

EX 1002



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/343,224	04/18/2019	Christian HANISCH	03101253US	6508
30743	7590	10/15/2024		
WC&F IP 11491 SUNSET HILLS ROAD SUITE 340 RESTON, VA 20190			EXAMINER YANCHUK, STEPHEN J	
			ART UNIT	PAPER NUMBER
			1752	
			MAIL DATE	DELIVERY MODE
			10/15/2024	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

APPLICATION NO.	ISSUE DATE	PATENT NO.
16/343,224	15-Oct-2024	12119463

WC&F IP
11491 SUNSET HILLS ROAD
RESTON, VA 20190

EGRANT NOTIFICATION

Your electronic patent grant (eGrant) is now available, which can be accessed via Patent Center at <https://patentcenter.uspto.gov>

The electronic patent grant is the official patent grant under 35 U.S.C. 153. For more information, please visit <https://www.uspto.gov/electronicgrants>



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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/343,224	10/15/2024	12119463	03101253US	6508

30743 7590 09/25/2024
WC&F IP
11491 SUNSET HILLS ROAD
SUITE 340
RESTON, VA 20190

ISSUE NOTIFICATION

The projected patent number and issue date are specified above. The patent will issue electronically. The electronically issued patent is the official patent grant pursuant to 35 U.S.C. § 153. The patent may be accessed on or after the issue date through Patent Center at <https://patentcenter.uspto.gov/>. The patent will be available in both the public and the private sides of Patent Center. Further assistance in electronically accessing the patent, or about Patent Center, is available by calling the Patent Electronic Business Center at 1-888-217-9197.

The USPTO is implementing electronic patent issuance with a transition period, during which period the USPTO will mail a ceremonial paper copy of the electronic patent grant to the correspondence address of record. Additional copies of the patent (i.e., certified and presentation copies) may be ordered for a fee from the USPTO's Certified Copy Center at <https://certifiedcopycenter.uspto.gov/index.html>. The Certified Copy Center may be reached at (800)972-6382.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment is 593 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Center (<https://patentcenter.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Patents Stakeholder Experience (OPSE), Stakeholder Support Division (SSD) at (571)-272-4200.

INVENTOR(s) (Please see PATENT CENTER site <https://patentcenter.uspto.gov> for additional inventors):

Christian HANISCH, Braunschweig, GERMANY;

APPLICANT(s) (Please see PATENT CENTER site <https://patentcenter.uspto.gov> for additional applicants):

DUESENFELD GMBH, Wendeburg, GERMANY;

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16343224
Filing Date	2019-04-18
First Named Inventor	Christian Hanisch
Art Unit	
Examiner Name	
Attorney Docket Number	03101253US

	9	9509025	B2	2016-11-29	IIDA SHUJI	
Change(s) applied to document, /K.D.D./ 9/7/2024	10	3671318	A	1972-06-20	MC DONNELL DOUGLAS CORP Moe	
	11	4118219	A	1978-10-03	GOULD INC Elmore et al.	
	12	6524737	B1	2003-02-25	MITSUBISHI HEAVY IND LTD Tanii et al.	
	13	9450277	B2	2016-09-20	RECYCLING COORDINATORS INC Dunagan et al.	
	14	7101425	B2	2006-09-05	THERMOSELECT AG Kiss	Corresponding with DE10118961B4
	15	6524737	B1	2003-02-25	MITSUBISHI HEAVY IND LTD Tanii et al.	Corresponding with EP1041659A1

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Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20030186110	A1	2003-10-02	Steven E. Sloop	
	2	20160043450	A1	2016-02-11	Steven E. Sloop	

If you wish to add additional U.S. Published Application citation information please click the Add button.

