

**URT UMWELT UND RECYCLINGTECHNIK
GMBH, Petitioner
v.
Duesenfeld GmbH, Patent Owner**

**U.S. Patent No. 11,050,097
IPR2024-00887
Oral Argument August 19, 2025**

DEMONSTRATIVE EXHIBIT—NOT EVIDENCE

Duesenfeld Hearing Demonstratives

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

Advantages of the invention:

- **Inactivation without addition of materials**

- “A further advantage is that no additional material has to be added to inactivate the comminuted material.”

Ex. 1001 ('097 Patent) at 2:5-6

- **Suppresses the formation of hazardous materials**

- “Fluorophosphates are often strong neurotoxins, the formation of which must be reliably prevented.”
- “The organic carbonate content is preferably so small that the formation of a significant amount of fluorophosphates can be ruled out.”

Ex. 1001 ('097 Patent) at 2:18-19; *id.* at 2:15-17

- **Material is safe for transport**

- “The comminuted material is therefore largely inert and can be transported safely, especially if it is packed under vacuum.”
- “In addition, it is advantageous that a comminuted material is obtained that can be transported safely.”

Ex. 1001 ('097 Patent) at 2:3-4; *id.* at 2:13-14

Pioneering Invention

Q. Are you aware of any prior art that recognized that you could inactivate shredded battery material by vacuum drying alone?

Spies. At the moment, I can't mention it, that one.

Q. Did any come to mind?

Spies. Sorry?

Q. Does anything come to mind?

Spies. Not at the moment, no. Maybe it's too late already for me.

Ex. 2061 (Spies Depo.) at 95:19-96:3; Paper 31 (PO's Sur-reply) at 10

Unexpected Results

LithoRec prior art:

E.4.3.3 Contribution margin in mechanical processing

The material and energy flow-related contribution margin is 340 [EUR/t systems]. The largest contribution is made by the copper chips in the anode. Assuming the high-purity separation of the chips and their briquetting capability, it amounts to 414 [EUR/t systems] at a revenue rate of 6.300 [EUR/t]. The main input materials are sodium hydroxide (NaOH), which is required for hydrofluoric acid washing (9 [EUR/t systems] at a cost rate of 250 [EUR/t])²⁵. The required quantities of NaOH and the substances sodium fluoride (NaF, 22.65 [kg/t system]) and sodium carbonate (Na₂CO₃, 17.95 [kg/t system]) produced by the chemical reaction were estimated stoichiometrically by the Öko-Institut. The hazardous waste disposal (SME) of the NaF-Na₂CO₃ mixture leads to costs of 16 [EUR/t systems]; alternatively, the substances could possibly be separated and sold in high-purity form.

Ex. 1016 (LithoRec) at 190; Paper 31 (PO's Sur-reply) at 24

'097 Patent:

"The advantage of low temperatures is that the formation of hydrogen fluoride is hindered."

Ex. 1001 ('097 Patent) at 3:12-13;
Paper 31 (PO's Sur-reply) at 24

"The drying preferably occurs at a maximum temperature of 80° C.: this produces almost no hydrogen fluoride.

Ex. 1001 ('097 Patent) at 5:7-8;
Paper 31 (PO's Sur-reply) at 24

Credibility of Spies Declaration

- Had not read cited material in his declaration since “[m]aybe a year ago... [m]aybe, maybe longer.”

Ex. 2061 (Spies Depo.) at 95:19-96:3

- **Declared:** “I confirmed with the Wayback machine that these documents were in fact publicly available prior to the time of the invention.”
But testified: “I don’t know” what the Wayback machine is.

Compare Ex. 1023 (Spies Reply Decl.) at ¶ 63 *with* Ex. 2062 (Spies Depo. Vol. 2) at 139:29-34

- **Declared:** “Optimizing result effective variables to achieve a desired drying output is standard practice in the industry.”
But testified: “I don't know that term.”

Compare Ex. 1023 (Spies Reply Decl.) at ¶ 52 *with* Ex. 2062 (Spies Depo. Vol. 2) at 138:24

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

Claim 1:

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

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

Claim 12:

12. A battery processing installation for treatment of used batteries, comprising:

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

Instituted Grounds

Trials@uspto.gov
571-272-7822

Paper 10
Date: November 20, 2024

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

URT UMWELT UND RECYCLINGTECHNIK GMBH,
Petitioner

- **Ground 1:** Claims 1-3, 7, 8 and 10 as obvious over LithoRec (Ex. 1016, “LithoRec”) in view of DIN 28400 -1 (Ex. 1018, “DIN 28400”) or Perry (Ex. 1006, “Perry”).
- **Ground 2:** Claim 9 as obvious over LithoRec in view of DIN 28400 and/or Perry and Hanisch (Ex. 1020, “Hanisch”).
- **Ground 3:** Claims 12, 13, 15, 16, 18, and 19 as anticipated by LithoRec.
- **Ground 4:** Claim 17 as obvious over LithoRec in view of Hanisch.

Paper 10 (Institution Dec.)

CLAIM CONSTRUCTION

Claim Construction

Term or Phrase	Duesenfeld's Proposal	Petitioner's Proposal
<p>“inactivate”/ “inactivated” Claim 1</p>	<p>“ordinary meaning, which is to render safe for transport”</p> <p>Paper 17 (POR) at 9</p>	<p>“the removal of at least one solvent in the conducting salt such that dimethyl carbonate [DMC] and/or ethyl methyl carbonate [EMC] is removed from the comminuted material results in inactivated material.”</p> <p>Paper 22 (Petitioner's Reply to the POR) at 2</p>

Claim Construction

Board Construction (IPR2024-00887) (URT)

“With **inactivation meaning the same as drying**, and both terms referring to the removal of at least one solvent, such as dimethyl carbonate or ethyl methyl carbonate, from the conducting salt...”

Paper 10 (Institution Decision) at 13

“First, the 097 patent states that the ‘inactivation device’ not only includes, but is ‘in the form of a drying device,’ **suggesting that drying and inactivation are intended to have similar, if not identical, meanings.**”

Paper 10 (Institution Decision) at 12

Claim Construction

Board Construction (IPR2024-00948) (Ascend)

“on the present record, we take inactivation to require the removal of sufficient amounts of dimethyl carbonate and/or ethyl methyl carbonate from the comminuted material to make an electrochemical reaction either no longer possible or only possible to a negligibly small extent”

Claim Construction

District Court Claim Construction

Case 1:23-cv-01194-JFM Document 62 Filed 10/30/24 Page 1 of 1 PageID #: 698

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

DUESENFELD GMBH,
Plaintiff,
v.
ASCEND ELEMENTS, INC.,
Defendant.

C.A. No. 23-1194-JFM
JURY TRIAL DEMANDED

ORDER

Having considered the parties' Joint Notice of Agreement on Outstanding Claim Construction Disputes, the Court hereby enters the following agreed constructions for U.S. Patent No. 11,050,097:

- "drying the comminuted material" (claims 1, 2, 7, 13) shall have its plain and ordinary meaning, which is removing at least one solvent from the comminuted material.
- "drying device configured to inactivate the comminuted material" (claim 12) shall have its plain and ordinary meaning, which is a device configured to produce inactivated comminuted material as a result of drying.

DATE: October 30, 2024


The Honorable John F. Murphy

- "drying device configured to inactivate the comminuted material" (claim 12) shall have its plain and ordinary meaning, which is a device configured to produce inactivated comminuted material as a result of drying.

Duesenfeld GmbH v. Ascend Elements, Inc.,
Case No. 1:23-cv-01194-JFM (D. Del.) at Dkt. 62;
Paper 31 (PO's Sur-reply) at 1 & 4

Claim Construction

“Inactivate”/ “inactivated” claim language:

1. A method for the treatment of used batteries, comprising the steps:

- (a) comminuting the batteries such that comminuted material is obtained;
- (b) **inactivating** the comminuted material such that an **inactivated comminuted material** is obtained, wherein the **inactivating** step is performed during or after the comminuting step; and
- (c) filling a transport container with the inactivated comminuted material;

wherein the **inactivating** step is performed by **drying** the comminuted material, and
wherein the drying occurs at a maximum pressure of 300 hPa.

Claim Construction

Different terms have different meanings

“There is an inference, however, that two different terms used in a patent have different meanings.”

Comaper Corp. v. Antec, Inc., 596 F.3d 1343, 1348 (Fed. Cir. 2010)

“In the absence of any evidence to the contrary, we must presume that the use of these different terms in the claims connotes different meanings.”

CAE Screenplates Inc. v. Heinrich Fiedler GmbH, 224 F.3d 1308, 1317 (Fed. Cir. 2000)

Claim Construction: Dependent Claims

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

2. The method according to claim 1, wherein the comminuted material is **dried until an electrolyte content in the comminuted material is so low that an electrochemical reaction is impossible.**

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

Claim Construction

“inactivation device”/ “drying device”

File history

‘097 Patent

Docket No.: 03101160/US; App. No.: 15/569,484

“an inactivation device” – Assuming even for the sake of argument that “inactivation device” ought to be interpreted under 112(f), the claims do in fact recite more structure for this device, namely a “drying device.”

“device” outside of 112(f) interpretation.

“an inactivation device” – Assuming even for the sake of argument that “inactivation device” ought to be interpreted under 112(f), the claims do in fact recite more structure for this device, namely a “drying device.”

“a drying device” – This term supplies sufficient structure and should not be interpreted

ment 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 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. This reduces the exposure of the environment to harmful dust.

The second filling device and the separation devices are preferably arranged in a joint stacked container, for

vacuum. A primary gas inlet 26, preferably 26 bPa, is present in the drying device 26. It should be noted that, within the scope of the present description, the vacuum pump should be understood particularly generally to mean a device that creates a vacuum. It is possible and preferred, but not necessary, for the vacuum pump to simultaneously work as a compressor, such that gas is emitted from it under a pressure that is greater than the ambient pressure.

In the case depicted in FIG. 1, the vacuum pump is a compressor which sucks in and compresses gas 31 that is present in the drying device 26. Alternatively or additionally,

Comminuted material 24 is produced during the comminuting; the material is fed into an inactivation device in the form of a drying device 26. An airlock 28 is arranged

“a filling device” and “second filling device” – Here prong (C) of the 112(f) test supports the conclusion that a 112(f) interpretation should not be applied. Claim 7 does not merely recite “a filling device” but rather modifies “filling device” with the requirements that it be physically capable of filling a transport container and be able to handle inactivated

- 11 -
154

DETAILED DESCRIPTION

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 gross weight reasons. In order to do this, the battery systems are opened and dismantled to the point at which the modules/stacks can be individually removed. If required, the cells can also be separated from the drive electronics. The

The drying of the comminuted material 24 takes place in the drying device 44, 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. The transport container 46 is preferably gas-tight. It is possible, but not necessary, for the transport container 46 to be filled with inert gas prior to transportation such that it is under normal pressure. Alternatively, it is also possible for the transport container to be sealed under vacuum and transported. It is possible that, instead of the transport container, a vacuum-sealed foil is selected, such as an aluminium compound foil.

The comminution unit 18 is fed with shielding gas 29 from the vacuum pump 30 via a flushing line 48. If the

Ex. 1002 (‘097 File History) at 154

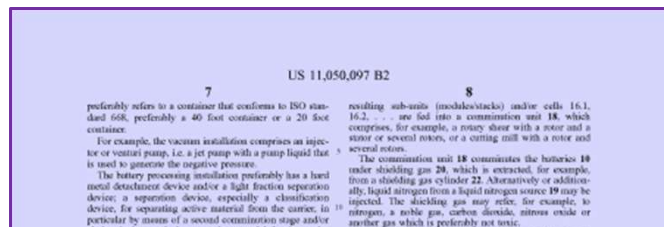
Ex. 1001 (‘097 Patent) at 8:14-15

Paper 1 (Petition) at 10; Paper 10 (Institution Decision) at 12

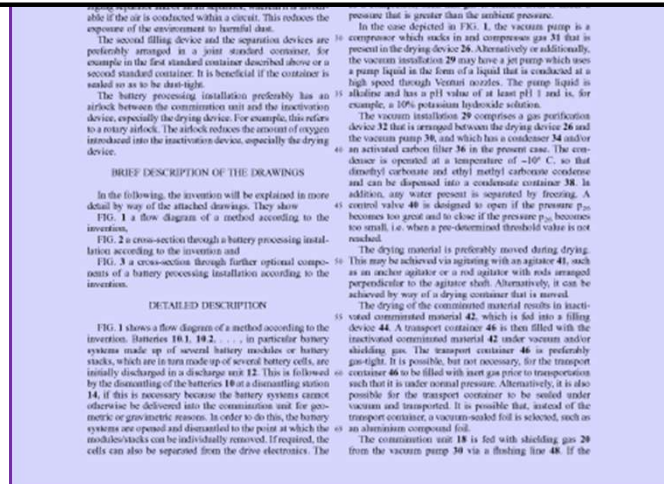
Claim Construction

Inactivation: result of drying

'097 Patent



“The drying of the comminuted material results in inactivated comminuted material....”



Ex. 1001('097 Patent) at 8:54-56; Paper 31 (PO's Sur-reply) at 2

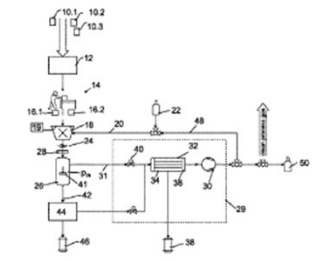
Claim Construction

“Inactivation”: Abstract

 US011050097B2	
(12) United States Patent Hanisch et al.	(10) Patent No.: US 11,050,097 B2 (45) Date of Patent: Jun. 29, 2021
(54) METHOD FOR THE TREATMENT OF USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION	(52) U.S. CL CPC <i>H01M 10/54</i> (2013.01); <i>B02C 21/00</i> (2013.01); <i>B02C 23/10</i> (2013.01); <i>B02C 23/20</i> (2013.01); (Continued)
(71) Applicant: DUESENFELD GMBH, Braunschweig (DE)	(58) Field of Classification Search CPC <i>Y02W 30/84</i> ; <i>Y02P 10/212</i> ; <i>B02C 23/08</i> ; <i>B02C 23/10</i> ; <i>B09B 3/008</i> ; <i>B09B 3/0058</i> ; (Continued)
(72) Inventors: Christian Hanisch, Braunschweig (DE); Bastian Westphal, Braunschweig (DE); Wolfmann-Hoschek, Braunschweig (DE)	(56) References Cited

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.

(87) PCT Pub. No.: WO2016/174156 PCT Pub. Date: Nov. 3, 2016	(Continued)
(65) Prior Publication Data US 2018/0301769 A1 Oct. 18, 2018	Primary Examiner — Gregory D Swiatocha (74) Attorney, Agent, or Firm — W&C IP
(30) Foreign Application Priority Data Apr. 28, 2015 (DE) 10 2015 207 843.4	(57) ABSTRACT A method is described 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 electro-
(51) Int. CL <i>H01M 10/54</i> (2006.01) <i>B09B 3/00</i> (2006.01) (Continued)	(Continued)



Claim Construction: Metrics For Result of Drying

Ex. 1001	Specification Text
3:49-4:4	...after the completion of the drying process, no flammable or explosive gas mixture can form...
4:5-18	The comminuted material is preferably dried until an electrolyte content in the comminuted material is so low that an electrochemical reaction is impossible....
4:19-27	The comminuted material is preferably dried for so long that a 50 kg amount of comminuted material... does not experience a build-up of heat, or the build-up of heat is so low that a thermal runaway...is ruled out for at least two months.
4:28-32	...dried until the electrolyte content of organic components that are volatile at 80° C. has a maximum value of 3% by weight....
4:33-36	The drying is preferably conducted for so long that the accumulated content of organic carbonates from the electrolyte that are volatile at 80° C. falls short of 3% by volume in the atmosphere above the comminuted material.
4:37-40	...the drying is conducted until the dimethyl carbonate content is lower than 4% by volume, especially 3% by volume, and/or the cyclohexylbenzene content is lower than 1 % by volume, in particular 0.5% by volume.

Claim Construction

Spies: Understanding of a POSITA

Q. If you remove just a small percentage of the electrolyte from the battery material, does it become inactivated?

Spies. Both the percentage or a small portion, I can't tell you, I don't know.

Q. You just don't know?

Spies. No, I don't know.

Claim Construction

Spies: Understanding of a POSITA

Q. Okay. And if you dry the material just a little bit, is that reactivity still present?

Spies. Nobody can tell you. Part of the electrolyte is still there, so drying just a little bit, it does not help you too much. It's not safe -- a safe status....

Q. Okay. So if you don't dry the material long enough, is it still potentially unsafe?

Spies. Yes.

Ex. 2061 (Spies Depo.) at 29:17-22; Paper 31 (PO's Sur-reply) at 3

Claim Construction

Spies: Understanding of a POSITA

Q. Okay. Let me ask again. If you comminute battery material and you remove just a small percentage of the solvent from the shredded material, does that shredded material become inactivated?

Spies: I don't know. I don't know how to answer, so -- apart from what I've already said, so -- maybe it's a question of understanding as well. I'm sorry.

BY MR. CARLSON:

Q. You're not able to answer the question?

MR. ROBERTS: Objection. Misstates prior testimony.

Spies: No.

Claim Construction

Spies: Understanding of a POSITA

Q. Okay. Let me ask again. If you comminute battery material and you remove just a small percentage of the solvent from the shredded material, does that shredded material become inactivated?

... [non-responsive answer]

MR. CARLSON: In fact, the court reporter, can you please read back the question?

... [non-responsive answer]

MR. CARLSON: Ms. Court Reporter, can you please read back the question?

THE WITNESS: I don't know. I don't know how to answer, so -- apart from what I've already said, so -- maybe it's a question of understanding as well. I'm sorry.

BY MR. CARLSON:

Q. You're not able to answer the question?

... [objection]

THE WITNESS: No.

Claim Construction

Petitioner & Board: inconsistent with the District Court

Case 1:23-cv-01194-JFM Document 62 Filed 10/30/24 Page 1 of 1 PageID #: 698

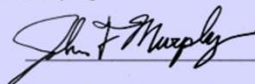
IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

- **"drying device configured to inactivate the comminuted material"** (claim 12) shall have its plain and ordinary meaning, which is a device configured to produce inactivated comminuted material as a result of drying.

No. 11,050,097:

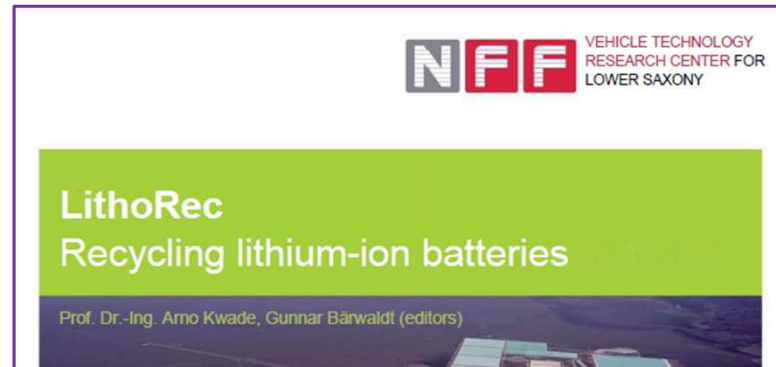
- **"drying the comminuted material"** (claims 1, 2, 7, 13) shall have its plain and ordinary meaning, which is removing at least one solvent from the comminuted material.
- **"drying device configured to inactivate the comminuted material"** (claim 12) shall have its plain and ordinary meaning, which is a device configured to produce inactivated comminuted material as a result of drying.

