

**UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE PATENT TRIAL AND APPEAL BOARD**

**URT Umwelt und Recyclingtechnik GmbH
v.
Duesenfeld GmbH**

**Case No. IPR2024-00887
Patent No. 11,050,097**

**PETITIONER'S DEMONSTRATIVES
AUGUST 19, 2025**

URT EX1040
URT Umwelt und Recyclingtechnik v. Duesenfeld
IPR2024-00887

Table of Contents

I.	Introduction	3
II.	US 11,050,097	5
III.	Instituted Grounds	7
IV.	Overview of the Prior Art	8
V.	Claim 1	10
VI.	Claim 2	25
VII.	Claim 7	26
VIII.	Claim 9	27
IX.	Claim 12	28
X.	Claim 13	37
XI.	PO's Secondary Considerations	38
XI.	PO's Contingent Motion to Amend	40

Introduction

- The '097 patent is directed to the processing of used battery material.
- Only four basic parts to every claim:
 - Comminuting unit
 - Inactivation unit comprising a dryer
 - Filling device
 - Vacuum installation
- These are old and well-known components.

See, e.g., Pet. 1-2; Reply 1; EX1001 ['097 patent], 1:8-23, 56-62; EX1003 ¶¶43-48.

Introduction

- All of the well-known components are being used in standard ways for standard purposes to achieve expected results.
- There is nothing new or non-obvious about the process conditions recited in some claims.
- Much of the relied-upon prior art is Patent Owner's own printed publications: LithoRec (EX1004), Hanisch (EX1013), Presentation (EX1027).

See, e.g., Pet. 1-2; Reply 11, 13-14, 22; EX1023 ¶¶49-50.

US 11,050,097

- “The advantage of the invention is that the amount of electrolyte that can be obtained from the comminuted material through drying is such that an electrochemical reaction is no longer possible, or only to a negligibly small extent. In addition, no flammable or explosive gas phase forms above the battery fragments, as the organic carbonates of the electrolyte have been removed [from the fragments].”

See, e.g., Pet. 5-7; EX1001 [‘097 patent], 1:27-50, 54-67, 2:1-2.

US 11,050,097

- “The drying of the comminuted material results in inactivated comminuted material 42.”
- “According to a preferred embodiment, the drying occurs under vacuum. The size of the vacuum is preferably selected such that the vapour pressure of dimethyl carbonate at 80° C., especially at 70° C., is not reached. It is beneficial if the drying occurs at a maximum pressure of 300 hPa, in particular a maximum pressure of 100 hPa. At such low pressures, considerable parts of most electrolytes vaporise, especially dimethyl carbonate and ethyl methyl carbonate, and do so at temperatures of less than 80° C.”

See, e.g., Pet. 9, 27; EX1001 [‘097 patent], 3:4-8, 8:54-58.

Instituted Grounds

IPR2024-00887 ('097 Patent)		
Claims Challenged	Basis	Applied References
1-3, 7, 8, 10	35 U.S.C. § 103	LithoRec, DIN 28400, Perry
9	35 U.S.C. § 103	LithoRec, DIN 28400, Perry, Hanisch
12, 13, 15, 16, 18, 19	35 U.S.C. § 102(a)(1)	LithoRec
17	35 U.S.C. § 103	LithoRec and Hanisch

See Inst. Dec. 5, 23.

Overview of the Prior Art

- LithoRec: A research paper co-authored by Hanisch, the '097 patent's first-named inventor.
- “In the ‘LithoRec – Recycling of lithium-ion batteries’ project, several processes for recycling traction batteries were evaluated...A conclusive concept was developed for separating the battery systems down to the level of the cathodic active material powder used.”

See, e.g., Pet. 4, 17-18; EX1016, 1.

Overview of the Prior Art

- Perry: An engineering reference manual providing examples of specific vacuum dryer types and the conditions (including pressure ranges) at which they operate.
- DIN 28400: A reference document discussing vacuum terminology and example vacuum ranges.
- Also:
 - Hanisch: A PCT Publication teaching compatible temperature ranges.
 - EX1027: A presentation from PO discussing comminuting for Li-ion battery recycling, and electrolytes of concern, target sizes, etc.

See, e.g., Pet. 4, 26; Reply 14-15; EX1006, 12-45, 12-65, 12-66; EX1005 ¶¶ 57-62; EX1023 ¶¶ 25, 63; EX1027.