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Doc code: IDS

PTO/SB/08a (02-18)

Doc description: Information Disclosure Statement (IDS) Filed

Approved for use through 11/30/2020. OMB 0651-0031

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		16343224	
	Filing Date		2019-04-18	
	First Named Inventor	Christian HANISCH		
	Art Unit			
	Examiner Name			
	Attorney Docket Number		03101253US	

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Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
Change(s) applied to document, /K.D.D./	1	20100230518	A1	2010-09-16	GOWLING LAFLEUR HENDERSON LLP <i>Ewles et al.</i>	

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Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ²	Kind Code ⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T ⁵
	1	2000243396	JP	A	2000-09-08			☐
	2	2741357	EP	A1	2014-06-11	TSR KAT GMBH		☐
	3	2005515605	JP	A	2005-05-26			☐

/STEPHEN J YANCHUK/

06/13/2024

Doc code: IDS

PTO/SB/08a (02-18)

Doc description: Information Disclosure Statement (IDS) Filed

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	Filing Date		2019-04-18
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	Examiner Name		
	Attorney Docket Number		03101253US

U.S.PATENTS Remove						
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	11050097	B2	2021-06-29	DUESENFELD GMBH Hanisch et al.	Corresponding with WO2016174156A1
Change(s) applied to document, /K.D.D./ 9/9/2024	2	8210456	B2	2010-07-03 7/2012	Wayne C. Stevens	
	3	5632863		1997-05-27	W. R. Meador	
	4	9780419	B2	2017-10-03	HANISCH CHRISTIAN	Corresponding with WO2013023640
	5	6447669	B1	2002-09-10	ACCENTUS PLC Hanisch et al.	
	6	9843077	B2	2017-12-12	MITSUBISHI MATERIALS CORP Hayashi et al.	
	7	4357215		1982-11-02	GOODENOUGH JOHN B	
	8	10396408	B2	2019-08-27	KOREA INST GEOSCIENCE & MINERAL RESOURCES Shin et al.	

Doc code: IDS

PTO/SB/08a (02-18)

Doc description: Information Disclosure Statement (IDS) Filed

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Application Number	16343224
Filing Date	2019-04-18
First Named Inventor	Christian HANISCH
Art Unit	
Examiner Name	
Attorney Docket Number	03101253US

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Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
Change(s) applied to document, /A.C./ 7/18/2024	1	9780419	B2	2017-10-03	LION ENGINEERING OMDH Hanisch et al.	

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	1	20050241943	A1	2005-11-03	KAWASAKI JUKOGYO, KABUSHIKI KAISHA Kakuta et al.	
	2	20140290438	A1	2014-10-02	C. HANISCH; W. HASELRIEDER; A. KWADÉ	
	3	20160049699	A1	2016-02-18	MITSUBISHI MATERIALS CORPORATION Hayashi et al.	

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	1	1438729	CN	A	2003-08-27	UNIV HUANAN NORMAL		×



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APPLICATION #
16/343,224

RECEIPT DATE / TIME
08/23/2024 02:10:50 PM Z ET

ATTORNEY DOCKET #
03101253US

Title of Invention

RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION

Application Information

APPLICATION TYPE	Utility - U.S. National Stage under 35 USC 371	PATENT #	-
CONFIRMATION #	6508	FILED BY	Michael Whitham
PATENT CENTER #	66905664	FILING DATE	04/18/2019
CUSTOMER #	30743	FIRST NAMED INVENTOR	Christian HANISCH
INTL. APPLICATION #	-	INTL. FILING DATE	-
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	-

Documents

TOTAL DOCUMENTS: 1

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
2024-08-23_03101253US_IF.pdf	1	Issue Fee Payment (PTO-85B)	156 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
2024-08-23_03101253US_IF.pdf	8DCF8C4FF31679559E6A3E6AA938AD02A13C3B1A959BD825 DBA02C085E74BE6BD023E8C6787D3C5C3E29EA4C89640EA6 5C04BC000C80C063739D07F89ECAB28F

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.