DATE: October 30, 2024


The Honorable John F. Murphy

Duesenfeld GmbH v. Ascend Elements, Inc.,
Case No. 1:23-cv-01194-JFM (D. Del.) at Dkt. 62;
Paper 31 (PO's Sur-reply) at 1 & 4

LithoRec



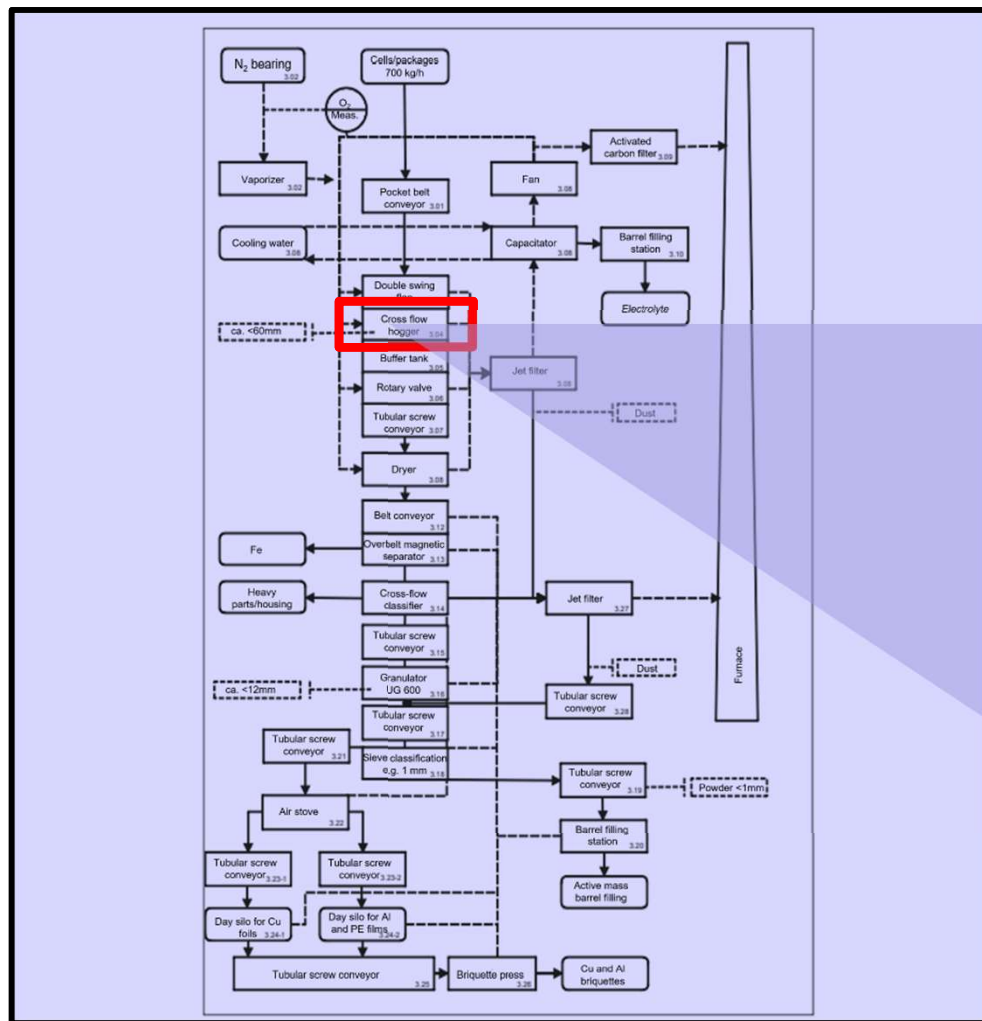
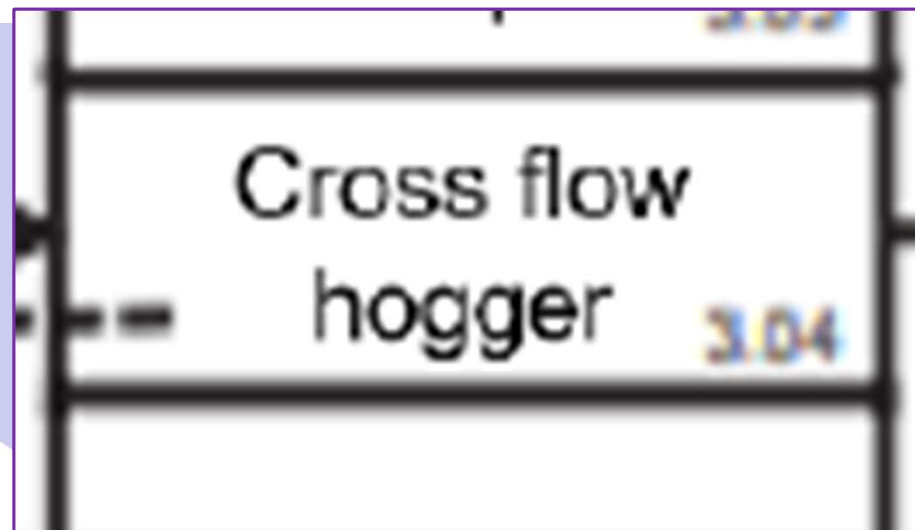
LithoRec: Disclosures



[illegible]

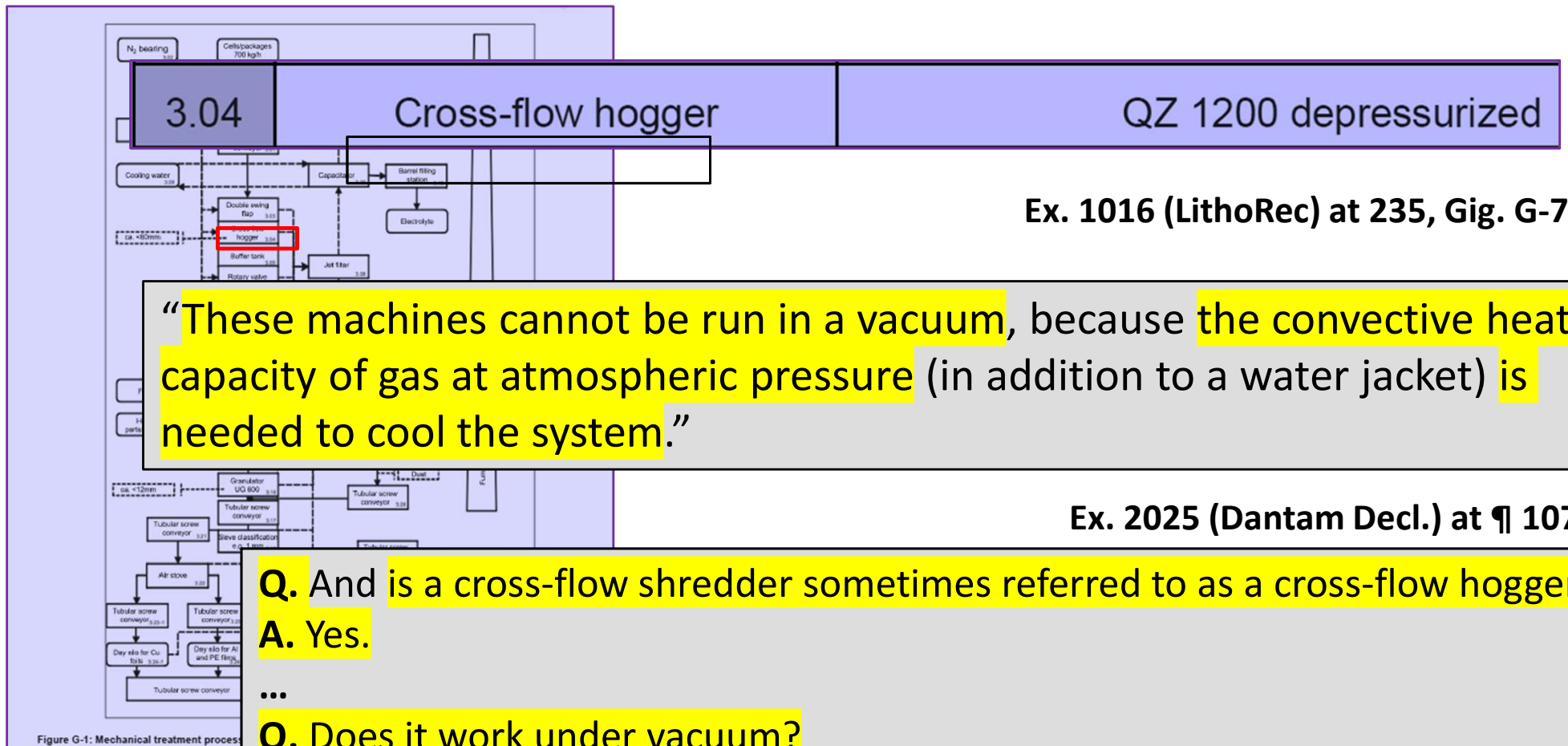
LithoRec

Shredder: cross-flow hogger



LithoRec

Cross-flow hogger: not under vacuum



Ex. 1016 (LithoRec) at 235, Gig. G-7

“These machines cannot be run in a vacuum, because the convective heat capacity of gas at atmospheric pressure (in addition to a water jacket) is needed to cool the system.”

Ex. 2025 (Dantam Decl.) at ¶ 107

Q. And is a cross-flow shredder sometimes referred to as a cross-flow hogger?

A. Yes.

...

Q. Does it work under vacuum?

A. The shredders don't work under vacuum, no.

LithoRec

Dryer: vibratory fluidized bed dryer

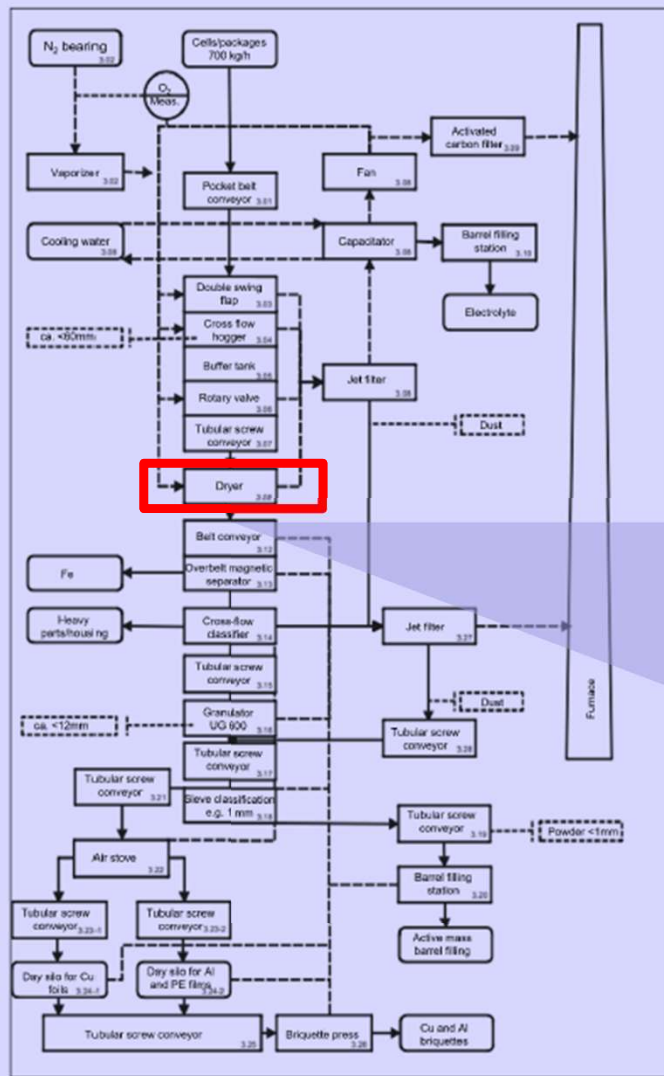
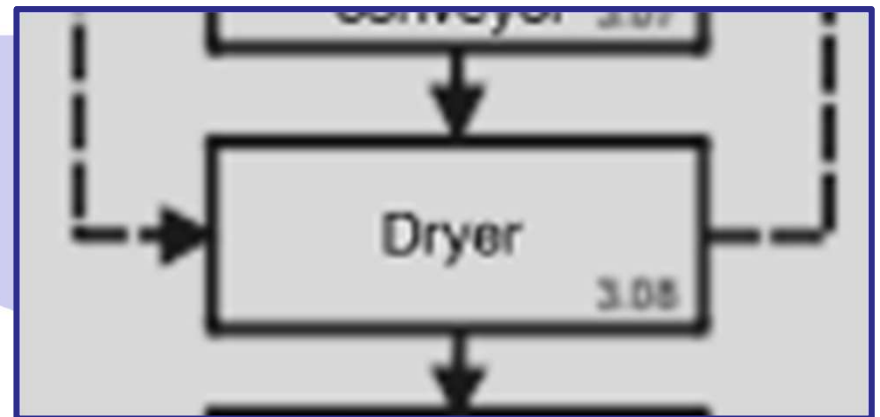


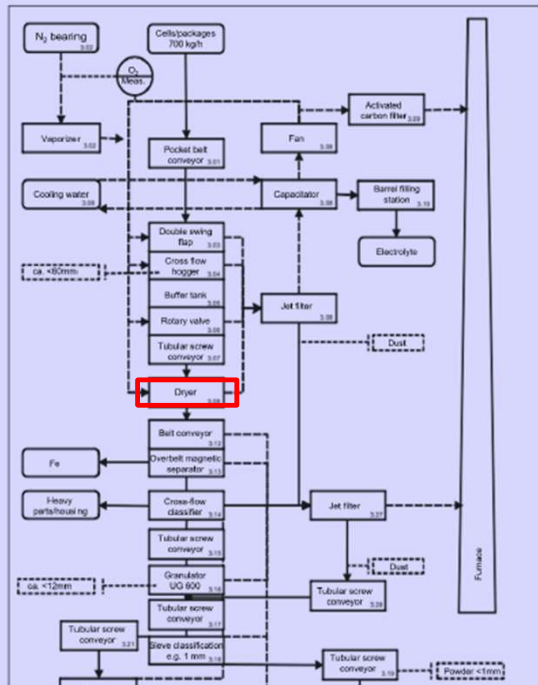
Figure G-1: Mechanical treatment process flow chart



Ex. 1016 (LithoRec) at 230, Fig. G-1

LithoRec

Recommended dryer: vibratory fluidized bed dryer



“The choice of dryer should therefore be a vibratory fluidized bed dryer.”

Ex. 1016 (LithoRec) at 227; Paper 17 (POR) at 17-18

3.08

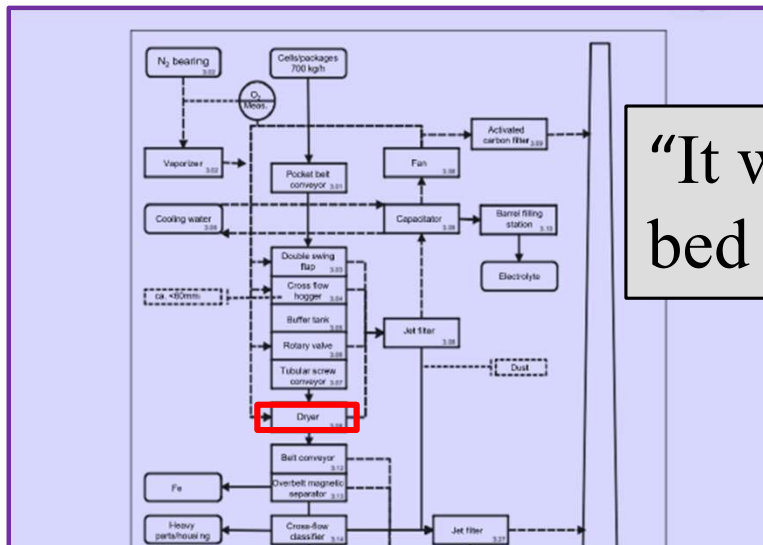
Drying system

2000 m³/h; incl. pulse jet filter; blower, condenser
explosion-proof incl. pressure relief devices

Ex. 1016 (LithoRec) at 235, Fig. G-7; Paper 17 (POR) at 17-18

LithoRec

Vibratory fluidized bed dryer: not under vacuum



“It would not work to operate the fluidized bed dryer under vacuum.”

Ex. 2025 (Dantam Decl.) at ¶ 99;
Paper 31 (PO’s Sur-reply) at 9

Q. ... And it refers to vibratory fluidized-bed dryer. Do you see that?

Spies. Yes.

Q. Does that work under vacuum?

Spies. Vibratory fluidized-bed dryer, the classical vibratory fluidized-bed dryer does not work under vacuum, no.

Q. What is a vibratory fluidized-bed dryer?

Spies. It's a dryer where -- which operates, let's say, under cross-flow. We have a vibratory motion in one direction, and air going through the bed of material from underneath.

LithoRec

Common nitrogen circuit

"It is planned to combine the drying gas of the dryer and the purge gas of the pre-shredder in a common gas circuit, the nitrogen circuit...."

Ex. 1016 (LithoRec) at 227

Q. Okay. And does a cross-flow hogger work under vacuum?

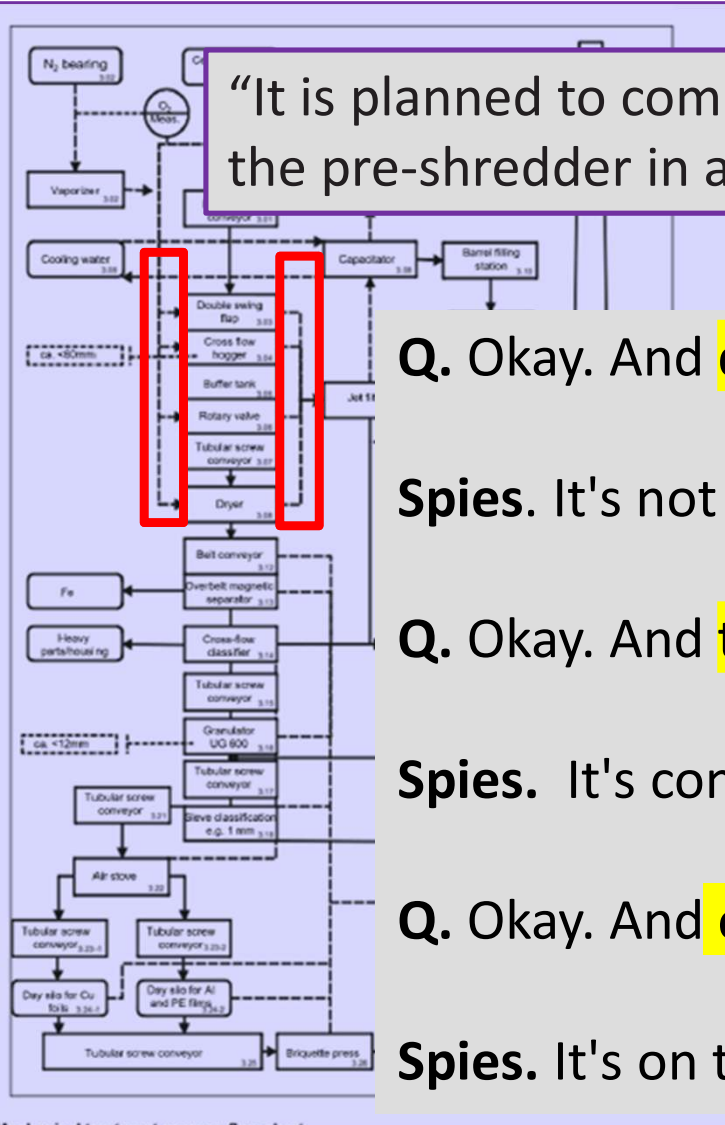
Spies. It's not working under vacuum, no.