Claim 1 Disputed Limitations

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 1: Inactivating and Drying

The '097 patent

Within the scope of the present description, the term drying should be understood particularly to mean the removal of at least one solvent in the conducting salt. In particular, the drying is executed such that dimethyl carbonate and/or ethyl methyl carbonate is removed.

EX1001, 2:23-27

The drying of the comminuted material results in inactivated comminuted material 42, which is fed into a filling

EX1001, 8:54-55

See Pet. 21-23; Reply 1-3; EX1003 ¶¶ 89-90.

Claim 1: Inactivating Under Vacuum

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.

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.

EX1016, 226

See Pet. 21-22; EX1003 ¶ 88.

Disputed Issue: “Inactivating”

Patent Owner’s Position:

supra, this is an incorrect claim construction. Applying the plain meaning of “inactivated” (*i.e.*, rendered safe for transport), this limitation is not taught by LithoRec. Ex. 2025, ¶91.

POR 41

PO’s Position Cannot Be Correct:

EX2023, ¶¶10-11, 15-16. “Render/rendered” safe for transport is merely one characteristic among many possible characteristics shared by several embodiments in the ‘097 patent. POR, 10, EX1001, 2:1-14; 4:5-7, 19-40; EX1023, ¶¶10-11. This

See Reply 1-3; EX1023 ¶¶ 10-16.

Reply 3

The Board Correctly Construed Inactivating

Institution Decision

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, we proceed to

Reply

The '097 patent also explicitly states, “[t]he drying of the comminuted material results in inactivated material.” EX1001, 8:54-55. When the term “drying” is replaced with its explicit definition, this statement becomes “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.” A POSITA would understand that this statement is an explicit definition of “inactivated.” In other words, according to the '097 patent, comminuted material becomes inactivated when at least one solvent (DMC and/or EMC) is removed from the conducting salt. EX1023, ¶¶13-15. A POSITA would understand that the above definition also applies to the act of inactivating (i.e., removing at least one solvent (DMC and/or EMC) from the conducting salt).

See, e.g., Inst. Dec. 13; Reply 2.

Claim 1: Pressure Range for “Vacuum”

LithoRec

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.

EX1016, 226

See Pet. 25; EX1003 ¶¶ 95-96.

Claim 1: Pressure Range for “Vacuum”

DIN 28400

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

EX1018, 8:54-55.

Symbol	Unit	Rough (low) vacuum
p	Pa	$1 \cdot 10^5$ to $1 \cdot 10^2$
p	mbar	$1 \cdot 10^3$ to 1
n	m^{-3}	$2.5 \cdot 10^{25}$ to $2.5 \cdot 10^{22}$

[1000 hPa to 1 hPa]

See Pet. 25-26; Reply 16.

EX1018, Table 1

Claim 1: Perry Pressure Ranges

During the constant-rate period, moisture is rapidly removed. Often 50 percent of the moisture will evaporate in the first hour of a 6- to 8-h cycle. The drying time has been found to be proportional to between the first and second power of the depth of loading. Shelf vacuum dryers operate in the range of 1 to 25 mmHg pressure. For size-estimating purposes, a heat-transfer coefficient of $20 \text{ J}/(\text{m}^2 \cdot \text{s} \cdot \text{K})$ may be used. The area employed in this case should be the shelf area in direct contact with the trays. Trays should be maintained as flatly as possible to obtain maximum area of contact with the heated shelves. For the same reason, the shelves should be kept free from scale and rust. Air vents should be installed on steam-heated shelves to vent noncondensable gases. The heating medium should not be applied to the shelves until after the air has been evacuated from the chamber in order to reduce the possibility of the material's overheating or boiling at the start of drying. Casehardening can sometimes be avoided by retarding the rate of drying in the early part of the cycle.

[1.33 to 33.33 hPa]

EX1006, 12-45

See Pet. 26.

Claim 1: Perry Pressure Ranges

In vacuum processing and drying the objective is to create a large temperature-driving force between the jacket and the product. To accomplish this purpose at fairly low jacket temperatures, it is necessary to reduce the internal process pressure so that the liquid being removed will boil at a lower vapor pressure. It is not always economical, however, to reduce the internal pressure to extremely low levels because of the large vapor volumes thereby created. It is necessary to compromise on operating pressure, considering leakage, condensation problems, and the size of the vapor lines and pumping system. Very few vacuum dryers operate below 5 mmHg pressure on a commercial scale. Air in-leakage through gasket surfaces will be in the range of 0.2 kg/(h·linear m of gasketed surface) under these conditions.

