is an air jet sieving device.”

177. As discussed above, with respect to claim 15, LithoRec teaches the claimed “separation device” to separate active material from foils. LithoRec does not otherwise limit the type of device used to perform the separation in claim 15.

178. Relevant to claim 17, Hanisch teaches using an air jet sieve to separate active material from foil. EX1020, p. 8: 23-30. Hanisch further discloses that the air jet sieve provides a “high level of separation.” EX1020, p. 6: 7-12. Therefore, in my view, it would have been obvious for a POSA to utilize the air jet sieve of Hanisch as the “separation device” of LithoRec in order to achieve a high level of separation between the active material and the foil. A POSA would understand that Hanisch relates specifically to comminution, and its air sieve is not dependent on the alleged extremely high temperatures upon which the patentee previously sought to distinguish it. In my view, claim 17 would have been obvious to a POSA based on the LithoRec/Hanisch combination.

XII. OBJECTIVE INDICIA DO NOT SUPPORT PATENTABILITY

179. I understand that the obviousness analysis includes considering evidence of secondary indicia of nonobviousness (if available). I understand that any secondary indicia of nonobviousness must have a nexus, or a close connection, to the novel aspects of the claimed invention. I understand that secondary indicia of nonobviousness include the following: commercial success, long-felt but unmet need, failure of others, copying, praise in the industry, and unexpectedly superior results as compared with the closest prior art.

180. Considering the information I have reviewed, my general knowledge of the field, and publications within the field and related fields, I am unaware of any objective evidence that might support the patentability of the claims of the '097 patent. Further, from my review of the prosecution history of the '097 patent, the applicant never raised secondary indicia of nonobviousness. I am not otherwise aware of any publicly available evidence of secondary indicia of nonobviousness. Should any alleged secondary indicia of nonobviousness be presented, I reserve the right to provide an opinion thereon.

XIII. CONCLUSION

181. In signing this declaration, I recognize that this declaration will be filed as evidence in an *inter partes* review before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross-examination in the case and that cross-examination will

take place within the United States. If cross-examination is required, I will appear for cross-examination within the United States during the time allotted.

182. I hereby declare that all statements made herein are made of my own knowledge and are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Executed on this 29th day of April, 2024.



VOLKER SPIES