Q. Okay. And the dryer is connected to the cross-flow hogger, right?

Spies. It's connected with the dryer, yes, correct.

Q. Okay. And everything's on the same nitrogen circuit. Is that right?

Spies. It's on the same nitrogen circuit, yes.



DEMONSTRATIVE EXHIBIT—NOT EVIDENCE

Ex. 2061 (Spies Depo.) at 51:2-11; Paper 31 (PO's Sur-reply) at 5

LithoRec

Fan

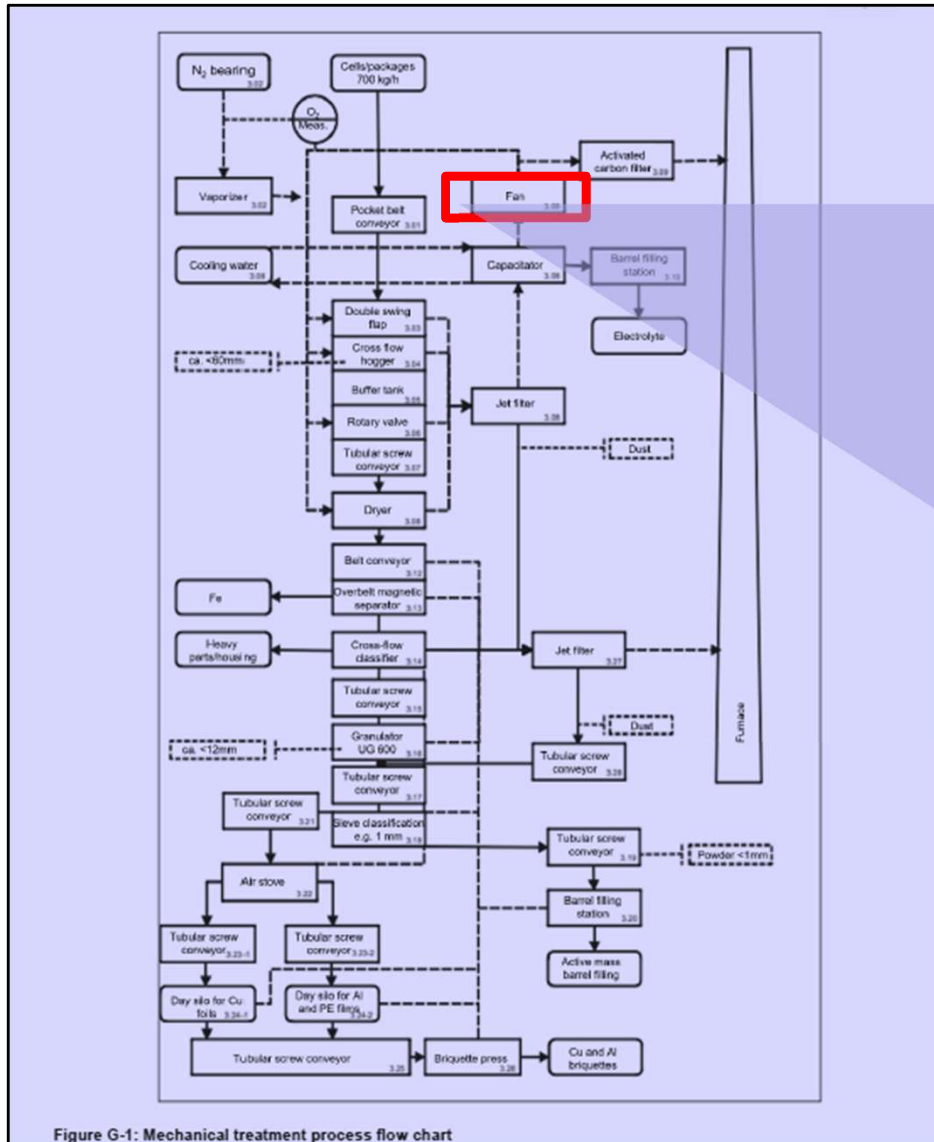
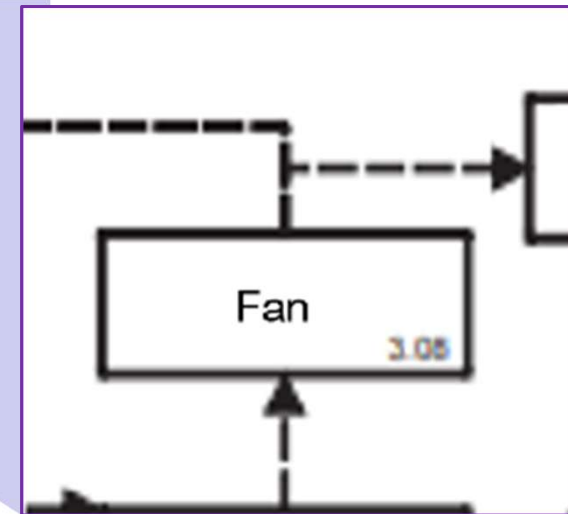
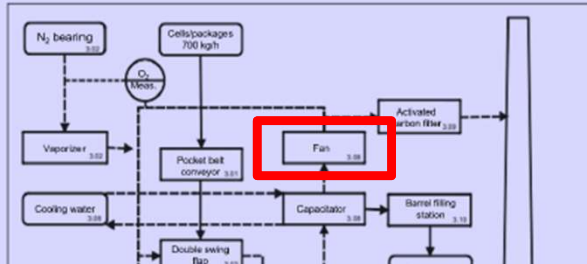


Figure G-1: Mechanical treatment process flow chart



Ex. 1016 (LithoRec) at 230, Fig. G-1

Fan: not a vacuum pump



“A person of skill in the art would understand that, while a fan can create a pressure differential, it is weaker than a vacuum pump. In a closed circuit, a fan simply directs/guides the flow of gas.”

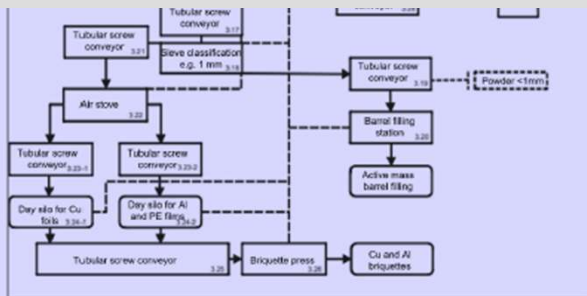
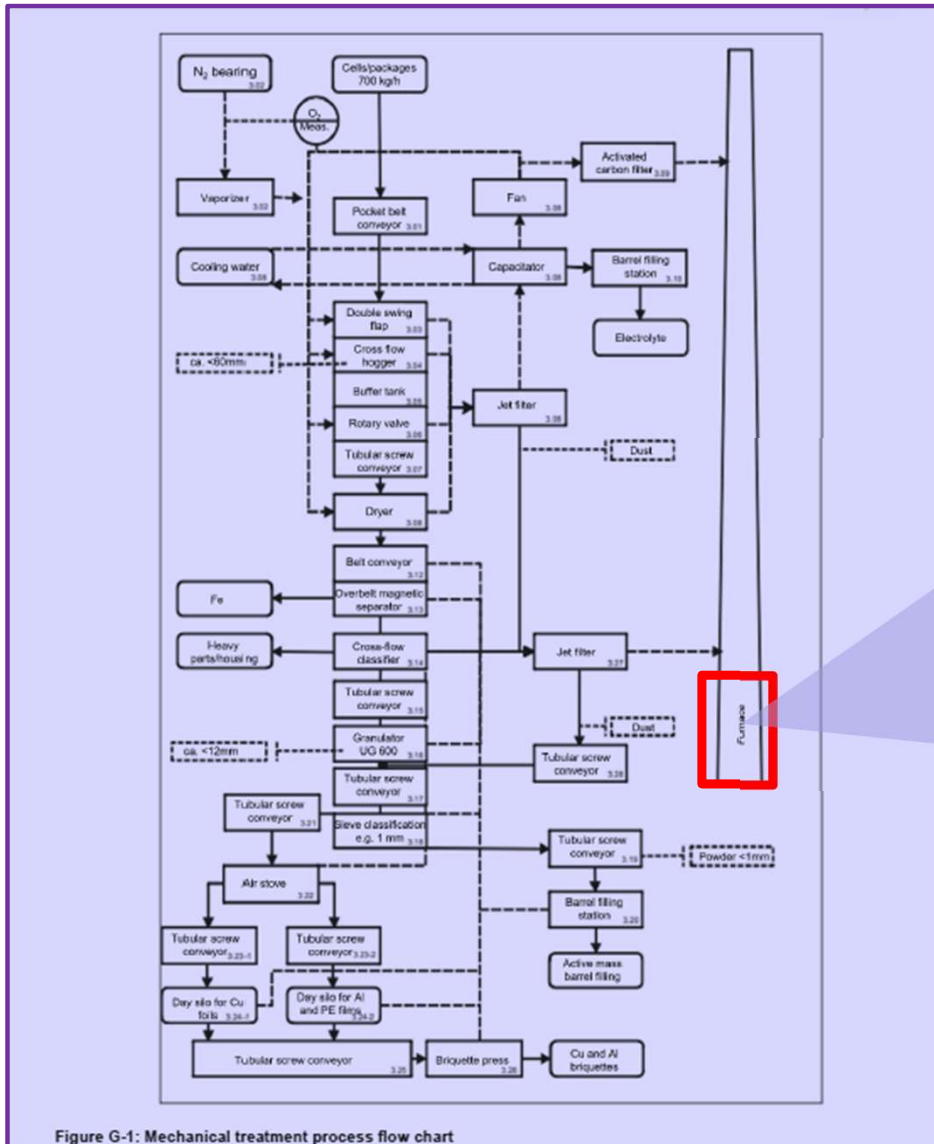


Figure G-1: Mechanical treatment process flow chart

Ex. 2025 (Dantam Decl.) at ¶ 109
(citing to Ex. 1016 at 230, Fig. G-1);
Paper 31 (PO's Sur-reply) at 4

Furnace



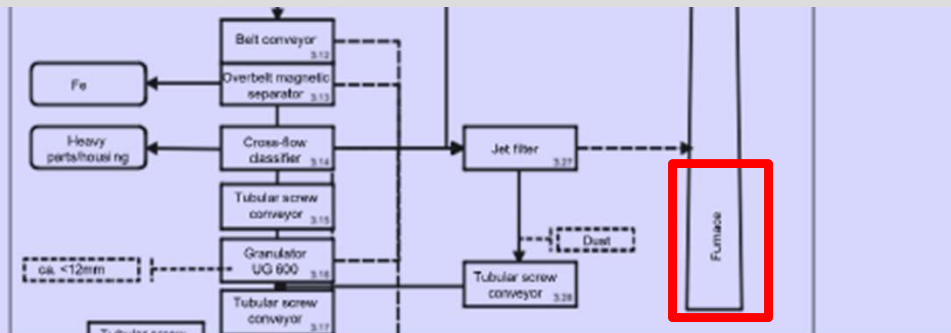
Ex. 1016 (LithoRec) at 230, Fig. G-1

LithoRec

Furnace: vents to atmosphere

“The output of the activated carbon filter is directed to a “Furnace,” which looks like a furnace exhaust flue or chimney. *Id.* A person of skill would understand that the furnace vents to the atmosphere.

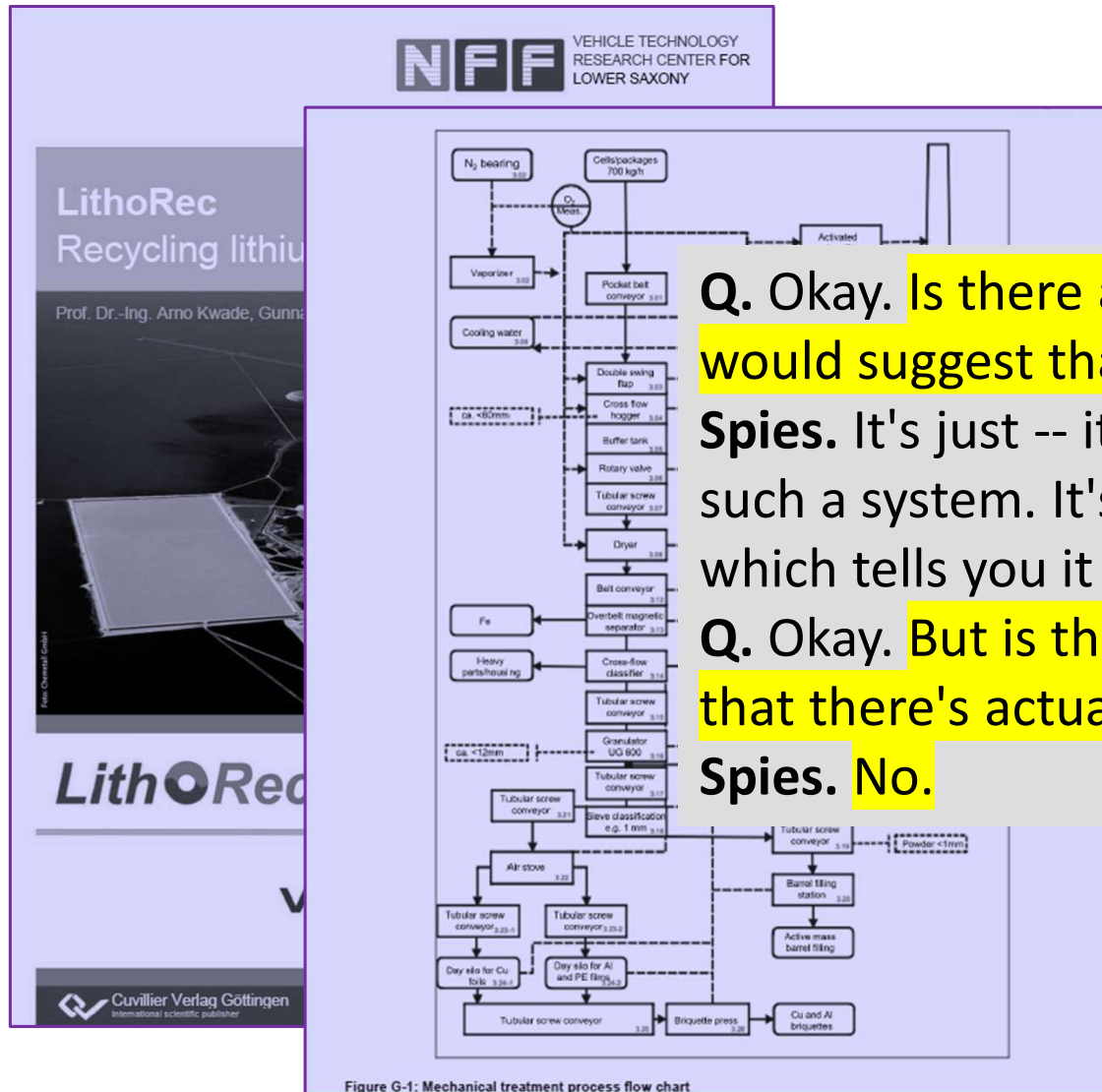
This is confirmed by LithoRec itself. Ex. 1016 at 227 (“In order to ensure the negative pressure in the gas circuit at all times, a partial quantity of gas must be discharged from the system into the environment. Due to the solvent residues it contains, the discharged gas must be cleaned using an activated carbon filter (3.09) before it can be released into the atmosphere.”).



Ex. 2025 (Dantam Decl.) at ¶ 111
(citing to Ex. 1016 at 230, Fig. G-1 & 227);
Paper 7 (POPR) at 32

LithoRec

Spies: no vacuum shown



Q. Okay. Is there anything on this figure [G-1] that would suggest that it is a vacuum process?

Spies. It's just -- it's the typical way how you design such a system. It's an overall functional diagram which tells you it needs a drying process, a drying –

Q. Okay. But is there anything on here that suggests that there's actually a vacuum present?

Spies. No.

Ex. 2061 (Spies Depo.) at 51:18-52:1;
Paper 31 (PO's Sur-reply) at 4-6

LithoRec

Other disclosed instrumentalities

“LithoRec discloses the use of “[c]onvection dryers” and “[s]low or high speed rotor shredders” in addition to vibratory fluidized bed dryers and cross-flow hoggers.”

Paper 10 (Institution Decision) at 11 (citing Ex. 1016 at 226)

“Convection dryers are simply a broader category of dryers that operate with airflow being a driving force to make the drying process work. Vibratory fluidized bed dryers are simply one kind of convection dryers.”