[6.67 hPa]

EX1006, 12-66

See Pet. 26; Reply 24.

Overlapping Pressure Ranges

- The vacuum range of LithoRec (e.g., as defined by DIN 28400) and the pressure ranges disclosed in Perry overlap the claimed range of 300 hPa or less.
- PO never directly addresses the evidence of overlapping ranges.
- PO fails to show surprising / unexpected results.

See, e.g., Pet. 25-26; EX1016, 226; EX1018, 1; EX1006, 12-45, 12-66.

Routine Experimentation / Optimization of Pressure Ranges

- PO's expert conceded it was standard practice to optimize pressure, temperature, and duration for dryer systems.

Q. Do you believe the time, temperature, and pressure are the most important variables to optimize in implementing a commercial or industrial dryer system?

A. Yeah, depends on the context.

- PO fails to show surprising / unexpected results.

See Reply 24; EX1039, 15:15-16:20.

Claim 1: Reliance on LithoRec and Perry

- Both LithoRec and Perry teach drying at low temperatures and pressures to avoid flammability/combustibility, exactly like the '097 patent teaches.
- PO misapprehends why Perry is being cited:
 - The Petition relies on Perry for overlapping pressure ranges, not for a particular dryer or dryer type.
 - Perry also discloses the desirability of certain dryers and dryer types.
 - Tradeoffs between different dryers and dryer types were well known.

See, e.g., Pet. 26; EX1016, 226; EX1006, 12-65, 12-66; EX1039, 21:14-27:8.

Claim 1: Reliance on LithoRec and Perry

- PO's batch dryer arguments are not commensurate in scope with claim 1.
- LithoRec does not teach away:
 - Fig. G-1 does not indicate whether vacuum drying is or is not used.
 - LithoRec provides guidance for adapting batch vacuum dryers for comminuting devices.

See, e.g., Reply 6-7, 43-44, 52.

Claim 1: LithoRec Is Enabled.

- PO's non-enablement arguments hinge on a misunderstanding of the basis for the invalidity challenge to claim 1.
- PO advances “bodily incorporation” arguments, but that is the incorrect legal standard for obviousness (and enablement).
- As a factual matter, LithoRec is enabled.
 - Petitioner provided examples of continuous vacuum dryers.

See, e.g., Reply 29-34; Reply 9; EX1023 ¶¶46-50.

Claim 1: LithoRec Is Enabled.

However, as exemplified by the existence of US 685,287 (EX1024); US 5,575,083 (EX1025); US 2008/0050295 (EX1026), shredders and vacuum dryers involve old technology and were well within the knowledge of a POSITA. The '097 patent does not describe any unconventional structure, function, or configuration relating to the shredder and vacuum dryer. Nor does claim 12 require any unique structure for the claimed dryer and comminuting device. EX1023, ¶¶49-50. Thus, a POSITA would need only a minimal amount of guidance to implement the shredder and vacuum dryer system on which claim 12 reads. EX1023, ¶¶49-50.

[Petitioner's observations relating to the enablement of LithoRec apply to claims 1 and 12. See Reply p. 22.]

See Reply 11, 13-14, 22; EX1023 ¶¶46-50.

Claim 2

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.

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.

LithoRec

See Pet. 28; EX1016, 226; EX1003 ¶¶102-105.

Claim 7

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.

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.

LithoRec

See Pet. 30; EX1016, 226; EX1003 ¶¶102-105.

Claim 9

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

A pre-dryer 28 is arranged downstream from the cell crushing device 12 in terms of the material flow direction, and is connected to the cell crushing device 12 via a pipe 30. Cell fragments arising when the galvanic cells 14 are crushed arrive in the pre-dryer 28 via the pipe 30. There is a drying temperature T_i of preferably $T_i = 80\text{ }^{\circ}\text{C}$ therein. The pre-dryer 28 comprises a circulation pump 32 and a condenser 34 for condensing electrolyte, which can be removed via a pipe 36. The pre-dryer 28 is formed gastight and is flushed with inert gas by the circulation pump 32.

Hanisch

See Pet. 35; EX1020, 8.

Claim 12 Disputed Limitations

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.