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ELECTRONIC PAYMENT RECEIPT

APPLICATION #
16/343,224

RECEIPT DATE / TIME
08/23/2024 02:10:50 PM Z ET

ATTORNEY DOCKET #
03101253US

Title of Invention

RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION

Application Information

APPLICATION TYPE	Utility - U.S. National Stage under 35 USC 371	PATENT #	-
CONFIRMATION #	6508	FILED BY	Michael Whitham
PATENT CENTER #	66905664	AUTHORIZED BY	-
CUSTOMER #	30743	FILING DATE	04/18/2019
INTL. APPLICATION #	-	INTL. FILING DATE	-
CORRESPONDENCE ADDRESS	-	FIRST NAMED INVENTOR	Christian HANISCH

Payment Information

PAYMENT METHOD CARD / 6511	PAYMENT TRANSACTION ID E20248ME11389433	PAYMENT AUTHORIZED BY Michael Whitham
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1501	UTILITY ISSUE FEE	1200.00	1	1200.00
TOTAL AMOUNT:				\$1,200.00

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PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via the USPTO patent electronic filing system.

By mail, send to: Mail Stop ISSUE FEE
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INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications. **Because electronic patent issuance may occur shortly after issue fee payment, any desired continuing application should preferably be filed prior to payment of this issue fee in order not to jeopardize copendency.**

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via the USPTO patent electronic filing system or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/343,224	04/18/2019	Christian HANISCH	03101253US	6508

TITLE OF INVENTION: RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1200	\$0.00	\$0.00	\$1200	11/20/2024

EXAMINER	ART UNIT	CLASS-SUBCLASS
YANCHUK, STEPHEN J	1752	429-049000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/AIA/122 or PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/AIA/47 or PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 WC&F IP

2 _____

3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY AND STATE OR COUNTRY)

DUESENFELD GMBH

Wendeburg, DE

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. Fees submitted: ☒ Issue Fee ☐ Publication Fee (if required)

4b. Method of Payment: (Please first reapply any previously paid fee shown above)

☒ Electronic Payment via the USPTO patent electronic filing system ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. Change in Entity Status (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature Michael E. Whitham/
Michael E. Whitham

Date 8/23/2024

32635

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APPLICATION #
16/343,224

RECEIPT DATE / TIME
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ATTORNEY DOCKET #
03101253US

Title of Invention

RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION

Application Information

APPLICATION TYPE	Utility - U.S. National Stage under 35 USC 371	PATENT #	-
CONFIRMATION #	6508	FILED BY	Michael Whitham
PATENT CENTER #	66905571	FILING DATE	04/18/2019
CUSTOMER #	30743	FIRST NAMED INVENTOR	Christian HANISCH
INTL. APPLICATION #	-	INTL. FILING DATE	-
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	-

Documents

TOTAL DOCUMENTS: 1

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
2024-08-23_03101253US_rePANCA.pdf	2	Drawings-only black and white line drawings	52 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
2024-08-23_03101253US_rePANCA.pdf	FEBF41D3B01ABE14A391B9865DA1E2D6E4CE26011E3CC8E97EBC4CB9309D960001AA8FB0E24B78E9920C4DDF695E4DACD51B50E194A8CEB8A8F450A9F2C55BE5

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New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re patent application of

Hanisch

Confirmation No. 6508

Serial No. 16/343,224

Group Art Unit 1752

Filed April 18, 2019

Examiner Yanchuck

For Recycling Method for Treating Used Batteries, in Particular Rechargeable
Batteries, and Battery Processing installation

Commissioner for Patents
PO Box 1450
Alexandria, Virginia 22313-1450

RESPONSE TO NOTICE TO FILE CORRECTED APPLICATION PAPERS

Sir:

A notice of allowance issued on August 20, 2024. The issue fee has not yet been paid.

A notice to file corrected application papers was issued August 13, 2021 which indicated that a Replacement Sheet for Figure 1 was required because part of the Figure was truncated or a lead line had no reference number. In response, attached is a Replacement Sheet for Figure 1 which presents Figure 1 as originally filed in an enlarged landscape format. The Replacement Sheet simply enlarges all of the items originally presented in the Figure, removes extraneous markings, and nothing is truncated therein and there are no leadlines which are unattached. No new matter is presented. Please substitute the attached Replacement Sheet for the first sheet with Figure 1 as originally filed.