“In my experiences I have worked with about ten rotor shredders, and none of them were under vacuum.”

fundamentally the same for decades. The SNOTHERMO webpage describes various types of convection dryers, “including Belt Dryers, Tray Dryers, Rotary

41

Duesenfeld Ex. 2025-042

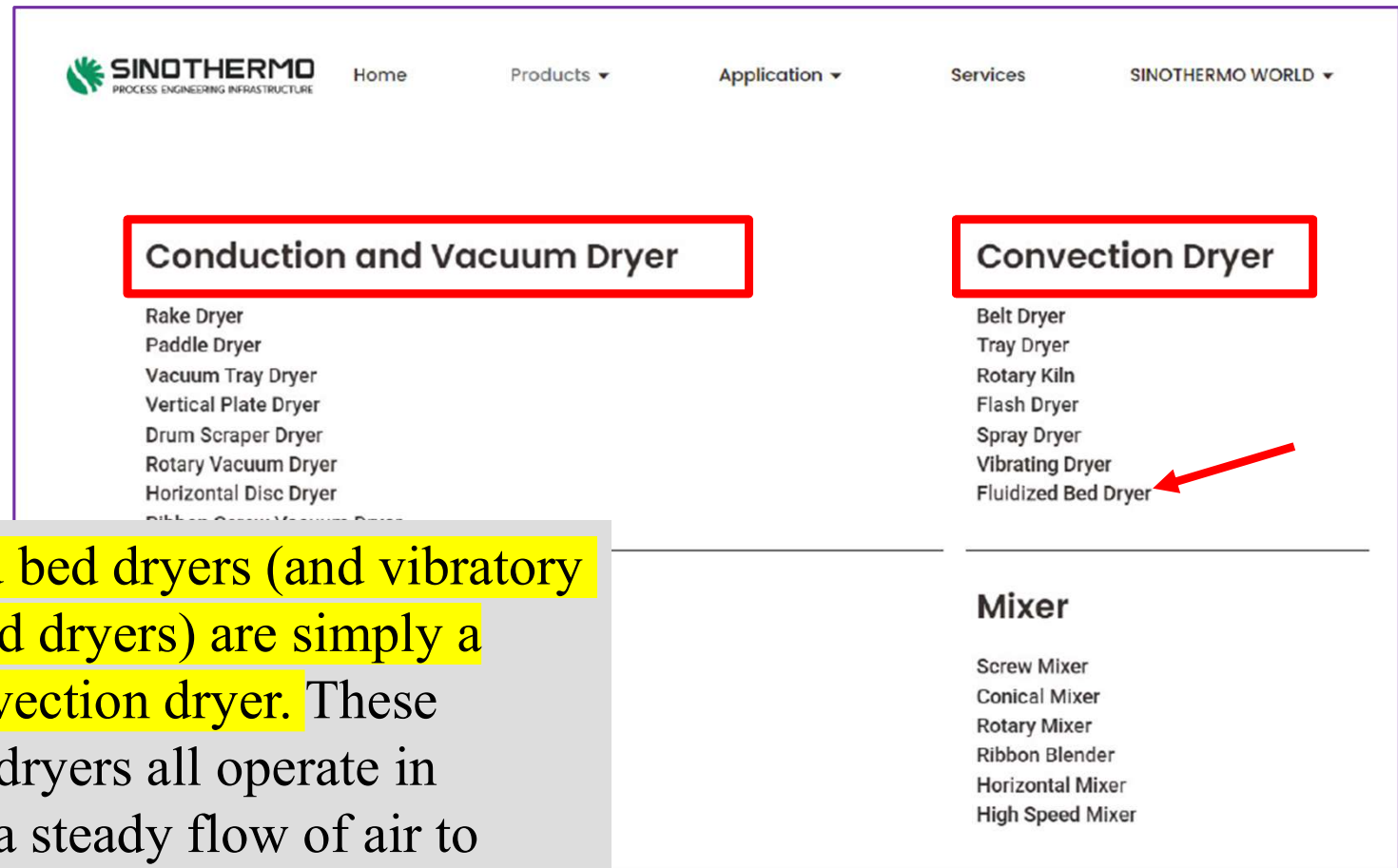
dryer, confirming that the dryer is likewise not run under vacuum. For

47

Duesenfeld Ex. 2025-048

LithoRec

Convection dryer: distinct from vacuum dryer



“[F]luidized bed dryers (and vibratory fluidized bed dryers) are simply a kind of convection dryer. These convention dryers all operate in reliance on a steady flow of air to drive the drying process.”

Ex. 2025 (Dantam Decl.) at ¶¶ 99.2-99.3 (citing Ex. 2026 (Sinothermo));
Paper 17 (POR) at 17-18 & 33-34

LithoRec

Rotor shredders: not under vacuum

“This brochure depicts the rotors that contain rows of knives that are used to shred materials. *Id.* at 2, 4. The brochure notes that there is an option for a “rotor cooling” design, which circulates chilled water through the rotors. *Id.* at 4. This confirms concerns about overheating. Indeed, there is not a mention of “vacuum” in this detailed brochure.”

Document Destruction
• C&D Waste
• Electric Media
• Nonconforming Product
• Pre-shredding Tissue
• Product Destruction
• Tires
• Wood Scrap

FEATURES & BENEFITS

LOW SPEED HIGH TORQUE, IN-LINE PLANETARY DRIVES
High efficiency reducers ensure maximum transfer of torque to the cutters. Also operates with reduced noise, less down time and ZERO emissions.

BEARING PROTECTION
Protection for the bearings that prevents shredded contaminants and processed materials from reaching the bearings through the use of false walls and seals.

AUTO SHAFT-LOCK SYSTEM
Improves reliability by preventing overfeeding, and protecting against damage from non shreddable objects.

INDIVIDUAL CLEANING FINGERS
Prevents wrapping and materials packing between the cutters, while being easy to remove and adjust.

BUILT TO ORDER
System engineers will work to ensure the shredder and any additional equipment fit seamlessly into your system.

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Ex. 2028-001

V-ECO Series Rotary Shredders

Smart, powerful, versatile - the Vecoplan V-ECO High Performance Rotary Shredder is designed especially for size reduction of difficult industrial materials such as plastics, dunnage, wood scrap, medical waste, municipal waste, furniture parts, pallets, carpet, cardboard and paper.

• Metal
• Municipal Solid Waste
• Plastics
• Product Destruction

NEFITS

• Handle tough to shred and particle size.

• Lower heat and dust generation than high speed shredders

• Self-Cleaning Chamber and screen design

• Removable screens designed per the application ranging from 1/2" to 6"

• Liberates materials for more effective downstream separation

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Ex. 2029-001

“These “shaft shredders” likewise do not operate under vacuum. Exh. 2028 & 2029.”

Ex. 2028 (Amos Dual Shaft Shredder)

Ex. 2029 (Amos Quad Shaft Shredder)

Ex. 2027 (Vecoplan Rotary Shredder)

Ex. 2025 (Dantam Decl.) at ¶¶ 99.1-99.3, 108.1 (citing Exs. 2027-2029);
Paper 17 (POR) at 20; 34 & 36

DEMONSTRATIVE EXHIBIT—NOT EVIDENCE

LithoRec

Rotor shredders/convection dryers: Petitioner's evidence

D. The Dryer of LithoRec Is Not Limited to Vibratory Fluidized Bed Dryers or Continuous Convection Dryers

22. PO's and Mr. Dantam's arguments assume that the dryers disclosed in LithoRec are limited to continuous convection dryers and, more particularly, vibratory fluidized bed dryers, because those are the specific types of dryers mentioned for use with the pilot plant. POR, §§VI-VIII; EX2025, §§VII-X. However, a person of ordinary skill would not have considered the teaching of LithoRec to be limited to vibratory fluidized bed dryers or continuous convection dryers.

23. In the development of the pilot plant, the authors of LithoRec created a process chain for the pilot plant and the equipment that could be installed in the g

Non-responsive

**Ex. 1023 (Spies Decl.) at ¶¶ 22-39;
Paper 22 (Petitioner's Reply) at 21;
Paper 31 (PO's Sur-reply) at 9**

Rotor shredders: Petitioner's evidence

32. In addition, LithoRec teaches that the longer work cycle can be accommodated when LithoRec discloses “Whereas conventional rotor shredders only work continuously in a throughput, the cross-flow shredders are operated in sets. This batch operation allows the duration and intensity of the load (rotor speed) to be optimally adapted to the desired degree of digestion.” EX1016, 226.

Ex. 1023 (Spies Reply Decl.) at ¶ 32; Paper 31 (PO's Sur-reply) at 9

LithoRec

Petitioner: identifies dryers not in LithoRec

“36. Also, vacuum drying is not exclusive to batch drying. Continuous dryers have also been implemented for vacuum drying. One example is provided in EX1029, 1-2. This is a brochure from a company called Draiswerke GmbH in Germany.”

2033 Boiling point of EMC

IV. RESPONSE TO CERTAIN ARGUMENTS RAISED BY VANI DANTAM

“37. ... But as is easily confirmable via a simple Google search, continuous vacuum dryers have been commercially available from Gebrüder Lödige GmbH, AVA GmbH & Co. KG (nowadays BHS-Sonthofen GmbH, which is my current employer), Bachiller, Barcelona, B&P Littleford, and 3V Tech for years, and they have been used in a broad array of industrial applications.”

drying temperature can be kept low.” EX1016, 226.

Ex. 1023 (Spies Reply Decl.) at ¶¶ 36-37; Paper 22 (Petitioner’s Reply) at 10

DEMONSTRATIVE EXHIBIT—NOT EVIDENCE

Objection: Untimely Evidence

Evidence presented for the first time on reply:

“Petitioner may not submit new evidence or argument in reply that it could have presented earlier”

Consolidated Trial Practice Guide at 73.

“It is of the utmost importance that petitioners in the IPR proceedings adhere to the requirement that the initial petition identify ‘with particularity’ the ‘evidence’ that supports the grounds for the challenge to each claim.’ 35 U.S.C. § 312(a)(3).

Intelligent Bio-Sys., Inc. v. Illumina Cambridge Ltd.,
821 F.3d 1359, 1369-1370 (Fed. Cir. 2016).

LithoRec

LithoRec at page 98: electrolyte recovery experiment

“LithoRec discloses that during their investigation into the treatment and recovery of electrolytes, vacuum drying was employed to evaporate electrolyte solvents under vacuum (“The electrolyte contained in the separator/electrode composite is removed at an elevated temperature in a vacuum.”). EX1016, 98.”

IV. RESPONSE TO CERTAIN ARGUMENTS RAISED BY VANI DANTAM

A. LithoRec

7 PO asserts that LithoRec only discloses a conventionalized system for

“A person of ordinary skill would also understand that the drying of the battery material under vacuum would inactivate (as defined in the ‘097 patent) the battery material because LithoRec describes using vacuum drying technology to remove at least one electrolyte from the battery material. EX1016, 98.”

3

Ex. 1023 (Spies Reply Decl.) at ¶¶ 8-9; Paper 22 (Petitioner’s Reply) at 6);
Paper 31 (PO’s Sur-reply) at 5 -6 & 21

LithoRec

Spies: cited source

Q. Okay. So what are they actually doing in -- on page 98 of LithoRec?

Spies. There's a measuring curve to conduct --decomposition of conducting salts and some --

Q. Did you ever read this paragraph before?

Spies. Hmm?

Q. Did you ever --

Spies. I've read it before, but it's -- yes, I've read this document, but it's a long time ago, so please excuse I'm not 100 percent --

Q. When did you last read this document?

Spies. This document -- this time --

Q. Well, this page, when did you last read this page?

Spies. I can't recall exactly. Maybe a year ago. I don't know.

Q. Okay. So was it maybe a year ago that you last read this page?

Spies. Maybe, maybe longer. I don't know. I can't recall.

LithoRec

Spies: cited source

Page 37

1 THE WITNESS: Exactly, that's the case.

2 BY MR. CARLSON:

Q. Did you look at page 98 of LithoRec when you prepared this reply declaration in May 2025?

A. As I said, I can't tell you when I had a last look at this LithoRec page over there. I can't remember.

14 last look at this LithoRec page over there. I can't
15 remember.

16 Q. If you had -- well, what's your best
17 recollection of the last time you saw page 98 of
18 LithoRec?

19 MR. ROBERTS: Objection. Asked and
20 answered. He can't remember.

21 THE WITNESS: That's the case. I don't
22 recall when I last looked at that page.

23 BY MR. CARLSON:

24 Q. Did you look at page 98 of LithoRec when
25 you wrote your declaration?

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**Ex. 2061 (Spies Depo.) at 37:11-15;
Paper 31 (PO's Sur-reply) at 6**

GROUND 3: CLAIMS 12-13, 15-16 & 18-19 ARE NOT ANTICIPATED BY LITHOREC

GROUND 3

Claim 12:

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

s

GROUND 3: Vacuum Installation

LithoRec: no vacuum installation disclosed

“Although LithoRec is silent regarding the device that produces the vacuum for the dryer, a POSITA would understand that the battery processing installation of LithoRec includes the “vacuum installation” recited in claim 12.”

Paper 1 (Petition) at 47

“Petitioner admits that ‘LithoRec is silent regarding the device that produces the vacuum for the dryer.’ See Pet. at 47. I agree—there is no vacuum installation disclosed in LithoRec that generates a vacuum in the drying device. See *supra* at ¶94.



Ex. 2025 (Dantam Decl.) at ¶ 149; Paper 17 (POR) at 16

Ground 3: Vacuum Installation

Admission: no vacuum installation in LithoRec

“Q. Turning back to Exhibit 1016, is there a disclosure of a vacuum installation? And, in particular, I've referenced the section from page 222 to roughly 230.

Spies. Not to the best of my memory, no.

Ex. 2061 (Spies Depo.) at 61:13-17;
Paper 17 (POR) at 16

Ground 3: Vacuum Installation

Anticipation

“Kennametal does not permit the Board to fill in missing limitations simply because a skilled artisan would immediately envision them.”

Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co., Ltd.,
851 F.3d 1270, 1274-75 (Fed. Cir. 2017)
(citing *Kennametal, Inc. v. Ingersoll Cutting Tool Co.*,
780 F.3d 1376, 1381 (Fed. Cir. 2015))

Ground 3: Vacuum Installation

Anticipation: elements arranged as in the claim

“To anticipate, the reference ‘must not only disclose all elements of the claim within the four corners of the document, but must also disclose those elements ‘arranged as in the claim.’”

Sanofi–Synthelabo v. Apotex, Inc., 550 F.3d 1075, 1083 (Fed. Cir. 2008)
(citing to *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1369 (Fed.Cir.2008))

Ground 3: Vacuum Installation

Board: vacuum installation

“Patent Owner is correct that LithoRec discloses the use of a vibratory fluidized bed dryer and a blower, and Vani Dantam, Patent Owner’s declarant, testifies that such a dryer and blower set up would not operate under a vacuum. ... To the extent that Dantam is correct that a vibratory fluidized bed dryer cannot be operated under a vacuum, given LithoRec’s teaching that drying under a vacuum is favorable, we are not persuaded that the present record limits LithoRec’s disclosure to the use of vibratory fluidized bed dryers. We invite parties to develop the record on this question more fully at trial.”

Paper 10 (Institution Decision) at 14

Ground 3: Vacuum Installation

Other disclosed instrumentalities

“LithoRec discloses the use of “[c]onvection dryers” and “[s]low or high speed rotor shredders” in addition to vibratory fluidized bed dryers and cross-flow hoggers.”

**Institution Decision at 11
(citing Ex. 1016 at 226)**

“Convection dryers are simply a broader category of dryers that operate with airflow being a driving force to make the drying process work. Vibratory fluidized bed dryers are simply one kind of convection dryers.”

“In my experiences I have worked with about ten rotor shredders, and none of them were under vacuum.”

Ground 3: Vacuum Installation

Convection dryer: distinct from vacuum dryer

[Home](#)[Products ▾](#)[Application ▾](#)[Services](#)[SINOTHERMO WORLD ▾](#)

Conduction and Vacuum Dryer

- Rake Dryer
- Paddle Dryer
- Vacuum Tray Dryer
- Vertical Plate Dryer
- Drum Scraper Dryer
- Rotary Vacuum Dryer
- Horizontal Disc Dryer

Convection Dryer

- Belt Dryer
- Tray Dryer
- Rotary Kiln
- Flash Dryer
- Spray Dryer
- Vibrating Dryer
- Fluidized Bed Dryer

“[F]luidized bed dryers (and vibratory fluidized bed dryers) are simply a kind of convection dryer. These convention dryers all operate in reliance on a steady flow of air to drive the drying process.”

Mixer

- Screw Mixer
- Conical Mixer
- Rotary Mixer
- Ribbon Blender
- Horizontal Mixer
- High Speed Mixer

Ex. 2025 (Dantam Decl.) at ¶¶ 99.2-99.3
(citing Ex. 2026 (Sinothermo));
Paper 17 (POR) at 17-18 & 33-34

Ground 3: Vacuum Installation

Rotor shredders: not under vacuum

“This brochure depicts the rotors that contain rows of knives that are used to shred materials. *Id.* at 2, 4. The brochure notes that there is an option for a “rotor cooling” design, which circulates chilled water through the rotors. *Id.* at 4. This confirms concerns about overheating. Indeed, there is not a mention of “vacuum” in this detailed brochure.”

- C&D Waste
- Electric Media
- Nonconforming Product
- Pre-shredding Tissue
- Product Destruction
- Tires
- Wood Scrap

FEATURES & BENEFITS

LOW SPEED HIGH TORQUE, IN-LINE PLANETARY DRIVES
High efficiency reducers ensure maximum transfer of torque to the cutters. Also operates with reduced noise, less down time and ZERO emissions.

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Protection for the bearings that prevents shredded contaminants and processed materials from reaching the bearings through the use of false walls and seals.

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Improves reliability by preventing overfeeding, and protecting against damage from non shreddable objects.

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BUILT TO ORDER
System engineers will work to ensure the shredder and any additional equipment fit seamlessly into your system.

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IPR2024-00887
Ex. 2028-001

“These “shaft shredders” likewise do not operate under vacuum. Exh. 2028 & 2029.”

V-ECO Series Rotary Shredders

Smart, powerful, versatile - the Vecoplan V-ECO High Performance Rotary Shredder is designed especially for size reduction of difficult industrial materials such as plastics, dunnage, wood scrap, medical waste, municipal waste, furniture parts, pallets, carpet, cardboard and paper.

- Municipal Solid Waste
- Plastics

IFITS

Idle size

Idle size

Lower heat and dust generation than high speed shredders

Self-Cleaning Chamber and screen design

Removable screens designed per the application ranging from 1/2" to 6"

Liberates materials for more effective downstream separation



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Ex. 2029-001

Ex. 2028 (Amos Dual Shaft Shredder)

Ex. 2029 (Amos Quad Shaft Shredder)

Ex. 2027 (Vecoplan Rotary Shredder)

DEMONSTRATIVE EXHIBIT—NOT EVIDENCE

Ex. 2025 (Dantam Decl.) at ¶¶ 99.1-99.3; 108.1 (citing Ex. 2027-2029); Paper 17 (POR) at 20; 34 & 36

Ground 3: Vacuum Installation

Convection dryers: Petitioner's evidence

D. The Dryer of LithoRec Is Not Limited to Vibratory Fluidized Bed Dryers or Continuous Convection Dryers

22. PO's and Mr. Dantam's arguments assume that the dryers disclosed in LithoRec are limited to continuous convection dryers and, more particularly, vibratory fluidized bed dryers, because those are the specific types of dryers mentioned for use with the pilot plant. POR, §§VI-VIII; EX2025, §§VII-X. However, a person of ordinary skill would not have considered the teaching of LithoRec to be limited to vibratory fluidized bed dryers or continuous convection dryers.

23. In the development of the pilot plant, the authors of LithoRec created a process chain for the pilot plant and then explored the different types of equipment that could be installed in the general layout. EX1016, 222-1

Non-responsive

**Ex. 1023 (Spies Reply Decl.) at ¶¶ 22-39;
Paper 22 (Petitioner's Reply) at 21;
Paper 31 (PO's Sur-reply) at 9**

GROUND 3: Inactivation

Inactivation: Petitioner's evidence for anticipation

"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. 1016 (LithoRec) at 226;
Paper 22 (Petitioner's Reply) at 8

"When handling electrolyte, consisting of highly flammable and sometimes irritating solvents, e.g. mixtures of diethyl carbonate, dimethyl carbonate and ethylene carbonate, as well as the conductive salt lithium hexafluorophosphate, safety measures such as wearing protective clothing, safety goggles, butyl rubber gloves and processing under a suitable fume hood must be taken."