Claim 12: Inactivating and Drying

The '097 patent

Within the scope of the present description, the term drying should be understood particularly to mean the removal of at least one solvent in the conducting salt. In particular, the drying is executed such that dimethyl carbonate and/or ethyl methyl carbonate is removed.

EX1001, 2:23-27

The drying of the comminuted material results in inactivated comminuted material 42, which is fed into a filling

EX1001, 8:54-55

See Pet. 43-44; Reply 1-3; EX1003 ¶¶ 140-142.

Claim 12: “Inactivation Device”

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.

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.

EX1016, 226

See Pet. 47-48; EX1003 ¶ 148.

Disputed Issue: “Inactivating”

Patent Owner’s Position:

supra, this is an incorrect claim construction. Applying the plain meaning of “inactivated” (*i.e.*, rendered safe for transport), this limitation is not taught by LithoRec. Ex. 2025, ¶191.

POR 9, 41

PO’s Position Cannot Be Correct:

EX2023, ¶¶10-11, 15-16. “Render/rendered” safe for transport is merely one characteristic among many possible characteristics shared by several embodiments in the ‘097 patent. POR, 10, EX1001, 2:1-14; 4:5-7, 19-40; EX1023, ¶¶10-11. This

Reply 3

See POR 9, 41; Reply 3; EX1023 ¶11.

The Board Correctly Construed Inactivating

Institution Decision

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, we proceed to

Reply

The '097 patent also explicitly states, “[t]he drying of the comminuted material results in inactivated material.” EX1001, 8:54-55. When the term “drying” is replaced with its explicit definition, this statement becomes “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.” A POSITA would understand that this statement is an explicit definition of “inactivated.” In other words, according to the '097 patent, comminuted material becomes inactivated when at least one solvent (DMC and/or EMC) is removed from the conducting salt. EX1023, ¶¶13-15. A POSITA would understand that the above definition also applies to the act of inactivating (i.e., removing at least one solvent (DMC and/or EMC) from the conducting salt).

See, e.g., Inst. Dec. 13; Reply 2.

Disputed Issue: “Vacuum Installation”

LithoRec

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.

EX1016, 226

See Pet. 47-48; EX1023 ¶¶ 19-20.

Disputed Issue: “Vacuum Installation”

- LithoRec discloses vacuum drying
- A vacuum installation is necessary to generate a vacuum pressure
- Claim 12 does not recite any structure for the “vacuum installation”
 - Claim 12 is not limited to a batch dryer
 - Petitioner provided evidence of batch and continuous dryers operating at vacuum.

See e.g., Reply 6; EX1023, ¶36; EX1029, 1-2.

Claim 12: LithoRec Is Enabled.

- LithoRec dries at low temperatures and pressures to avoid flammability/combustibility, exactly like the '097 patent teaches.
- PO's batch dryer arguments are not commensurate in scope with claim 12.
- As a factual matter, LithoRec is enabled.
- Fig. G-1 does not indicate whether vacuum drying is or is not used.
- LithoRec provides guidance for adapting batch vacuum dryers for comminuting devices.
- Petitioner provided examples of continuous vacuum dryers.

See, e.g., POR 6-7, 29-34, 43-44, 52; Reply 9.

Disputed Issue: Enablement

However, as exemplified by the existence of US 685,287 (EX1024); US 5,575,083 (EX1025); US 2008/0050295 (EX1026), shredders and vacuum dryers involve old technology and were well within the knowledge of a POSITA. The '097 patent does not describe any unconventional structure, function, or configuration relating to the shredder and vacuum dryer. Nor does claim 12 require any unique structure for the claimed dryer and comminuting device. EX1023, ¶¶49-50. Thus, a POSITA would need only a minimal amount of guidance to implement the shredder and vacuum dryer system on which claim 12 reads. EX1023, ¶¶49-50.

See Reply 11, 13-14, 22.

Claim 13

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

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.

LithoRec

See Pet. 28; EX1016, 226; EX1003 ¶¶154-158.

PO's Secondary
Considerations Arguments
Deserve No Weight.

PO's Secondary Considerations Arguments Fail

Nexus requirement is not met:

- Significant unclaimed critical features.
- Broad ranges are claimed, relative to narrow declaration assertions.

No bona fide showing of long-felt need.

Commercial success via licensing campaign is irrelevant because the licenses do not include the U.S. patent.