Respectfully submitted,

/Michael E. Whitham/

Michael E. Whitham
Reg. No. 32,635

WCF IP
11491 Sunset Hills Road, Suite 340
Reston, VA 20190
Tel. (703) 787-9400
Fax. (703) 787-7557
Customer No.: 164319

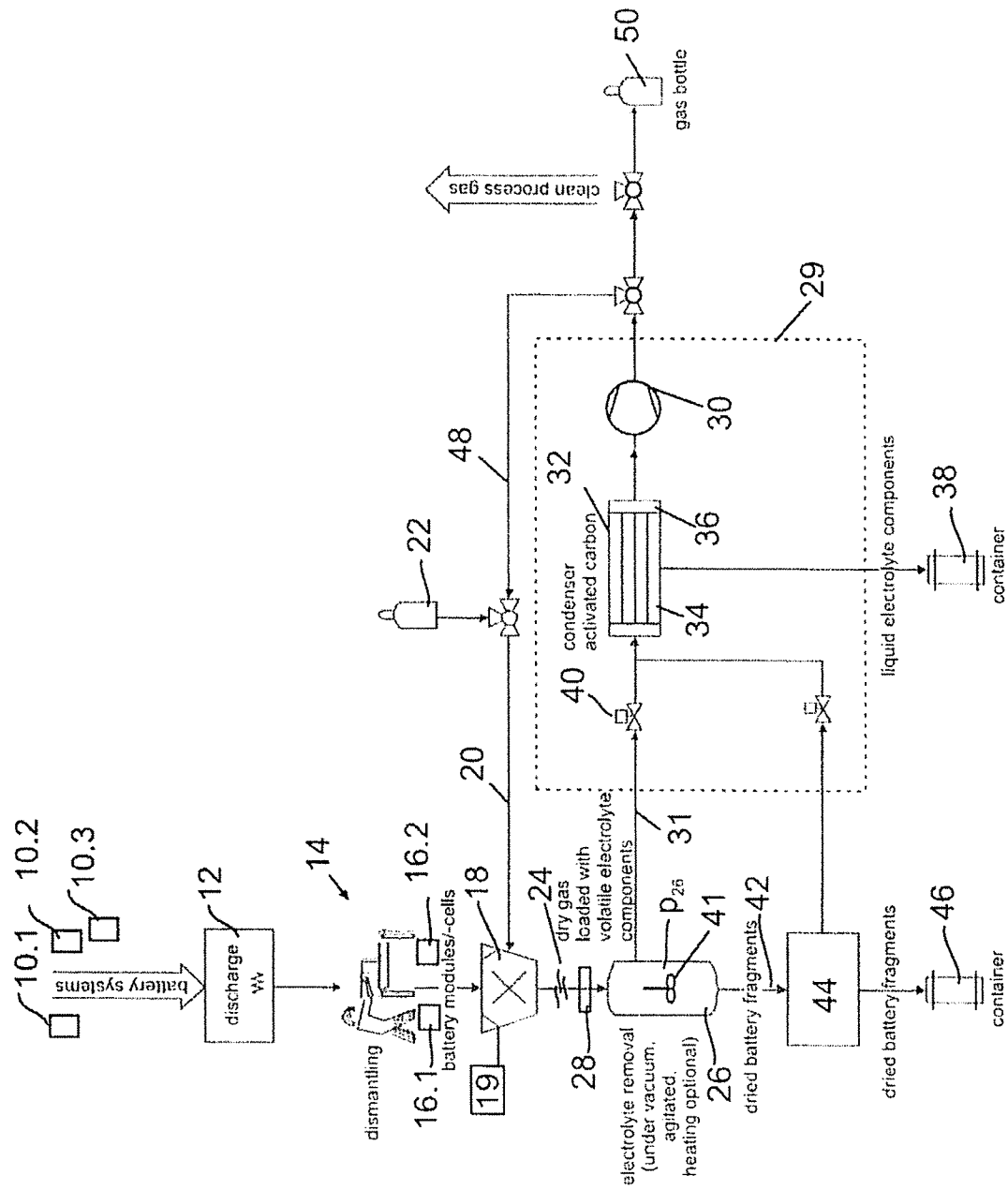


Fig. 1

Placeholder Sheet for Supplemental Content

Application Number: 16343224

Document Date: 08/23/2024

The presence of this form indicates that the following document type was received in electronic format on the date identified above. This document is stored separately from the typical case contents which are stored in image format.