EX. 1016 (LithoRec) at 100;
Paper 22 (Petitioner's Reply) at 17

GROUND 3: Inactivation

Claim construction governs the “inactivation” dispute

Patent Owner: “ordinary meaning, which is to render safe for transport”

Paper 17 (POR) at 9

V.

Petitioner: “the removal of at least one solvent in the conducting salt such that dimethyl carbonate [DMC] and/or ethyl methyl carbonate [EMC] is removed from the comminuted material results in inactivated material.”

Paper 22 (Petitioner’s Reply to the POR) at 2

Ground 3: Inactivation

Inactivation: LithoRec not configured to inactivate

- Machine selection Pre-shredding

The Li-Ion batteries currently on the market use various mixtures of solvents as electrolytes, which are flammable even at room temperature and form explosive vapor mixtures. Under certain circumstances, mechanical stress and/or short circuits occurring in the cells can trigger an exothermic reaction of the active mass, which takes place with the release of oxygen. As no thermal pre-treatment (pyrolysis) is performed prior to processing, pulping must be performed under inert conditions.

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. Slow or high-speed rotor shredders (e.g. hammer shredders) or the so-called cross-flow shredders - QZ - appear to be suitable.

The pre-shredding should cause the cell housings (sheet steel, sheet aluminum or foil) to break open and ideally already lead to an extensive separation of the active mass from the arrester foils.

With conventional rotor shredders, the degree of digestion can only be influenced by selecting a suitable grate that limits the size of the discharge unit. However, the grate gap width is limited downwards by the dimensions of the largest non-crushable components in the accumulator. Whereas conventional rotor shredders only work continuously in a throughput, the cross-flow shredders are operated in sets. This batch operation allows the duration and intensity of the load (rotor speed) to be optimally adapted to the desired degree of digestion. While slow-running rotor shredders tend to produce coarse, poorly broken down shredded products, it can be assumed that fast-running machines will deliver well broken down products.

The choice of a suitable pre-shredding unit fell on a MEWA QZ1200 cross-flow shredder, taking into account the above criteria. Another advantage of the QZ is that it is very easy to operate under inert conditions thanks to its completely closed process chamber. Cross-flow shredders from MEWA are already in use in various recycling applications, also with a closed nitrogen circuit.

Whether the QZ will be able to open all future types of battery cells (e.g. stainless steel sheet housings > 1 mm sheet thickness - GAIA cells) must be tested in detail. For planning based on the current state of knowledge, it seems irrelevant which machine is used as the basis for planning.

- Machine selection Drying

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.

Convection dryers are used for drying, as they provide the best drying result for the very inhomogeneous composition of the material. There is also the question of whether drying should also take place in a batch or continuously. 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.

As there is currently no reliable data on the substances contained in the battery cells that would allow drying to be reliably designed, only a rough estimate of drying can be made at this point. The manufacturers of drying systems could not be persuaded to submit an offer under the given circumstances. It is assumed that the necessary process steps (inerting, filling, drying, emptying) of a discontinuously operating dryer require a longer work cycle in total than the pre-shredder. For this reason, batch drying is not used.

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“As there is currently no reliable data on the substances contained in the battery cells that would allow drying to be reliably designed, only a rough estimate of drying can be made at this point. The manufacturers of drying systems could not be persuaded to submit an offer under the given circumstances.”

**Ex 1016 (LithoRec) at 226; Paper 31
(PO's Sur-reply) at 6-8**

Ground 3: Inactivation

Petitioner: LithoRec process → inconsistent drying

“For example, a POSITA would understand that batch drying offers better control of drying, while continuous drying is used when drying consistency is not necessary. EX1039, 21:14-23.”

**Paper 25 (Petitioner’s Opposition to PO’s Motion to Amend) at 8;
Paper 17 (POR) at 24 & 42)**

Ground 3: Inactivation

LithoRec process: inconsistent drying

“The materials exiting the dryer would be a mix of shredded battery materials—some more wet, some more dry. *See supra* at ¶¶ 119-120. LithoRec does not provide for any mechanism that would ensure that the material exiting the system would be completely dry (*i.e.*, inactivated).”

Ex. 2025 (Dantam Decl.) at ¶ 160; Paper 17 (POR) at 24 & 42)

- “Thus, freshly shredded material is mixed with material that is partially dry.”
- “Lithium-ion batteries typically contain a mix of solvents. Some evaporate at a lower temperature, others at a higher temperature.”
- “Depending on the degree of fluidization in the bed, the newly-entered materials may tumble together with the materials that had been in the dryer already. It would be difficult to design this system such that material exiting the dryer is fully inactivated for subsequent safe for transport.”

Ex. 2025 (Dantam Decl.) at ¶¶ 119 & 160; Paper 17 (POR) at 24 & 42)

Ground 3: Inactivation

Inherent anticipation:

“Inherent anticipation requires that the missing descriptive material is ‘necessarily present,’ not merely probably or possibly present, in the prior art.”

Trintec Inds., Inc. v. Top-U.S.A. Corp., 295 F.3d 1292, 1295 (Fed. Cir. 2002) (citing cases)

Ground 3: Inactivation

Spies: LithoRec system does not guarantee safe product

Spies: If you go to a continuous systems, you get a distribution of particle sizes there, some particles which pass the dryer faster than others. So that's statistics. Goals distribution.

Q: And what would be the problem if certain particles pass through the continuous system faster than others?

Spies: The problem is that they may not be dried enough, not be dry enough, so -- and the final moisture you need to have in order to have a safe product is not guaranteed.

Ex. 2061 (Spies Depo.) at 30:22-31:7;
Paper 31 (PO's Sur-reply) at 3

Ground 3: Inactivation

LithoRec: Distillation experiment did not remove LiPF_6

B.2.3 Process development of a suitable distillation process for electrolyte recovery

In AS B.2.3, central attention is paid to the recovery of the valuable lithium salts of the electrolyte. In a first step, the IPC-WWU is establishing a distillation process for gentle distillation of the electrolyte for this purpose. The FRZ is testing the establishment of the distillation process in practice and is recovering the first electrolyte liquids using a suitable liquid separation method to be selected and installed. The selection and suitability of the device to be procured is based on the results of the IPC-WWU. The electrolyte contained in the separator/electrode composite is removed at an elevated temperature in a vacuum, collected in a cold trap and recovered by distillation. The distillation process to be developed by the IPC-WWU and the subsequent recrystallization are to be examined by FRZ for technical feasibility with the aid of condensate separators for collecting the liquids. The different

■ ■ ■

The distillation results showed that the conductive salt was still present in all fractions. The investigations were performed using inductively coupled plasma with optical emission spectroscopy.

■ ■ ■

The distillation process for electrolyte recovery must therefore be examined more closely and suitable alternatives sought in parallel. Extraction with supercritical CO_2 offers a promising alternative and initial tests within the project were very promising.

Ex. 1016 (LithoRec) at 98-99; Ex. 1023 (Spies Reply Decl.) at ¶¶9; Paper 22 (Petitioner's Reply to POR) at 6-7; 14-15 & 23; Paper 31 (PO's Sur-reply) at 5-6 & 21

DEMONSTRATIVE EXHIBIT—NOT EVIDENCE

Ground 3: Inactivation

LithoRec distillation experiment: not comminuted material

Some cells were deep-discharged to check for any copper deposits on the cathode. Using ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry), no copper could be detected in the corresponding materials. The discharged cell is then inserted into a glove box. For the further dismantling of the cell, it is important to remove the conductive salt present in the cell as completely as possible, especially with regard to safety aspects and the processing of the electrolyte. For this purpose, approx. 25 ml of dimethyl carbonate is injected using a cannula. The injected dimethyl carbonate is distributed by moving the cell (15 minutes). The solution can then be drawn off with a syringe and transferred to airtight sample containers for further work steps. Once the cell has been ejected, it can be opened using a suitable tool.



Figure B-18: Electrode stack (IPC-WWU)

Ex. 1016 (LithoRec) at 96-97;
Ex. 2061 (Spies Depo.) at 38:19 – 41:18; Ex.
1023 (Spies Reply Decl.) at ¶¶ 8-9;
Paper 22 (Petitioner's Reply to POR) at 6-7
Paper 31 (PO's Sur-reply) at 5-6

Ground 3: Inactivation

Anticipation: requires complete and operative invention

“Patented inventions cannot be superseded by the mere introduction of a foreign publication of the kind, though of prior date, unless the description and drawings contain and exhibit a substantial representation of the patented improvement, in such full, clear, and exact terms as to enable any person skilled in the art or science to which it appertains, to make, construct, and practice the invention Mere vague and general representations will not support such a defence.... Whatever may be the particular circumstances under which the publication takes place, the account published, to be of any effect to support such a defence [of anticipation], must be an account of a complete and operative invention capable of being put into practical operation.”

Seymour v. Osborne, 78 U.S. 516, 555 (1870)

Ground 3: Inactivation

Anticipation: prior art must be enabling

“To serve as an anticipating reference, the reference must enable that which it is asserted to anticipate. ‘A claimed invention cannot be anticipated by a prior art reference if the allegedly anticipatory disclosures cited as prior art are not enabled.’”

Elan Pharms., Inc. v. Mayo Found. for Med. Educ. & Rsch., 346 F.3d 1051, 1054 (Fed. Cir. 2003)
(quoting *Amgen Inc. v. Hoechst Marion Roussel, Inc.*, 314 F.3d 1313, 1354 (Fed. Cir. 2003))

“Long ago our predecessor court recognized that a non-enabled disclosure cannot be anticipatory (because it is not truly prior art) if that disclosure fails to ‘enable one of skill in the art to reduce the disclosed invention to practice.’”

Amgen, 314 F.3d at 1354 (citing *In re Borst*, 52 C.C.P.A. 1398, 345 F.2d 851, 855 (C.C.P.A.1962) & *In re Donohue*, 766 F.2d 531, 533 (Fed. Cir. 1985))

LITHOREC IS NOT AN ENABLING REFERENCE

Enablement: Legal Framework

- Burden of proof on Petitioner
35 U.S.C. § 316(e)
- Prior art must be enabling, for both §§ 102 & 103
Impax Lab'ys, Inc. v. Aventis Pharms., Inc., 545 F.3d 1312, 1314 (Fed. Cir. 2008)
Raytheon Techs. Corp. v. General Elec. Co., 993 F.3d 1374, 1380 (Fed. Cir. 2021)
- No presumption of enablement for non-patent literature
unconsidered by Examiner
C.f., Amgen Inc. v. Hoechst Marion Roussel, Inc., 457 F.3d 1293, 1307 (Fed. Cir. 2006);
In re Antor Media Corp., 689 F.3d 1282, 1288 (Fed. Cir. 2012)
- Burden shifts to challenger upon showing of non-enablement
Forest Lab'ys, Inc. v. Ivax Pharms., Inc., 438 F.Supp.2d 479, 487 n.3 (D. Del. 2006),
aff'd 501 F.3d 1263 (Fed. Cir. 2007)

Enablement: Legal Standard

Research plan insufficient to enable

“Tossing out the mere germ of an idea does not constitute enabling disclosure.”

Enzo Biochem, Inc. v. Calgene, Inc., 188 F.3d 1362, 1374 (Fed. Cir. 1999) (quoting *Genentech, Inc. v. Novo Nordisk, A/S*, 108 F.3d 1361, 1366 (Fed. Cir. 1997))

“Thus, the reference explains that the authors had not achieved a touchscreen employing transparent electrodes. The only discussion of transparent electrodes appears under the ‘Conclusions and Directions for Future Work’ section, in which the authors explain that they were interested in future ‘research directions.’”

Apple Inc. v. Int’l Trade Comm’n, 725 F.3d 1356, 1364 (Fed. Cir. 2013)
(finding no enablement of prior art non-patent publication)

Undue Experimentation

Wands factors: 2 (“the amount of direction or guidance present”) and 3 (“the presence or absence of working examples”)

Q. Is there anything on this figure [G-1] that would suggest that it is a vacuum process?

Spies. It's just -- it's the typical way how you design such a system. It's an overall functional diagram which tells you it needs a drying process, a drying –

Q. Okay. But is there anything on here that suggests that there's actually a vacuum present?

Spies. No.

Ex. 2061 (Spies Depo.) at 51:18-52:1;
Paper 31 (PO's Sur-reply) at 5

“Q. Turning back to Exhibit 1016, is there a disclosure of a vacuum installation?

And, in particular, I've referenced the section from page 222 to roughly 230.

Spies. Not to the best of my memory, no.

Ex. 2061 (Spies Depo.) at 61:13-17;
Paper 31 (PO's Sur-reply) at 5

Enablement

***Wands* factors: 4 (“nature of the invention”) & 7 (“the predictability or unpredictability of the art”)**

- “high level of uncertainty” in obtaining batteries and “different chemical compositions of the battery variants”
Ex. 1016 (LithoRec) at 8; Paper 31 (PO’s Sur-reply) at 10-11
- “danger posed by defective batteries”
Ex. 1016 (LithoRec) at 33; Paper 31 (PO’s Sur-reply) at 10-11
- “Due to the high reactivity of the electrolyte salt to water (humidity) and the associated difficulty and costly handling when opening the cells, safe operating concepts must be developed as a first step.”
Ex. 1016 (LithoRec) at 96; Paper 31 (PO’s Sur-reply) at 10-11

See also Ex. 2061 (Spies Depo.) at 10:25-19:12; 28:3-29:22
(discussing the various hazards of the battery recycling process);
Paper 31 (PO’s Sur-reply) at 9-10

Undue Experimentation

***Wands* factors: 4 (“nature of the invention”) & 7 (“the predictability or unpredictability of the art”)**

Q. So are there well-known issues of combustibility and flammability with recycling plants?

Spies. Yes, I mean, we are dealing with flammable substances in that plant, and they are with low boiling points, so it's essential to design a system which is safe for operation, and you have to deeply look into that topic to design a safe system.

Q. What do you mean, deeply look into the topic?

Spies. It means you have to analyze the chemistry which is behind this – the thermodynamics related to this – to the unit operations.

Q. What do you mean by that?

Spies. It means, especially when you're operating on the flammable substances, inertization is always a topic that needs to be guaranteed that at every point in time, you have a nitrogen atmosphere in order to avoid combustible situations.

Ex. 2061 (Spies Depo.) at 10:25-11:18; Paper 31 (PO's Sur-reply) at 9-10

Undue Experimentation

***Wands* factors: 4 (“nature of the invention”) & 7 (“the predictability or unpredictability of the art”)**

Q. What kind of hazards are there in a battery recycling plant?

Spies. The kind of hazards. Oh, you have a lot of -- many kinds of hazards. There's hazards for health because we are dealing with sometimes things which are -- which can cause cancer, and the cathode material, there's cancerous substances included, there's explosion issues, and, of course, work safety. You're dealing with temperatures, so it's not the type of plant which is straightforward and easy.

Ex. 2061 (Spies Depo.) at 12:4-16 (objection omitted);
Paper 31 (PO's Sur-reply) at 9-10

Undue Experimentation

***Wands* factor: 5 (“the state of the prior art”)**

Q. Are you aware of any prior art that recognized that you could inactivate shredded battery material by vacuum drying alone?

Spies. At the moment, I can't mention it, that one.

Q. Did any come to mind?

Spies. Sorry?

Q. Does anything come to mind?

Spies. Not at the moment, no. Maybe it's too late already for me.

Ex. 2061 (Spies Depo.) at 95:19-96:3; Paper 31 (PO's Sur-reply) at 10

Undue Experimentation

***Wands* factor 6: “the relative skill of those in the art”**

Agreed level of skill: 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 experience in the recycling or processing of lithium-ion batteries.

Ex. 1003 (Spies Decl.) at ¶¶ 62-63 & Ex. 2025 (Dantam Decl.) at ¶ 17

Undue Experimentation

***Wands* factor 6: “the relative skill of those in the art”**

Spies’ colleagues: “normally have a masters degree or a PhD”

Ex. 2061 (Spies Depo.) at 21:6-8; Paper 31 (PO’s Sur-reply) at 9-10

Q. So if you had someone with a bachelor's degree in, let's say, chemical engineering or mechanical engineering and who had been in the field for a couple years, two to three years, for example, how much guidance would they need in order to develop a vacuum drying system to dry shredded battery material?

Spies. Developing such a system is always --there's always teamwork, so you don't – normally you don't do it by yourself.

Ex. 2061 (Spies Depo.) at 70:14-23; Paper 31 (PO’s Sur-reply) at 9-10

Enablement: Board Instruction

IPR2024-00887
Patent 11,050,097 B2

vibratory fluidized bed dryer,” as well as with the recommended “cross-flow

fluidized bed dryers and cross-flow hoggers. Ex. 1016, 226. Thus, on the present record, we are not persuaded that LithoRec is limited to the use of vibratory fluidized bed dryers and cross-flow hoggers in the way that Patent Owner argues it is. Because the only non-enablement arguments in the present record are based on the difficulty of vacuum drying using a vibratory fluidized bed dryer and a cross-flow hogger attached to the same nitrogen circuit, we are not persuaded that there is a sufficient question of enablement to warrant the denial of institution. We encourage the parties to develop the enablement issue further at trial.

In particular, Patent Owner argues that “[t]here is no mechanism described in LithoRec to ensure that the material exiting the dryer be dried to the point of inactivation.” *Id.* at 49. According to Patent Owner,

11

GROUND 3: CLAIM 13 IS NOT ANTICIPATED BY LITHOREC

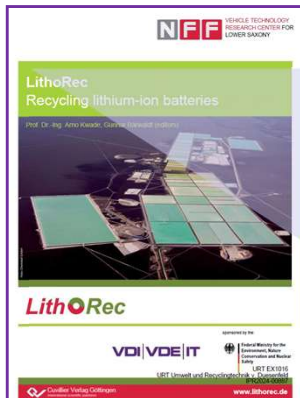
- CLAIM 13 DEPENDS FROM CLAIM 12
- INCORPORATE ARGUMENTS FROM CLAIM 12
- INCORPORATE ARGUMENTS FROM GROUND 1 (CLAIM 2), *INFRA*.