Surprising/unexpected results arguments fail:

- No comparative data.
- No evidence that the results were actually surprising.
- Arguments discuss narrow ranges that are not commensurate in scope with the claims.

See Reply 24-27.

PO's Contingent Motion
to Amend Should Be
Denied.

Introduction

- The proposed new claims recite the same features recited in the original claims except for:
 - Operating in batch mode, and
 - Producing a gaseous electrolyte component recoverable by condensation.
- Other features were already discussed in the Petition:
 - Pressure and temperature ranges, and
 - Vacuum installation.

Operating in Batch Mode

- Claims 22-25 recite “wherein the drying uses a drying device operated in batch mode.”
- Claims 26-29 recite “an inactivation device comprising a drying device, operated in batch mode.”

Operating in Batch Mode: LithoRec and Perry

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.

LithoRec

See Opp. 5; EX1016, 226; EX1030 ¶ 14.

Operating in Batch Mode: LithoRec and Perry

- Perry teaches a number of example batch dryer types.
For instance:

Batch Vacuum Rotary Dryers The more common type of vacuum rotary dryer consists of a stationary cylindrical shell, mounted horizontally, in which a set of agitator blades mounted on a revolving central shaft stirs the solids being treated. Heat is supplied by circula-

See Opp. 10; EX1006, 12-65, Table 12-9; EX1030 ¶16.

Operating in Batch Mode: LithoRec and Perry

- Perry and LithoRec provide the same motivation for using batch dryers that operate under vacuum:

Perry

Vacuum is used in conjunction with drying or other chemical operations when low solids temperatures must be maintained because heat will cause damage to the product or change its nature, when air combines with the product as it is heated, causing oxidation or an explosive condition, when solvent recovery is required, and when materials must be dried to extremely low moisture levels.

LithoRec

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.

See Opp. 10-11; EX1006, 12:65, 12:66; EX1016, 226; EX1030 ¶¶ 14-16.

Operating in Batch Mode: LithoRec and Uchida

seal of the injection opening 27 is opened, a method in which the safety valve 28 is activated, or the like. A vacuum pump 65 is operated to reduce the pressure inside the treatment chamber 64. The pressure level is not limited in particular. Normally, preferably the pressure is reduced to at least 100 kPa or less (typically, 0.1 to 100 kPa, and preferably 1 to 80 kPa). In the present embodiment, the pressure in the treatment chamber 64 is reduced to about 50 kPa.

Uchida

LithoRec

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.

See Opp. 14; EX1026 ¶74; EX1030 ¶26.

Maximum Pressure of 300 hPa

- Claims 22-25 recite “wherein the drying occurs at a maximum pressure of 300 hPa.”
- Claims 26-29 recite “such that the drying device operates with a pressure of 300 hPa or less.”

Maximum Pressure of 300 hPa: LithoRec and Perry

Opposition

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;

Dantam Deposition

Q. Do you believe the time, temperature, and pressure are the most important variables to optimize in implementing a commercial or industrial dryer system?

A. Yeah, depends on the context.

See Opp. 11; EX1039, 15:15-16:20.

Maximum Pressure of 300 hPa: LithoRec and Perry

During the constant-rate period, moisture is rapidly removed. Often 50 percent of the moisture will evaporate in the first hour of a 6- to 8-h cycle. The drying time has been found to be proportional to between the first and second power of the depth of loading. Shelf vacuum dryers operate in the range of 1 to 25 mmHg pressure. For size-estimating purposes, a heat-transfer coefficient of $20 \text{ J}/(\text{m}^2 \cdot \text{s} \cdot \text{K})$ may be used. The area employed in this case should be the shelf area in direct contact with the trays. Trays should be maintained as flatly as possible to obtain maximum area of contact with the heated shelves. For the same reason, the shelves should be kept free from scale and rust. Air vents should be installed on steam-heated shelves to vent noncondensable gases. The heating medium should not be applied to the shelves until after the air has been evacuated from the chamber in order to reduce the possibility of the material's overheating or boiling at the start of drying. Casehardening can sometimes be avoided by retarding the rate of drying in the early part of the cycle.