Since this was an electronic submission, there is no physical artifact folder, no artifact folder is recorded and no paper documents or physical media exist.

- Drawing

At the time of document entry (noted above):

- USPTO employees may access this supplemental content via Docket Application Viewer (DAV) or Supplemental Content Viewer (SCV).
- External customers may access this supplemental content via Patent Center.



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NOTICE OF ALLOWANCE AND FEE(S) DUE

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1752	

DATE MAILED: 08/20/2024

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/343,224	04/18/2019	Christian HANISCH	03101253US	6508

TITLE OF INVENTION: RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1200	\$0.00	\$0.00	\$1200	11/20/2024

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 40% the amount of undiscounted fees, and micro entity fees are 20% the amount of undiscounted fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via the USPTO patent electronic filing system.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications. **Because electronic patent issuance may occur shortly after issue fee payment, any desired continuing application should preferably be filed prior to payment of this issue fee in order not to jeopardize copendency.**

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

30743 7590 08/20/2024
WC&F IP
11491 SUNSET HILLS ROAD
SUITE 340
RESTON, VA 20190

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via the USPTO patent electronic filing system or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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16/343,224 04/18/2019 Christian HANISCH 03101253US 6508

TITLE OF INVENTION: RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1200	\$0.00	\$0.00	\$1200	11/20/2024

EXAMINER	ART UNIT	CLASS-SUBCLASS
YANCHUK, STEPHEN J	1752	429-049000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/AIA/122 or PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/AIA/47 or PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,

1 _____

(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

2 _____

3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. Fees submitted: ☐ Issue Fee ☐ Publication Fee (if required)

4b. Method of Payment: (Please first reapply any previously paid fee shown above)

☐ Electronic Payment via the USPTO patent electronic filing system ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. Change in Entity Status (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/343,224	04/18/2019	Christian HANISCH	03101253US	6508
30743	7590	08/20/2024	EXAMINER	
WC&F IP 11491 SUNSET HILLS ROAD SUITE 340 RESTON, VA 20190			YANCHUK, STEPHEN J	
			ART UNIT	PAPER NUMBER
			1752	

DATE MAILED: 08/20/2024

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. The United States Patent and Trademark Office (USPTO) collects the information in this record under authority of 35 U.S.C. 2. The USPTO's system of records is used to manage all applicant and owner information including name, citizenship, residence, post office address, and other information with respect to inventors and their legal representatives pertaining to the applicant's/owner's activities in connection with the invention for which a patent is sought or has been granted. The applicable Privacy Act System of Records Notice for the information collected in this form is COMMERCE/PAT-TM-7 Patent Application Files, available in the Federal Register at 78 FR 19243 (March 29, 2013).

<https://www.govinfo.gov/content/pkg/FR-2013-03-29/pdf/2013-07341.pdf>

Routine uses of the information in this record may include disclosure to:

- 1) law enforcement, in the event that the system of records indicates a violation or potential violation of law;
- 2) a federal, state, local, or international agency, in response to its request;
- 3) a contractor of the USPTO having need for the information in order to perform a contract;
- 4) the Department of Justice for determination of whether the Freedom of Information Act (FOIA) requires disclosure of the record;
- 5) a Member of Congress submitting a request involving an individual to whom the record pertains, when the individual has requested the Member's assistance with respect to the subject matter of the record;
- 6) a court, magistrate, or administrative tribunal, in the course of presenting evidence, including disclosures to opposing counsel in the course of settlement negotiations;
- 7) the Administrator, General Services Administration (GSA), or their designee, during an inspection of records conducted by GSA under authority of 44 U.S.C. 2904 and 2906, in accordance with the GSA regulations and any other relevant (i.e., GSA or Commerce) directive, where such disclosure shall not be used to make determinations about individuals;
- 8) another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c));
- 9) the Office of Personnel Management (OPM) for personnel research purposes; and
- 10) the Office of Management and Budget (OMB) for legislative coordination and clearance.