GROUND 4: CLAIM 17 IS NOT OBVIOUS OVER LITHOREC IN VIEW OF HANISCH

- **Claim 17 depends from Claim 12**
- **Incorporate arguments from Ground 3**

GROUND 1: CLAIMS 1-3, 7-8 & 10 ARE
NOT OBVIOUS OVER LITHOREC, DIN
28400, AND PERRY

GROUND 1: LithoRec, DIN 28400, and Perry



LithoRec

Recycling lithium-ion batteries

Final report of the joint project

Ex. 1016 (LithoRec)

DK 621.521 : 533.5 : 001.4

GERMAN STANDARD

May 1990

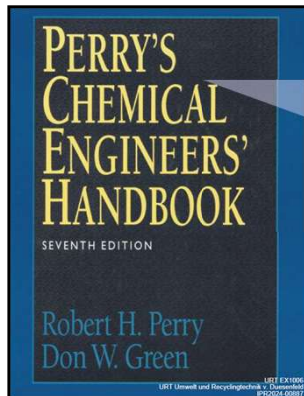
Vacuum technology – Terms and Definitions – General terms

DIN 28 400 Part 1

Replacement for Edition 07.79

In conjunction with International standard ISO 3529-1:1981 published by the International Organization for Standardization (ISO) – see notes.

Ex. 1018 (DIN 28400)



12-44 PSYCHROMETRY, EVAPORATIVE COOLING, AND SOLIDS DRYING

Ex. 1006 (Perry)

Arguments from Ground 3 incorporated

DEMONSTRATIVE EXHIBIT–NOT EVIDENCE

Ground 1 Arguments

	LithoRec	
Inactivation		
300 hPa		<div>DIN 28400  Perry </div>

GROUND 1: Inactivation

- Machine selection Pre-shredding

The Li-ion batteries currently on the market use various mixtures of solvents as electrolytes, which are flammable even at room temperature and form explosive vapor mixtures. Under certain circumstances, mechanical stress and/or short circuits occurring in the cells can trigger an oxygen. As no thermal performed under inert

established in the field of low or high-speed rotor - QZ - appear to be

to break open the arrester foils.

by selecting a suitable limited downwards by. Whereas conventional ers are operated in sets. speed) to be optimally ders tend to produce t-running machines will

be checked for electrical charge and discharged if necessary. When consisting of highly flammable and sometimes irritating solvents, e.g. carbonate, dimethyl carbonate and ethylene carbonate, as well as the um hexafluorophosphate, safety measures such as wearing protective les, butyl rubber gloves and processing under a suitable fume hood must re, sparks must be avoided when opening the cell casings, some of which e, as the highly flammable electrolyte solvent could otherwise ignite.

ear that manual dismantling and thus possible manual dismantling and taking safety measures into account, was not economically viable. As e existing preparation technology was used for a more realistic view of the es.

g of a rotor shear, the separator could be separated by air separation. tion in a cutting mill made it possible to separate approx. 80% by weight ing. To recover the remaining 20%, the findings from the downstream AP d. A complete separation of coating and carrier films by type is thus applications.

LithoRec

Recycling lithium-ion batteries

Prof. Dr.-Ing. Arno Kwade, Gunnar Bärwaldt (editors)



LithoRec

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- LithoRec: Inactivation

battery cells that would made at this point. The offer under the given y, drying, emptying) of a pre-shredder. For this

to third parties.

226

100

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GROUND 1: Inactivation

Inactivation: Petitioner's evidence

“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. 1016 (LithoRec) at 226; Paper 22
(Petitioner's Reply) at 8

“When handling electrolyte, consisting of highly flammable and sometimes irritating solvents, e.g. mixtures of diethyl carbonate, dimethyl carbonate and ethylene carbonate, as well as the conductive salt lithium hexafluorophosphate, safety measures such as wearing protective clothing, safety goggles, butyl rubber gloves and processing under a suitable fume hood must be taken.”

EX. 1016 (LithoRec) at 100;
Paper 22 (Petitioner's Reply) at 17

GROUND 1: Inactivation

Claim 1: Requires Obtaining Comminuted Material

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

Ground 1: Inactivation

Obviousness: research plan insufficient

“Here, however, the teachings set forth in the specifications provide no more than a “plan” or “invitation” for those of skill in the art to experiment practicing antisense in eukaryotic cells; they do not provide sufficient guidance or specificity as to how to execute that plan.”

Enzo Biochem, Inc. v. Calgene, Inc., 188 F.3d 1362, 1374 (Fed. Cir. 1999)

Ground 1: Inactivation

LithoRec process: inconsistent drying

“For example, a POSITA would understand that batch drying offers better control of drying, while continuous drying is used when drying consistency is not necessary. EX1039, 21:14-23.”

Paper 25 (Petitioner’s Opposition to PO’s Motion to Amend) at 8;
Paper 17 (POR) at 24 & 42

Ground 1: Inactivation

LithoRec process: inconsistent drying

“The materials exiting the dryer would be a mix of shredded battery materials—some more wet, some more dry. *See supra* at ¶¶119-120. LithoRec does not provide for any mechanism that would ensure that the material exiting the system would be completely dry (*i.e.*, inactivated).”

Ex. 2025 (Dantam Decl.) at ¶ 160; Paper 17 (POR) at 24 & 42

- “Thus, freshly shredded material is mixed with material that is partially dry.”
- “Lithium-ion batteries typically contain a mix of solvents. Some evaporate at a lower temperature, others at a higher temperature.”
- “Depending on the degree of fluidization in the bed, the newly-entered materials may tumble together with the materials that had been in the dryer already. It would be difficult to design this system such that material exiting the dryer is fully inactivated for subsequent safe for transport.”

Ex. 2025 (Dantam Decl.) at ¶¶ 119 & 160; Paper 17 (POR) at 24 & 42

GROUND 1: Pressure Level

Claim 1: 300 hPa requirement

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

Ground 1: Pressure Level

LithoRec: 300 hPa



“As some of the liquid 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.”



Ground 1: Pressure Level

Petitioner: 300 hPa

Petition for *Inter Partes* Review of U.S. Patent No. 11,050,097
Filed: May 1, 2024

LithoRec discloses general conditions at which drying should occur, including keeping pressures low in order 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 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.

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 in order 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.

DIN 28400 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

25

“LithoRec does not explicitly teach a specific vacuum pressure to be used.”

GROUND 1: Pressure Level

Mr. Spies: no pressure range mentioned

Page 141

1 correct?

2 A. Yes.

3 Q. Is it true, sir, that LithoRec does not

4 specify any particular pressure range under which

5 drying is performed?

6 A. Yes, in this section, there's not a

7 pressure range mentioned, yes, that's correct.

8 Q. Okay. Could you turn to Figure G-1, which

9 I believe we looked at on Friday too. It's on the

10 247th page of the PDF and has the Page Number 230.

11 A. Yes, it's in front of me.

12 Q. Okay. You remember this diagram?

13 A. Yes.

14 Q. And can you see the box labeled "Dryer"?

15 A. Yes.

16 Q. Isn't it true, sir, that this system would

17 need a fan located on the outlet side of the dryer?

18 A. This dryer section, yes, it's -- there's

19 the fan mentioned over there, yes.

20 Q. It would need an additional fan, right, at

21 the outlet, correct?

22 A. Depending on which type of dryer you use,

23 yes.

24 Q. And if it's using a vibratory fluidized

25 bed dryer, would it need a fan at the outlet?

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Q. Is it true, sir, that LithoRec does not specify any particular pressure range under which drying is performed?

Spies. Yes, in this section, there's not a pressure range mentioned, yes, that's correct.

**EX. 2062 (Spies Depo. Vol. 2) at 141:3-7;
Paper 1 (Petition) at 25;
Paper 31 (PO's Sur-reply) at 14**

Ground 1: DIN 28400

DIN 28400: 300 hPa limitation

1 Fundamental concepts, vacuum ranges and units

1.1 Vacuum

Vacuum refers to the state of a gas

1.2 Ideal vacuum

Ideal vacuum within vacuum technology is the state in a compartment in which the number density of molecules is zero

“DIN 28400 is simply a glossary of terms and does not teach any particular application of vacuum drying. DIN 28400 teaches broad characterizations of ranges of vacuum.”

molecules n is

$p = nkT$ (strictly speaking, this formula is only valid for ideal gases)

k = Boltzmann constant

T = thermodynamic temperature

convention. The rounded limits of these ranges are listed in Table 1 in pressures or equivalent number density of molecules. The stated number densities of molecules apply for a temperature of $t = 20^\circ\text{C}$.

Table 1. **Ranges of vacuum**

Symbol	Unit	Rough (low) vacuum	Medium vacuum	High vacuum HV	Ultra-high vacuum UHV
p	Pa	$1 \cdot 10^5$ to $1 \cdot 10^2$	$1 \cdot 10^2$ to $1 \cdot 10^{-1}$	$1 \cdot 10^{-1}$ to $1 \cdot 10^{-5}$	$< 1 \cdot 10^{-5}$
p	mbar	$1 \cdot 10^3$ to 1	1 to $1 \cdot 10^{-3}$	$1 \cdot 10^{-3}$ to $1 \cdot 10^{-7}$	$< 1 \cdot 10^{-7}$
n	m^{-3}	$2.5 \cdot 10^{25}$ to $2.5 \cdot 10^{22}$	$2.5 \cdot 10^{22}$ to $2.5 \cdot 10^{19}$	$2.5 \cdot 10^{19}$ to $2.5 \cdot 10^{15}$	$< 2.5 \cdot 10^{15}$

Ground 1: DIN 28400

DIN 28400: no guidance as to pressure selection

1 Fundamental concepts, vacuum ranges and units

1.1 Vacuum

Vacuum refers to the state of a gas

when the pressure of the gas, and thus the number density of molecules, in a container is lower than outside, or

when the pressure of the gas is lower than 300 mbar, i.e. lower than the lowest atmospheric pressure on the Earth's surface.

Note: the correlation between pressure p and number density of molecules n is

$p = nkT$ (strictly speaking, this formula is only valid for ideal gases)

k = Boltzmann constant

T = thermodynamic temperature

1.2 Ideal vacuum

Ideal vacuum within vacuum technology is the state in a compartment in which the number density of molecules is zero (previously referred to as "absolute vacuum").

1.3 Ranges of vacuum

Ranges of vacuum are ranges of pressures or number densities of molecules into which the vacuum is subdivided according to convention. The rounded limits of these ranges are listed in Table 1 in pressures or equivalent number density of molecules. The stated number densities of molecules apply for a temperature of $t = 20^{\circ}\text{C}$.

"DIN 28400 does not provide any direction as to what range of vacuum would be appropriate for particular applications. There is no mention of drying of shredded EV batteries. A person of skill in the art, looking to develop a vacuum drying system, would find no teachings in DIN 28400 as to how to select an appropriate range of vacuum pressure."

Ground 1: DIN 28400

“300 mbar” in DIN 28400: Mount Everest

1.1 Vacuum

Vacuum refers to the state of a gas when the pressure of the gas, and thus the number density of molecules, in a container is lower than outside, or when the pressure of the gas is lower than 300 mbar, i.e. lower than the lowest atmospheric pressure on the Earth's surface.

Note: the correlation between pressure p and number density of molecules n is

$p = nkT$ (strictly speaking, this formula is only valid for ideal gases)

k = Boltzmann constant

T = thermodynamic temperature

Ex. 1018 at Section 1.1.

DIN 28400: “lowest atmospheric pressure on the Earth's surface.”

1 DIN 28400 Part 1, Section 1.1

ISO Standard: “The prevailing atmospheric pressure on ground depends on weather conditions and altitude and ranges from 31 kPa (altitude of the Mount Everest, weather condition ‘low’) up to 110 kPa (altitude Dead Sea, weather condition ‘high’).”

Ex. 2019 at 1, Section 3.1.2, n.2

See also, Ex. 2025 (Dantam Decl.) at ¶135;
Paper 31 (PO's Sur-reply) at 19-20

Ground 1: DIN 28400

DIN 28400: no motivation to combine

“There would be no motivation for a person of skill in the art to combine the teachings of LithoRec with the reference to “300 hPa” in DIN 28400, because that 300 hPa parameter is applicable only to the prevailing atmospheric pressure in environments such as Mount Everest, inapplicable here.”

“DIN 28400 does not cure LithoRec’s deficiencies. Therefore, a POSITA seeking to determine specifications for drying comminuted battery material would not be motivated to combine LithoRec with DIN 28400.”

Ground 1: Perry

Perry: Vacuum-shelf dryers

12-44 PSYCHROMETRY, EVAPORATIVE COOLING, AND SOLIDS DRYING

A relationship for estimating the surface temperature t_s , based on the use of Eq. (12-47) to determine H_s , is as follows:

$$(H_s - H) = (h_{fg}/\lambda_h)(t_s - t) \quad (12-48)$$

Equation (12-48) can be solved numerically or graphically. Figure 12-47 indicates how H_s and t_s may be determined graphically on a humidity chart by the point of intersection on the saturation-humidity curve of a straight line of slope h_{fg}/λ_h passing through point (H, t) .

Performance Data for Direct-Heat Tray Dryers. A standard two-track dryer is illustrated in Fig. 12-48. Adjustable baffles or a perforated distribution plate is normally employed to develop 0.2 to 1.5 cm of water-pressure drop at the wall through which air enters the track enclosure. This will enhance the uniformity of air distribution, from top to bottom, among the trays. In three (or more) track ovens, air-reheat coils may be placed between tracks if the evaporative load is high. Means for reversing air-flow direction may also be provided in multiple-track units.

Performance data on some typical tray and compartment dryers are tabulated in Table 12-10. These indicate that an overall rate of evaporation of 0.0025 to 0.025 kg water/(m² of tray area) may be expected from tray and track dryers. The thermal efficiency of this type of dryer will vary from 20 to 50 percent, depending on the drying temperature used and the humidity of the exhaust air. In drying to very low moisture contents under temperature restrictions, the thermal efficiency may be in the order of 10 percent. The major operating cost for a tray dryer is the labor involved in loading and unloading the trays. About two labor-hours are required to load and unload a standard two-track tray dryer. In addition, about one-third to one-fifth of a

worker's time is required to supervise the dryer during the drying period. Power for tray and compartment dryers will be approximately 1.1 kW per track in the dryer. Maintenance will run from 3 to 5 percent of the installed cost per year.

BATCH THROUGH-CIRCULATION DRYERS

In one type of batch through-circulation dryer, heated air passes through a stationary permeable bed of the wet material placed on removable screen-bottom trays suitably supported in the dryer. This type is similar to a standard tray dryer except that hot air passes through the wet solid instead of across it. The pressure drop through the bed of material does not usually exceed about 2 cm of water. In another type, deep perforated bottom trays are placed on top of plenum chambers in a closed-circuit hot-air-circulating system. In some food-drying plants, the material is placed in finishing bins with perforated bottoms; heated air passes up through the material and is removed from the top of the bin, reheated, and recirculated. The latter types involve a pressure drop through the bed of material of 1 to 5 cm of water at relatively low air rates. Table 12-11 gives performance data on three applications of batch through-circulation dryers. Batch through-circulation dryers are restricted in application to granular materials that permit free flow-through circulation of air. Drying times are usually much shorter than in parallel-flow tray dryers.

Design methods are included in the subsection "Continuous Through-Circulation Dryers."

Vacuum-Shelf Dryers. Vacuum-shelf dryers are indirect-heated batch dryers consisting of a vacuumtight chamber usually constructed of cast iron or steel plate, heated, supporting shelves within the chamber, a vacuum source, and usually a condenser. One or two doors are provided, depending on the size of the chamber. The doors are sealed with resilient gaskets of rubber or similar material (Fig. 12-49).

Hollow shelves of flat steel plate are fastened permanently inside the vacuum chamber and are connected in parallel to inlet and outlet headers. The heating medium, entering through one header and passing through the hollow shelves to the exit header, is generally steam ranging in pressure from 700 kPa gauge to subatmospheric pressure for low-temperature operations. Low temperatures can be provided by circulating hot water, and high temperatures can be obtained by circulating hot oil or Dötherm. Some small dryers employ electrically heated shelves. The material to be dried is placed in pans or trays on the heated shelves. The trays are generally of metal to ensure good heat transfer between the shelf and the tray.

Vacuum-shelf dryers may vary in size from 1 to 24 shelves, the largest chambers having overall dimensions of 6 m wide, 3 m long, and 2.5 m high. Vacuum is applied to the chamber and vapor is removed through a large pipe which is connected to the chamber in a manner such that, if the vacuum is broken suddenly, the rushing air will not greatly disturb the bed of material being dried. This line leads to a condenser where moisture or solvent that has been vaporized is condensed. The noncondensable exhaust gas goes to the vacuum source, which may be a wet or dry vacuum pump or a steam-jet ejector.

Vacuum-shelf dryers are used extensively for drying pharmaceuticals, temperature-sensitive or easily oxidizable materials, and materials so valuable that labor cost is insignificant. They are particularly useful for handling small batches of materials wet with toxic or valuable solvents. Recovery of the solvent is easily accomplished without danger of passing through an explosive range. Dusty materials may be dried with negligible dust loss. Hygroscopic materials may be completely dried at temperatures below that required in atmospheric dryers. The equipment is employed also for freeze-drying processes, for retreating furnace operations, and for the manufacture of semiconductor parts in controlled atmospheres. All these latter processes demand much lower operating pressures than do ordinary drying operations.

Design Methods for Vacuum-Shelf Dryers. Heat is transferred to the wet material by conduction through the shelf and bottom of the tray and by radiation from the shelf itself. The critical moisture content will not be necessarily the same as for atmospheric tray drying [Ernst, Ridgway, and Tiller, *Ind. Eng. Chem.*, 30, 1122 (1938)].

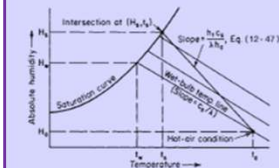


FIG. 12-47 Graphical estimation of surface temperature during constant rate period.

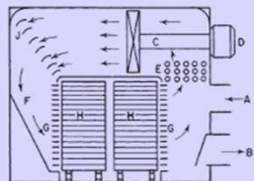


FIG. 12-48 Double-track dryer. (A) Air inlet duct. (B) Air exhaust duct with damper. (C) Adjustable-pitch fan 1 to 15 hp. (D) Fan motor. (E) Fan heaters. (F) Vacuum chamber. (G) Adjustable air-blast nozzles. (H) Tracks and trays. (I) Turning vane.

Ex. 1006 (Perry) at 12-44;
Paper 31 (PO's Sur-reply) at 20;
Paper 17(POR) at 43-44

“Vacuum-Shelf Dryers Vacuum-shelf dryers are indirect-heated batch dryers consisting of a vacuumtight chamber usually constructed of cast iron or steel plate, heated, supporting shelves within the chamber, a vacuum source, and usually a condenser.”

“Hollow shelves of flat steel plate are fastened permanently inside the vacuum chamber and are connected in parallel to inlet and outlet headers.”

“The material to be dried is placed in pans or trays on the heated shelves.”

Ground 1: Perry

Spies: shelf drying teachings inapplicable to drum dryers

Q. Okay. In the -- in the vacuum dryers for battery recycling, is that a shelf dryer?

Spies. No, that's not a shelf dryer, it's a drum dryer.

Q. A drum dryer. What's the difference?

Spies. It's not a shelf dryer because we need some agitation because it's needed some agitation to keep the material moving, and that's the disadvantage of the shelf dryer where materials just laying on the shelf, lying on the shelf, so...