In vacuum processing and drying the objective is to create a large temperature-driving force between the jacket and the product. To accomplish this purpose at fairly low jacket temperatures, it is necessary to reduce the internal process pressure so that the liquid being removed will boil at a lower vapor pressure. It is not always economical, however, to reduce the internal pressure to extremely low levels because of the large vapor volumes thereby created. It is necessary to compromise on operating pressure, considering leakage, condensation problems, and the size of the vapor lines and pumping system. Very few vacuum dryers operate below 5 mmHg pressure on a commercial scale. Air in-leakage through gasket surfaces will be in the range of $0.2 \text{ kg}/(\text{h} \cdot \text{linear m of gasketed surface})$ under these conditions.

Perry

See Opp. 11-12; EX1006, 12:45, 12:66; EX1030 ¶ 21.

Maximum Pressure of 300 hPa: LithoRec and Uchida

[0074] Using an apparatus having such a structure, the organic solvents are volatilized and removed from the secondary battery 1, for example, as follows, and these volatilized materials are recovered (step 222). Specifically, the spent lithium ion secondary battery 1 that has been opened in advance is accommodated in the treatment chamber 64. The method of opening the secondary battery 1 may be appropriately selected from a method in which a through-hole is opened in the container 20, a method in which the seal of the injection opening 27 is opened, a method in which the safety valve 28 is activated, or the like. A vacuum pump 65 is operated to reduce the pressure inside the treatment chamber 64. The pressure level is not limited in particular. Normally, preferably the pressure is reduced to at least 100 kPa or less (typically, 0.1 to 100 kPa, and preferably 1 to 80 kPa). In the present embodiment, the pressure in the treatment chamber 64 is reduced to about 50 kPa.

Uchida

See Opp. 13-17; EX 1026, ¶174.

Maximum Pressure of 300 hPa: LithoRec, Mitsubishi, and Perry

Next, a round rod with a slightly smaller diameter than the through-hole of the explosion-proof valve 8 provided on the sealing plate 7 is pressed against the through-hole, breaking through the aluminum sheet 8a sealing the through-hole of the explosion-proof valve 8 to create an opening. The lithium-ion secondary battery 1 is then placed in a vacuum dryer to evaporate the electrolyte injected inside. During this process, the vacuum pressure of the vacuum dryer is set to 0.1 MPa or lower, preferably 0.01 MPa or lower, the drying temperature is set to 80 to 120°C, and drying is performed for 6 to 8 hours.

Mitsubishi

See Opp. 20-21; EX1030 ¶ 45; EX1032 ¶ 25.

Gaseous Electrolyte Component Recoverable by Condensation

Claims 23 and 25 recite “producing, during the drying, a gaseous electrolyte component recoverable by condensation.”

Drying must take place in a protective gas atmosphere (nitrogen), just like the crushing process beforehand. The dryer gases are circulated in a closed circuit and cleaned using a filter and condenser.

While the nitrogen is used in its initial state in the pre-shredder with its auxiliary units, it must be heated to the specified maximum permissible dry gas temperature for the dryer through a gas heater. Both the nitrogen from the pre-comminution and that from the dryer are loaded with solid particles and solvent vapors. The nitrogen to be circulated is freed from the solids through a jet filter and then passed through a condenser in which the solvents contained are separated. The condenser can be

LithoRec

See Opp. 4; EX1016, 227.

Temperature of 80 °C or Less

Claims 25 and 29 recite “wherein the drying occurs at a temperature of 80 °C or less”

Next, a round rod with a slightly smaller diameter than the through-hole of the explosion-proof valve 8 provided on the sealing plate 7 is pressed against the through-hole, breaking through the aluminum sheet 8a sealing the through-hole of the explosion-proof valve 8 to create an opening. The lithium-ion secondary battery 1 is then placed in a vacuum dryer to evaporate the electrolyte injected inside. During this process, the vacuum pressure of the vacuum dryer is set to 0.1 MPa or lower, preferably 0.01 MPa or lower, the drying temperature is set to 80 to 120°C, and drying is performed for 6 to 8 hours.

Mitsubishi

See Opp., 21-23; EX1030 ¶ 48; EX1032 ¶¶25.

Conclusion

The PTAB should find each original patent claim invalid in view of the prior art.

- All components/steps were well known, including from PO's own publications.
- All process conditions were well known, or easily would have been arrived at by a POSITA, as confirmed by PO's expert.

The PTAB should deny PO's Contingent Motion to Amend.

- The proposed amendments merely recite features already shown to be present in, or obvious from, the prior art.
- Further references confirm the obviousness of the "new" claims.