If you do not furnish the information requested on this form, the USPTO may not be able to process and/or examine your submission, which may result in termination of proceedings, abandonment of the application, and/or expiration of the patent.

Notice of Allowability	Application No. 16/343,224	Applicant(s) HANISCH, Christian	
	Examiner STEPHEN J YANCHUK	Art Unit 1752	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 08/02/2024.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☒ The allowed claim(s) is/are 1-8,17 and 21-25. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a) ☒ All b) ☐ Some* c) ☐ None of the:

1. ☒ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. _____.

3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892) 2. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date <u>08/02/2024</u> . 3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____. 4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.	5. ☐ Examiner's Amendment/Comment 6. ☒ Examiner's Statement of Reasons for Allowance 7. ☐ Other _____.
--	--

/STEPHEN J YANCHUK/
Primary Examiner, Art Unit 1752

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 08/02/2024 has been entered.

Reasons for Allowance

The following is an examiner's statement of reasons for allowance:

Prior art included do not teach or obviate the claim scope as previously allowed. The previous reasons for allowance remain.

The prior art recited in IDS filed 08/02/2024 do not teach the specific method for treating used lithium batteries as positively recited in the instant claim. Some prior art features are silent to the pressure or to the temperature and do not comment on the decomposition of fluorine salt. Prior art that fails to recognize this attribute do not read on the scope of the instant claim as presented. Examiner is unable to make a rejection that the normal processing of the prior art filed in the IDS would vaporize organic carbonate of the electrolyte while having a temperature and pressure that dos not decompose the fluorine salt; it would be inappropriate for examiner to make a statement that the scope conditions recited occur in the method of the prior art without recitation to the such; inferring the condition is present is not appropriate. The examiner is unable to make a rejection and therefore finds the claims allowable.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

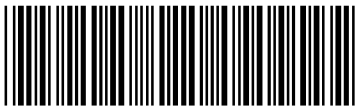
Any inquiry concerning this communication or earlier communications from the examiner should be directed to STEPHEN J YANCHUK whose telephone number is (571)270-7343. The examiner can normally be reached M-Th 10a-8p.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Pamela Weiss can be reached on 571-270-7057. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of published or unpublished applications may be obtained from Patent Center. Unpublished application information in Patent Center is available to registered users. To file and manage patent submissions in Patent Center, visit: <https://patentcenter.uspto.gov>. Visit <https://www.uspto.gov/patents/apply/patent-center> for more information about Patent Center and <https://www.uspto.gov/patents/docx> for information about filing in DOCX format. For additional questions, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/STEPHEN J YANCHUK/
Primary Examiner, Art Unit 1752

<i>Search Notes</i> 	Application/Control No. 16/343,224	Applicant(s)/Patent Under Reexamination HANISCH, Christian
	Examiner STEPHEN J YANCHUK	Art Unit 1752

CPC - Searched*		
Symbol	Date	Examiner
H01M: 10/54, 6/52	05/22/2021	SJY
C22B: 1/005, 7/00,001	05/22/2021	SJY
H01M10/54.cpc. H01M6/52.cpc. Y02P10/20.cpc. Y02W30/84.cpc. C22B1/005.cpc. C22B7/00,001.cpc.*	03/23/2024	SJY

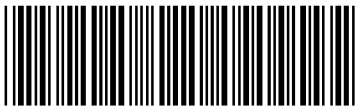
CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
Inventor Search	05/22/2021	SJY
IDS Review	05/22/2021	SJY
App history review: 15/569484	05/22/2021	SJY
East Word Search	05/22/2021	SJY
Updated Search Notes	11/20/2021	SJY
NPL Review: drying comminuted electrolyte	11/20/2021	SJY
Updated SEARCH: Carbonate vaporization with fluorine maintance	03/23/2024	SJY
Updated SEARCH	08/09/2024	SJY
IDS Review	08/09/2024	SJY

/STEPHEN J YANCHUK/ Primary Examiner, Art Unit 1723	
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<i>Search Notes</i> 	Application/Control No. 16/343,224	Applicant(s)/Patent Under Reexamination HANISCH, Christian
	Examiner STEPHEN J YANCHUK	Art Unit 1752