Q. Okay. But when you design a dryer for battery recycling to dry shredded battery material do you look to teachings from vacuum-shelf dryers?

Spies. Normally not, no, no.

Ex 2061 (Spies Depo.) at 67:1-11; *id.* at 67:18-21;
Paper 31 (PO's Sur-reply) at 20

Ground 1: Perry

LithoRec: continuous process, not batch

 VEHICLE TECHNOLOGY
RESEARCH CENTER FOR

“There is also the question of whether drying should also take place in a batch or continuously. 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. As there is currently no reliable data on the substances contained in the battery cells that would allow drying to be reliably designed, only a rough estimate of drying can be made at this point. The manufacturers of drying systems could not be persuaded to submit an offer under the given circumstances. It is assumed that the necessary process steps (inerting, filling, drying, emptying) of a discontinuously operating dryer require a longer work cycle in total than the pre-shredder. For this reason, batch drying is not used.”

VDI|VDE|IT



Federal Ministry for the
Environment, Nature
Conservation and Nuclear
Safety

URT EX1016

URT Umwelt und Recyclingtechnik v. Duesenfeld
IPR2024-00887



Cuvillier Verlag Göttingen
International scientific publisher

www.lithorec.de

Ex 1016 (LithoRec) at 226;
Paper 31 (PO's Sur-reply) at 20;
Paper 17 (POR) at 43-44

Ground 1: Perry

Perry: no combination with continuous process of LithoRec

BATCH THROUGH-CIRCULATION DRYERS

In one type of batch through-circulation dryer, heated air passes through a stationary permeable bed of the wet material placed on removable screen-bottom trays suitably supported in the dryer. This type is similar to a standard tray dryer except that hot air passes through the wet solid instead of across it. The pressure drop through

Ex 1006 (Perry) at 12-44

“Batch drying, as taught by Perry, is fundamentally incompatible with the continuous process drying recommended by LithoRec.”

Ex 2025 (Dantam Decl.) at ¶ 127; Paper 17 (POR) at 43-45

12-44 PSYCHROMETRY, EVAPORATIVE COOLING, AND SOLIDS DRYING

A relationship for estimating the surface temperature t_s , based on the use of Eq. (12-47) to determine h_s , is as follows:

$$(H_s - H) = (h_s C_s / \Delta h_s) (t_s - t_a) \quad (12-48)$$

Equation (12-48) can be solved numerically or graphically. Figure 12-47 indicates how H_s and t_s may be determined graphically on a humidity chart by the point of intersection on the saturation humidity curve of a straight line of slope $h_s C_s / \Delta h_s$ passing through point (H, t_a) .

Performance Data for Direct-Heat Tray Dryers A standard two-truck dryer is illustrated in Fig. 12-48. Adjustable baffles or a perforated distribution plate is normally employed to develop 0.5 to 1.3 cm of water-pressure drop at the wall through which air enters the truck enclosure. This will enhance the uniformity of air distribution, from top to bottom, among the trays. In three (or more) truck ovens, air-reheat coils may be placed between trucks if the evaporative load is high. Means for reversing air-flow direction may also be provided in multiple-truck units.

Performance data on some typical tray and compartment dryers are tabulated in Table 12-10. These indicate that an overall rate of evaporation of 0.0025 to 0.025 kg water/(m²) of tray area may be expected from tray and tray-truck dryers. The thermal efficiency of this type of dryer will vary from 20 to 50 percent, depending on the drying temperature used and the humidity of the exhaust air. In drying to very low moisture contents under temperature restrictions, the thermal efficiency may be in the order of 10 percent. The major operating cost for a tray dryer is the labor involved in loading and unloading the trays. About two labor-hours are required to load and unload a standard two-truck tray dryer. In addition, about one-third to one-fifth of a

worker's time is required to supervise the dryer during the drying period. Power for tray and compartment dryers will be approximately 1.1 kW per truck in the dryer. Maintenance will run from 3 to 5 percent of the installed cost per year.

BATCH THROUGH-CIRCULATION DRYERS

In one type of batch through-circulation dryer, heated air passes through a stationary permeable bed of the wet material placed on removable screen-bottom trays suitably supported in the dryer. This type is similar to a standard tray dryer except that hot air passes through the wet solid instead of across it. The pressure drop through the bed of material does not usually exceed about 2 cm of water. In another type, deep perforated-bottom trays are placed on top of plenum chambers in a closed-circuit hot-air-circulating system. In some food-drying plants, the material is placed in finishing bins with perforated bottoms; heated air passes up through the material and is removed from the top of the bin, reheated, and recirculated. The latter types involve a pressure drop through the bed of material of 1 to 8 cm of water at relatively low air rates. Table 12-11 gives performance data on three applications of batch through-circulation dryers. Batch through-circulation dryers are restricted in application to granular materials that permit free flow-through circulation of air. Drying times are usually much shorter than in parallel-flow tray dryers. Design methods are included in the subsection "Continuous Through-Circulation Dryers."

Vacuum-Shelf Dryers Vacuum-shelf dryers are indirect-heated batch dryers consisting of a vacuumtight chamber usually constructed of cast iron or steel plate, heated, supporting shelves within the chamber, a vacuum source, and usually a condenser. One or two doors are provided, depending on the size of the chamber. The doors are sealed with resilient gaskets of rubber or similar material (Fig. 12-49).

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Vacuum is applied to the chamber and vapor is removed through a large pipe which is connected to the chamber in a manner such that, if the vacuum is broken suddenly, the rushing air will not greatly disturb the bed of material being dried. This line leads to a condenser where moisture or solvent that has been vaporized is condensed. The noncondensable exhaust gas goes to the vacuum source, which may be a wet or dry vacuum pump or a steam-jet ejector.

Vacuum-shelf dryers are used extensively for drying pharmaceuticals, temperature-sensitive or easily oxidizable materials, and materials so valuable that labor cost is insignificant. They are particularly useful for handling small batches of materials wet with toxic or valuable solvents. Recovery of the solvent is easily accomplished without danger of passing through an explosive range. Dusty materials may be dried with negligible dust loss. Hygroscopic materials may be completely dried at temperatures below that required in atmospheric dryers. The equipment is employed also for freeze-drying processes, for retreating furnace operations, and for the manufacture of semiconductor parts in controlled atmospheres. All these latter processes demand much lower operating pressures than do ordinary drying operations.

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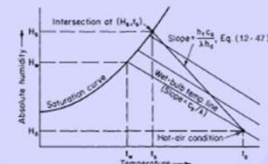


FIG. 12-47 Graphical estimation of surface temperature during constant-rate period.

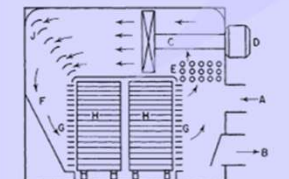


FIG. 12-48 Double-truck dryer. (A) Air inlet duct. (B) Air exhaust duct with damper. (C) Adjustable air-blind screen. (D) Fan heater. (E) Plenum chamber. (F) Plenum chamber. (G) Adjustable air-blind screen. (H) Trucks and trays. (I) Turning vanes.

Ground 1: Perry

Teaching away: batch/continuous

“A reference teaches away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant.”

Pozen Inc. v. Par Pharm., Inc., 696 F.3d 1151, 1164–65 (Fed. Cir. 2012)

“A reference ‘teaches away’ when it ‘suggests that the line of development flowing from the reference’s disclosure is unlikely to be productive of the result sought by the applicant.’”

Santarus, Inc. v. Par Pharmaceutical, 694 F.3d 1344, 1354-55 (Fed. Cir. 2012)

Ground 1: Claims 2 & 7

Specific metrics of drying:

2. The method according to claim 1, wherein the comminuted material is dried until an electrolyte content in the comminuted material is so low that an electrochemical reaction is impossible.

Ex. 1001 ('097 Patent) at Cl. 2

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

Ex. 1001 ('097 Patent) at Cl. 7

Ground 1: Claims 2 & 7

Evidence from LithoRec:

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. 1016 (LithoRec) at 226; Paper 22 (Petitioner's Reply) at 8

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. Dust from the pre-shredding/drying process is fed into the main dust extraction system at the same time (pneumatic conveying). This means that all dust is collected centrally and fed into the drum filling process.

Ex. 1016 (LithoRec) at 229; Paper 22 (Petitioner's Reply) at 20

Insufficient evidence to disclose the claimed drying metrics

Ex. 2025 (Dantam Decl.) at ¶¶ 145.1-145.2; Paper 17 (POR) at 42

Optimization

Optimization: inapplicable

“For decades, this court and its predecessor have recognized that ‘where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.’”

E.I. DuPont de Nemours & Co. v Synvina C.V., 904 F.3d 996,
1006 (Fed. Cir. 2018)

Q. Are you aware of any prior art that recognized that you could inactivate shredded battery material by vacuum drying alone?

Spies. At the moment, I can't mention it, that one.

Q. Did any come to mind?

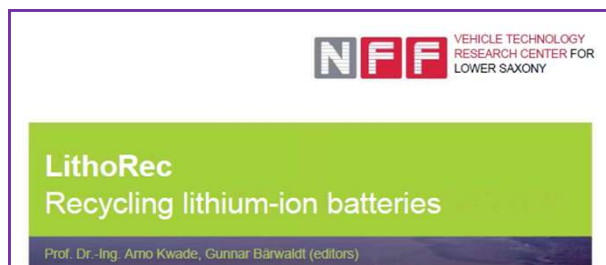
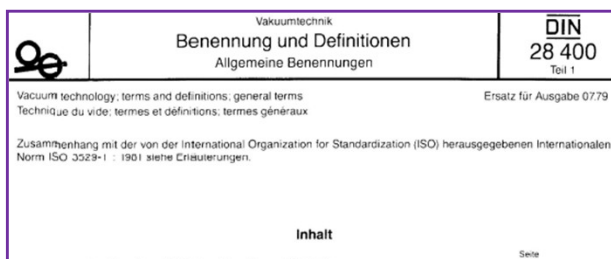
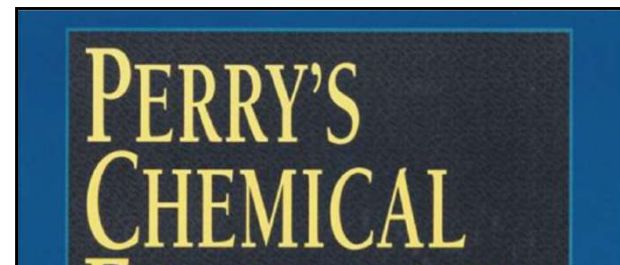
Spies. Sorry?

Q. Does anything come to mind?

Spies. Not at the moment, no. Maybe it's too late already for me.

Ground 1: LithoRec, DIN 28400, and Perry

Conclusion



“A person skilled in the art would not be able to practice Claim 1 of the '097 patent based on the combined disclosures of LithoRec with Perry and DIN 28400.”

“The combination of LithoRec with Perry and DIN 28400 would not teach inactivating of shredded batteries by drying at a maximum pressure of 300 hPa.”

Ex. 2025 (Dantam Decl.) at ¶¶ 140-141;
Paper 17 (POR) at 43-48;
Paper 31 (PO's Sur-reply) at 19-21

GROUND 2: CLAIM 9 IS NOT OBVIOUS OVER
LITHOREC IN VIEW OF DIN 24800 AND PERRY,
AND FURTHER IN VIEW OF HANISCH

Ground 2: Claim 9

Claim 9:

(12) **United States Patent**
Hanisch et al.

(10) Patent No.: **US 11,050,097 B2**
(45) Date of Patent: **Jun. 29, 2021**

(54) **METHOD FOR THE TREATMENT OF USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION**

(52) U.S. CL.
CPC **H01M 10/54** (2013.01); **B02C 21/00** (2013.01); **B02C 23/10** (2013.01); **B02C 23/20** (2013.01);
(Continued)

(71) Applicant: **DUESENFELD GMBH, Braunschweig (DE)**

(58) **Field of Classification Search**
CPC **Y02W 30/84**; **Y02P 10/212**; **B02C 23/08**; **B02C 23/10**; **B09B 3/008**; **B09B 3/0058**;
(Continued)

(72) Inventors: **Christian Hanisch, Braunschweig (DE)**; **Bastian Westphal, Braunschweig (DE)**; **Wolfgang Haselrieder**

(56) **References Cited**

(73) **9. The method according to claim 1 wherein**
(*) **drying occurs at a temperature of less than 80° C.**

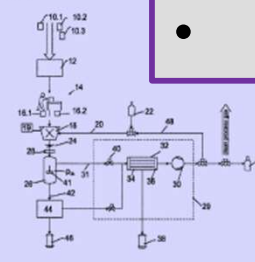
(21) (22) (86) § 371 (c)(1),
(2) Date: **Oct. 26, 2017**
Machine Translation of DE 4424825, Translated Sep. 5, 2019, 3
Pages (Year: 1996)*
(Continued)

(87) PCT Pub. No.: **WO2016/174156**
PCT Pub. Date: **Nov. 3, 2016**
Primary Examiner — Gregory D Swiatucha
(74) Attorney, Agent, or Firm — W&C IP

(65) **Prior Publication Data**
US 2018/0501769 A1 Oct. 18, 2018

(30) **Foreign Application Priority Data**
Apr. 28, 2015 (DE) 10 2015 207 843.4

(51) **Int. Cl.**
H01M 10/54 (2006.01)
B09B 3/00 (2006.01)
(Continued)



URT Umwelt und Recyclingtechnik URT EX1001
100-2021-00887

- **Claim 9 depends from Claim 1**
- **Incorporate Ground 1 arguments**

Ex. 1001 ('097 Patent) at Cl. 9

Ground 2: Claim 9

Combination: LithoRec + Hanisch + DIN 28400 + Perry

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

(19) Weltorganisation für geistiges Eigentum
Internationales Büro
(43) Internationales Veröffentlichungsdatum
21. Februar 2013 (21.02.2013)

WIPO | PCT

(10) International WO 2

(51) Internationale Patentklassifikation:
H01M 10/54 (2006.01) B07B 4/08 (2006.01)

(21) Internationales Aktenzeichen: PCT/DE2012/000811

(22) Internationales Anmeldedatum: 10. August 2012 (10.08.2012)

(25) Einreichungssprache: Deutsch

(26) Veröffentlichungssprache: Deutsch

(30) Angaben zur Priorität:
10 2011 110 083.4
12. August 2011 (12.08.2011) DE

(71) Anmelder (für alle Bestimmungsstaaten mit Ausnahme von US): TECHNISCHE UNIVERSITÄT BRAUNSCHWEIG CAROLO-WILHELMINA [DE/DE]; Pockelsstrasse 14, 38106 Braunschweig (DE).

(72) Erfinder; und
(75) Erfinder/Anmelder (nur für US): HANISCH, Christian [DE/DE]; Sophienstrasse 14, 38118 Braunschweig (DE); HASELRIEDER, Wolfgang [DE/DE]; Huttenstrasse 3, 38114 Braunschweig (DE); KWADE, Arno [DE/DE]; Teichstrasse 12, 38176 Wendeburg (DE).

(74) Anwalt: PLÖGER, Patent- und Rechtsanwältin, 38122 Braunschweig

(81) Bestimmungsstaaten
jede verfügbare nationale
AM, AO, AT, AU, /
BY, BZ, CA, CH, C
DO, DZ, EC, EE, EG
HN, HR, HU, ID, IL
KR, KZ, LA, LC, L
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NO, NZ, OM, PE, P
SC, SD, SE, SG, SK
TN, TR, TT, TZ, U
ZW.

(84) Bestimmungsstaaten
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CZ, DE, DK, EE, ES
LT, LU, LV, MC, M
SI, SK, SM, TR, OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

[Fortsetzung auf der nächsten Seite]

(54) Title: METHOD FOR RECLAIMING ACTIVE MATERIAL FROM A GALVANIC CELL, AND AN ACTIVE MATERIAL SEPARATION INSTALLATION, PARTICULARLY AN ACTIVE METAL SEPARATION INSTALLATION

(54) Bezeichnung: VERFAHREN ZUM WIEDERGEGWINNEN VON AKTIVMATERIAL AUS EINER GALVANISCHEN ZELLE UND AKTIVMATERIAL-SEPARATIONSANLAGE, INSBESONDERE AKTIVMETALL-SEPARATIONSANLAGE

The active material separation installation preferably has a **pre-dryer** arranged downstream from the cell crushing device and upstream from the oven in terms of the material flow. The pre-dryer is set up to heat the cell fragments to the drying temperature.

Ex. 1020 (Hanisch) at 6:17-19

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.... [I]t is advantageous for the drying temperature to be below 100 °C, in particular **below 80 °C**.

WO

URT EX1013
URT Umwelt und Recyclingtechnik v. Duesenfeld
IPR2024-00887

Ex. 1020 (Hanisch) at 5:10-15

Ground 2: Claim 9

Claim 9: Absence of evidence

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES
PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG
(19) Weltorganisation für geistiges
Eigentum
Internationales Büro



- **Petitioner:** no evidence of motivation to combine Hanisch with other references
- **Petitioner:** no citation to Expert Declaration at all in Ground 2
- **Petitioner:** no assertion or evidence that 80°C pre-dryer inactivates battery material

Paper 1 (Petition) at 35-38

- **Dantam:** pre-dryer does not inactivate

Ex. 2025 (Dantam Decl.) at ¶¶146-146.1; Paper 17 (POR) at 51-53

SECONDARY CONSIDERATIONS OF NON-OBVIOUSNESS

Long Felt But Unmet Need

172. Companies tried and failed prior to the '097 invention to develop a process for inactivating depleted rechargeable batteries for safe storage and transport. Prior approaches included mixing various additional chemicals with the comminuted material to mitigate known hazards relating to the comminuted material, including: flame retardants (Ex. 2008 at 2-3); aqueous solution or a

deactivating powder (Ex. 2008 at 5:18-52); brine solution (Ex. 2008 at 3:3-5). However, these methods required the use of battery material h

173. The '097 patent allows batteries to be comminuted directly, and then inactivated by drying at a pressure below 300 hPa. The '097 patent eliminates contaminants from recycling by not requiring foreign substances. *See, e.g.*, Ex.

1001, 1:63-2:4, 2:5-12. The '097 patent

174. The '097 invention demonstrated unexpected results. As previously mentioned, prior battery recycling methods involved the use of foreign substances or high temperatures that introduced significant hazards, such as freezing, incineration, melting, adding reactants, and shredding in water. The '097 patent adopted a fundamentally different and unforeseen approach to mitigating these hazards—by avoiding their creation altogether. The advantages and benefits of vacuum drying at pressures below 300 hPa without using foreign substances were

Unexpected Results

LithoRec prior art:

E.4.3.3 Contribution margin in mechanical processing

The material and energy flow-related contribution margin is 340 [EUR/t systems]. The largest contribution is made by the copper chips in the anode. Assuming the high-purity separation of the chips and their briquetting capability, it amounts to 414 [EUR/t systems] at a revenue rate of 6.300 [EUR/t]. The main input materials are sodium hydroxide (NaOH), which is required for hydrofluoric acid washing (9 [EUR/t systems] at a cost rate of 250 [EUR/t])²⁵. The required quantities of NaOH and the substances sodium fluoride (NaF, 22.65 [kg/t system]) and sodium carbonate (Na₂CO₃, 17.95 [kg/t system]) produced by the chemical reaction were estimated stoichiometrically by the Öko-Institut. The hazardous waste disposal (SME) of the NaF-Na₂CO₃ mixture leads to costs of 16 [EUR/t systems]; alternatively, the substances could possibly be separated and sold in high-purity form.

Ex. 1016 (LithoRec) at 190; Paper 31 (PO's Sur-reply) at 24

'097 Patent:

"The advantage of low temperatures is that the formation of hydrogen fluoride is hindered."

Ex. 1001 ('097 Patent) at 3:12-13;
Paper 31 (PO's Sur-reply) at 24

"The drying preferably occurs at a maximum temperature of 80° C.: this produces almost no hydrogen fluoride.

Ex. 1001 ('097 Patent) at 5:7-8;
Paper 31 (PO's Sur-reply) at 24

Unexpected Results

174. The '097 invention demonstrated unexpected results. As previously mentioned, prior battery recycling methods involved the use of foreign substances or high temperatures that introduced significant hazards, such as freezing, incineration, melting, adding reactants, and shredding in water. The '097 patent adopted a fundamentally different and unforeseen approach to mitigating these hazards—by avoiding their creation altogether. The advantages and benefits of vacuum drying at pressures below 300 hPa without using foreign substances were

Commercial Success

Seval and Riplastic will be the first industrial operators in Italy for the recycling of lithium-ion batteries

Two plants on the national territory, one in Lombardy and one in Basilicata, for a treatment capacity of almost 30,000 tons per year of lithium-ion batteries, for a total investment of approximately 30 million euros.

Roberto Ardenghi, sole director of Seval Srl, explains: *"It is the largest investment ever for Seval and Riplastic, who will face this great challenge together. Our goal is to become the national point of reference for battery recycling to recycle and maintain in our country the important and rare critical raw materials that our industries increasingly need to stay competitive".*

The announcement follows the agreements signed in recent days - at the end of almost two years of joint work - with Duesenfeld GmbH - *Ecofriendly Recycling of Lithium-Ion Batteries*, for the exploitation of the patents necessary to the technological process chosen by Seval and Riplastic. Thanks to this process, the treatment of lithium-ion batteries is carried out at a low temperature in complete safety, with emissions largely below the most stringent thresholds and no hydrogen fluoride release, producing a *black mass* with an excellent level of purity, rich in nickel, cobalt and lithium, as well as noble metals like aluminum, copper, iron. The technology also allows us to achieve a very high recovery rate as required by the new European Regulation 2023/1542.

Full operation of the plants is planned for the end of 2025 and the beginning of 2026. First activities are scheduled for spring 2025.

ANDRITZ and Duesenfeld sign cooperation agreement for lithium-ion battery recycling

GRAZ, FEBRUARY 10, 2025. International technology group ANDRITZ, a global leader in recycling solutions, has signed a cooperation agreement with the German battery recycling pioneer Duesenfeld. This agreement marks a significant milestone in the advancement of sustainable battery recycling solutions.

Under the agreement, Duesenfeld will license its patented processes, including deep discharging and low-temperature drying. ANDRITZ will act as the EPC (Engineering, Procurement, and Construction) or EPS (Engineering, Procurement, and Supply) contractor, responsible for delivering the recycling plant and manufacturing key equipment such as shredders and dryers. Additionally, ANDRITZ will provide comprehensive service and supply spare and wear parts throughout the operating lifetime of the equipment and plant.

Till Bußmann, CTO of Duesenfeld, says: *"This partnership marks a major step forward in the circular economy, combining advanced expertise, innovative technology, and long-standing experience in plant engineering to provide comprehensive solutions for our customers."*

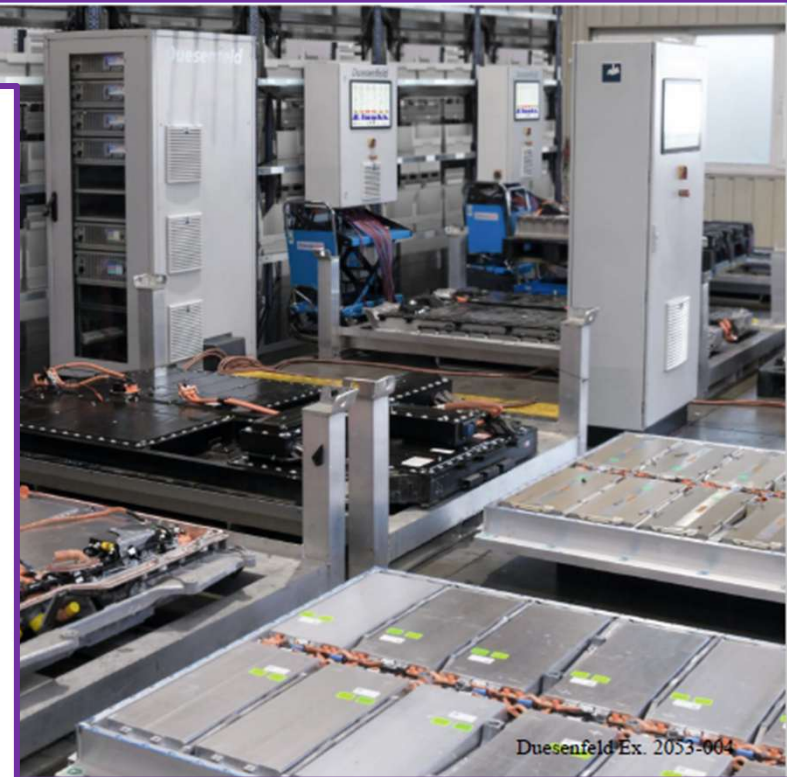
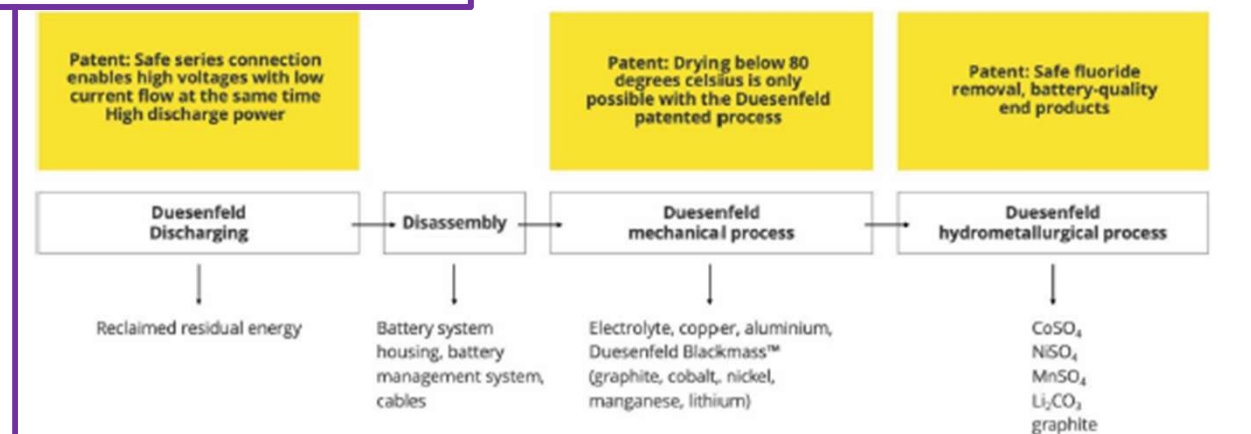
The collaboration positions ANDRITZ and Duesenfeld as the ideal partners for the mechanical pre-treatment of lithium-ion batteries, especially in the production of black mass. The partnership aims to enhance the efficiency and sustainability of battery recycling processes, contributing to a circular economy.

As a first reference project, the Duesenfeld pilot plant in Wendeburg will be upgraded with ANDRITZ equipment, including state-of-the-art shredders and dryers. This upgrade will showcase the combined expertise and innovative solutions offered by both companies.

**Ex. 2040 (Grote Decl.) at ¶¶ 10-11
(citing to Exs. 2051 & 2052;
Paper 17 (POR) at 56-58**

Nexus

176. I understand that Duesenfeld operates a battery comminution facility at its Wendeberg Plant. Ex. 2040 ¶¶ 6-8 (Declaration of Lydia Grote). I have reviewed materials regarding the Wendeberg Plant and have determined that it practices the '097 claimed invention. Ex. 2037; Ex. 2040, ¶¶ 1-9; Ex. 2041; Ex. 2053. Exhibit 2036 (Confidential **Appendix D**) is a chart illustrating, on a per-limitation basis, how Duesenfeld's Wendeberg Plant practices Independent Claims 1 and 12 and various dependent claims. These claims directly address the functionality that drove customer demand and commercial success, and that frustrated others in the field.



Ex. 2025 (Dantam Dec.) ¶176; Ex. 2053; Paper 17 (POR) at 58-61

Motion to Amend

- Batch drying
- Bodily incorporation
- Reasonable Expectation of Success
- Alleged “routine” optimization
- Overlapping ranges

Batch Drying

LithoRec states:

As there is currently no reliable data on the substances contained in the battery cells that would allow drying to be reliably designed, only a rough estimate of drying can be made at this point. The manufacturers of drying systems could not be persuaded to submit an offer under the given circumstances. It is assumed that the necessary process steps (inerting, filling, drying, emptying) of a discontinuously operating dryer require a longer work cycle in total than the pre-shredder. For this reason, batch drying is not used.

LithoRec, Ex. 1016, p. 226

Batch Drying

Testimony of Petitioner's expert, Mr. Spies:

4 Q. And one of the things I want to ask you is
5 what is important to be considered when you're
6 drying or -- you're designing one of these drying
7 processes, okay?

8 So when designing a drying process in the
9 relevant timeframe, would the process throughput be
0 an important consideration for the drying?

1 A. Yes, throughput is one of the key
2 components you need to know.

3 Q. Okay. And what is process throughput?

4 A. Process throughput can either be the
5 amount of material per hour put into the system.
6 Sometimes it's also defined as the throughput of,
7 let's say, target product you would like to achieve,
8 and then you have to count backwards.

Ex. 2061 (Spies Dep.) 99:4-8

Batch Drying

“In *In re Gurley*, 27 F.3d 551, 553 (Fed.Cir.1994), we emphasized that ‘[a] reference may be said to teach away when ‘a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or **would be led in a direction divergent from the path that was taken by the applicant.**’”

In re Mouttet, 686 F.3d 1322, 1333–34 (Fed. Cir. 2012)(Emphasis added)

Batch Drying

Petitioner argues:

deficiency of batch drying. EX1016, 226; EX1030, ¶14. In particular, LithoRec discloses that the only reason for choosing continuous drying over batch drying (i.e., the longer work cycle associated with batch drying) is based on incomplete data. EX1016, 226. In addition, LithoRec teaches that the longer work cycle can be accommodated when LithoRec discloses “Whereas conventional rotor shredders only work continuously in a throughput, the cross-flow shredders are operated in sets. This batch operation allows the duration and intensity of the load (rotor speed) to be optimally adapted to the desired degree of digestion.” EX1016, 226, EX1030, ¶14.

Pet. Opp. Motion to Amend, p. 8

Bodily incorporation

Example Petitioner “bodily incorporation” arguments:

PO further asserts that it is unclear how LithoRec would be modified to accommodate Perry’s batch dryer. But there is no bodily incorporation requirement for obviousness. “Combining the teachings of references does not involve an ability to combine their specific structures.” *In re Nievelt*, 482 F.2d 965, 968 (CCPA 1973). Continuous and batch dryers were both well known to POSITAs at the time of the invention. It would have been obvious to have selected a suitable batch dryer for reasons already of record.

Petitioner’s Sur-Reply to Motion to Amend, p. 4

clear what Petitioner is proposing.” Prelim Guidance 16; Reply 11. PO incorrectly assumes that Petitioner is required to explain exactly how Uchida’s treatment chamber can be incorporated into LithoRec’s vibratory fluidized bed dryer. But again, there is no bodily incorporation requirement. *Nievelt*, 482 F.2d at 968.

Petitioner’s Sur-Reply to Motion to Amend, p. 5

Bodily incorporation

“The Board explained ‘[t]he extensive need to modify Kontos’ device in a way not suggested in the Petition supports [Teleflex's] argument that the proposed modifications are based on a hindsight desire to recreate the claimed invention, as opposed to a known need in the art for such a device.’ *Id.* The Board did not err in discounting modifications not presented in Medtronic’s petition as indicative of hindsight.”

Medtronic, Inc. v. Teleflex Innovations S.A.R.L.,
70 F.4th 1331, 1347 (Fed. Cir. 2023).

Reasonable Expectation of Success

“[W]e must first emphasize the clear distinction in our case law between a patent challenger's burden to prove that a skilled artisan would have been motivated to combine prior art references and the additional requirement that the patent challenger also prove that the skilled artisan would have had a reasonable expectation of successfully achieving the claimed invention from the combination....A finding by the Board that a patent challenger has demonstrated a motivation to combine references does not necessarily imply that the challenger has also met its burden of showing a reasonable expectation of success in achieving a claimed method of treatment.”

Eli Lilly & Co. v. Teva Pharms. Int'l GmbH,
8 F.4th 1331, 1344 (Fed. Cir. 2021)

Alleged “routine” optimization

Petitioner argues:

LithoRec explicitly teaches vacuum drying but does not specify any particular pressure range under which drying is performed. However, a POSITA would have known to optimize the pressure, temperature, and duration of the drying process for the particular chemicals being dried. EX1039, 15:15-16:13; EX1030, ¶¶18-22.

Pet. Opp. to Motion to Amend, p. 11

Alleged “routine” optimization

Petitioner argues:

LithoRec explicitly teaches vacuum drying but does not specify any particular pressure range under which drying is performed. However, a POSITA would have known to optimize the pressure, temperature, and duration of the drying process for the particular chemicals being dried. EX1039, 15:15-16:13; EX1030, ¶¶18-22.

Pet. Opp. to Motion to Amend, p. 11

Alleged “routine” optimization

LithoRec explicitly teaches vacuum drying but does not specify any particular pressure range under which drying is performed. However, a POSITA would have known to optimize the pressure, temperature, and duration of the drying process for the particular chemicals being dried. EX1039, 15:15-16:13; EX1030, ¶¶18-22.

22. At the very least, in my view, it would have been obvious to arrive at the claimed pressure range through routine optimization, because pressure and temperature were recognized as being outcome-effective variables. EX1039, 15:15-16:13. In my experience, a process engineer would perform this kind of routine optimization at the time of the invention as a standard part of plant setup—just as Mr. Dantam also explained. EX1039, 15:15-16:13.

Ex. 1030 (Spies Dec.), ¶22

Alleged “routine” optimization

Testimony of Petitioner’s expert, Mr. Spies:

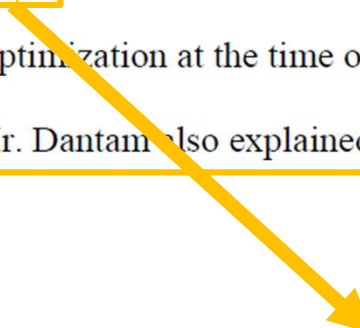
8 Q. Okay. Sir, what is your understanding of
9 the term "result-effective variable"?
10 MR. ROBERTS: Objection --
11 BY MR. SMITH:
12 Q. Hold on. Jonathan has an objection.
13 MR. ROBERTS: Objection to the extent that
14 this calls for a legal conclusion. I'll object on
15 that basis.
16 MR. SMITH: Did you say calls for a --
17 MR. ROBERTS: To the extent that it calls
18 for a legal conclusion, I'll object on that basis.
19 BY MR. SMITH:
20 Q. So with the objection that it potentially
21 calls for a legal conclusion, what is your
22 understanding of the term "result-effective
23 variable"?
24 A. I don't know that term.
25 Q. What is your understanding of the term
1 "outcome-effective variable"?
2 A. Maybe I know, but in this, let's say,
3 content, maybe it's a question of translation, so I
4 don't know what you mean by that.
5 Q. Okay. Did you say in this context or in
6 this consent --
7 A. No, actually, I don't know what's -- what
8 this should be no, I don't know.

Ex. 2061 (Spies Dep.), 138:8-139:8

Alleged “routine” optimization

22. At the very least, in my view, it would have been obvious to arrive at the claimed pressure range through routine optimization, because pressure and temperature were recognized as being outcome-effective variables. EX1039, 15:15-16:13. In my experience, a process engineer would perform this kind of routine optimization at the time of the invention as a standard part of plant setup—just as Mr. Dantam also explained. EX1039, 15:15-16:13.

Ex. 1030 (Spies Dec.), ¶22



7	Q. Would you agree that a standard
8	part of making sure a dryer works is to
9	optimize variables like time, temperature, and
10	pressure?
11	MR. CARLSON: Objection. Vague.
12	A. I mean, you can say that. I mean,
13	there are other variables, too, but yeah.

Ex. 1039 (Dantam Dep.), 16:7-13

Alleged “routine” optimization

What is a PHOSITA optimizing for?

- **Throughput (speed of process)?**
- **Level of drying?**
- **Cost of drying?**
- **Energy use?**
- **Recovery of solvent?**
- **Environmental?**
- **Safety?**

See, e.g., Ex. 2061 (Spies Dep.) 98:25-101:13.

Alleged “routine” optimization

Petitioner argues:

PO incorrectly argues that it would not have been obvious to incorporate Perry’s batch dryers into LithoRec’s pilot plant because LithoRec allegedly teaches away from vacuum shelf dryers. Reply, 9-10. Vacuum shelf dryers are only one of many types of batch dryers described in LithoRec. EX1006, 12-36 through 12-88; EX1030, ¶17. Thus, even if LithoRec teaches away from vacuum *shelf* dryers (which it does not), Perry describes other batch dryers that achieve the same result as vacuum shelf dryers (e.g., drying under low temperatures, avoiding oxidation or explosion, solvent recovery, etc.). EX1006, 12-67, Table 12-39, Fig. 12-74; EX1030, ¶16-17.

Pet. Sur-Reply to Motion to Amend, p. 3

Overlapping ranges

[A] presumption of obviousness may be invoked ‘when the only difference from the prior art is a difference in the range or value of a particular variable.’ *In re Kumar*, 418 F.3d 1361, 1366 (Fed. Cir. 2005). In this case, however, there are additional differences between the prior art and claim 2 of the ’090 patent. For example, the district court found that the prior art did not disclose that ibrutinib was effective at treating R/R MCL in particular. *Pharmacyclics*, 556 F. Supp. 3d at 403 & n.8. That finding was not clearly erroneous.

Pharmacyclics LLC v. Alvogen, Inc.,
No. 2021-2270, 2022 WL 16943006, at *9 (Fed. Cir.
Nov. 15, 2022)(unpublished).