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
H01M	10/54, 6/52	03/23/2024	SJY
Y02P	10/20	03/23/2024	SJY
Y02W	30/84	03/23/2024	SJY
C22B	1/005 7/00,001	03/23/2024	SJY

/STEPHEN J YANCHUK/ Primary Examiner, Art Unit 1723	
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Issue Classification 	Application/Control No. 16/343,224	Applicant(s)/Patent Under Reexamination HANISCH, Christian
	Examiner STEPHEN J YANCHUK	Art Unit 1752

CPC						
Symbol					Type	Version
H01M	/	10	/	54	F	2013-01-01
C22B	/	1	/	005	I	2013-01-01
C22B	/	7	/	001	I	2013-01-01
H01M	/	6	/	52	I	2013-01-01
C22B	/	7	/	00	I	2013-01-01
Y02W	/	30	/	84	A	2015-05-01
Y02P	/	10	/	20	A	2015-11-01

CPC Combination Sets				
Symbol		Type	Set	Version
	/			

NONE	Total Claims Allowed:	
(Assistant Examiner)	(Date)	14
/STEPHEN J YANCHUK/ Primary Examiner, Art Unit 1752	09 August 2024	O.G. Print Claim(s)
(Primary Examiner)	(Date)	1

Issue Classification 	Application/Control No. 16/343,224	Applicant(s)/Patent Under Reexamination HANISCH, Christian
	Examiner STEPHEN J YANCHUK	Art Unit 1752

INTERNATIONAL CLASSIFICATION			
CLAIMED			
H01M	/	10	/ 54
NON-CLAIMED			
	/		/

US ORIGINAL CLASSIFICATION	
CLASS	SUBCLASS

CROSS REFERENCES(S)						
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	14	
/STEPHEN J YANCHUK/ Primary Examiner, Art Unit 1752	09 August 2024	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

Issue Classification 	Application/Control No. 16/343,224	Applicant(s)/Patent Under Reexamination HANISCH, Christian
	Examiner STEPHEN J YANCHUK	Art Unit 1752

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47															
CLAIMS															
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1		10		19										
2	2		11		20										
3	3		12	10	21										
4	4		13	11	22										
5	5		14	12	23										
6	6		15	13	24										
7	7		16	14	25										
8	8	9	17												
	9		18												

NONE	Total Claims Allowed:	
(Assistant Examiner)	(Date)	14
/STEPHEN J YANCHUK/ Primary Examiner, Art Unit 1752	09 August 2024	O.G. Print Claim(s)
(Primary Examiner)	(Date)	1
		O.G. Print Figure
		1

Doc code: IDS

PTO/SB/08a (02-18)

Doc description: Information Disclosure Statement (IDS) Filed

Approved for use through 11/30/2020. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		16343224
	Filing Date		2019-04-18
	First Named Inventor	Christian Hanisch	
	Art Unit		
	Examiner Name		
	Attorney Docket Number		03101253US

U.S.PATENTS Remove						
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	11050097	B2	2021-06-29	DUESENFELD GMBH	Corresponding with WO2016174156A1
	2	8210456	B2	2010-07-03	Wayne C. Stevens	
	3	5632863		1997-05-27	W. R. Meador	
	4	9780419	B2	2017-10-03	HANISCH CHRISTIAN	Corresponding with WO2013023640
	5	6447669	B1	2002-09-10	ACCENTUS PLC	
	6	9843077	B2	2017-12-12	MITSUBISHI MATERIALS CORP	
	7	4357215		1982-11-02	GOODENOUGH JOHN B	
	8	10396408	B2	2019-08-27	KOREA INST GEOSCIENCE & MINERAL RESOURCES	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number		16343224
Filing Date		2019-04-18
First Named Inventor	Christian Hanisch	
Art Unit		
Examiner Name		
Attorney Docket Number	03101253US	

	9	9509025	B2	2016-11-29	IIDA SHUJI	
	10	3671318	A	1972-06-20	MC DONNELL DOUGLAS CORP	
	11	4118219	A	1978-10-03	GOULD INC	
	12	6524737	B1	2003-02-25	MITSUBISHI HEAVY IND LTD	
	13	9450277	B2	2016-09-20	RECYCLING COORDINATORS INC	
	14	7101425	B2	2006-09-05	THERMOSELECT AG	Corresponding with DE10118961B4
	15	6524737	B1	2003-02-25	MITSUBISHI HEAVY IND LTD	Corresponding with EP1041659A1

If you wish to add additional U.S. Patent citation information please click the Add button.

Add

U.S.PATENT APPLICATION PUBLICATIONS

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Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear
	1	20030186110	A1	2003-10-02	Steven E. Sloop	
	2	20160043450	A1	2016-02-11	Steven E. Sloop	

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number		16343224
Filing Date		2019-04-18
First Named Inventor	Christian Hanisch	
Art Unit		
Examiner Name		
Attorney Docket Number	03101253US	

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	1	2013023640	WO	A1	2013-02-21	Technische Universitat Braunschweig Carolo-Wilhelm		☐
	2	2016174156	WO	A1	2016-11-03	LION ENG GMBH		☐
	3	0794587	EP	A2	1997-09-10	CANON KK		☐
	4	105552470	CN	A	2016-05-04	ZHOU HU		☐
	5	10118961	DE	B4	2006-08-31	THERMOSELECT AG		☐
	6	1041659	EP	A1	2000-10-04	MITSUBISHI HEAVY IND LTD		☐
	7	1760821	EP	A1	2007-03-07	TOYOTA MOTOR CO LTD		☐

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	1	Carolo-Wilhelmina University of Technology in Braunschweig Final report "Joint project as part of the "Renewably Mobile" funding program of the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety", July 01, 2012 - March 31, 2016	☒

/STEPHEN J YANCHUK/

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**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	16343224
Filing Date	2019-04-18
First Named Inventor	Christian Hanisch
Art Unit	
Examiner Name	
Attorney Docket Number	03101253US

2	Kwade, A. et al., "LithoRec Recycling von Lithium-Ionen-Batterien " LithoRec, 2012	☒
3	Perry, R. & Green, D., "Perry's Chemical Engineer's Handbook, Seventh Edition", 1997	☐
4	Vacuum Technology; Terms and Definitions; General Terms." DIN 28400-1, German Institute for Standards e.V., 1990.	☐

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Examiner Signature	/STEPHEN J YANCHUK/	Date Considered	08/09/2024
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¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	16343224
Filing Date	2019-04-18
First Named Inventor	Christian Hanisch
Art Unit	
Examiner Name	
Attorney Docket Number	03101253US

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☒ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Michael E. Whitham/	Date (YYYY-MM-DD)	2024-08-02
Name/Print	Michael E. Whitham	Registration Number	32635

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. **DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

08/09/2024

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1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
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/STEPHEN J YANCHUK/

08/09/2024

PE2E SEARCH - Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
L1	1	"16343224"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 09:30 AM
L2	3763	(H01M10/54.cpc.) and @ad<"20161020"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 10:01 AM
L3	4198	(H01M10/54.cpc. H01M6/52.cpc.) and @ad<"20161020"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 10:02 AM
L4	25	L3 and (dry drying) same (pressure mpa hpa) same (temp temperature)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 10:03 AM
L5	5	"15569484"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 10:11 AM
L6	158	L3 and (comminut\$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 10:21 AM
L7	1	L6 and condens\$4 same (dry drying)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 10:22 AM
L8	23	L6 and (agitat\$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 10:23 AM
L9	45	Duesenfeld	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 10:23 AM
L10	255	L3 and (convey\$4 integrated adj3 system)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 10:46 AM
L11	0	L10 and (dustfree dust adj free)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 10:47 AM
L12	32	L10 and (dust)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 10:47 AM
L14	6441	(C22B1/005.cpc.	(US-PGPUB; USPAT;	OR	ON	ON	2021/05/22

		C22B7/00,001.cpc.) and @ad<"20161020"	USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)				11:57 AM
L15	65	L14 and (MPA HPA hectopascal megapascal)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 01:50 PM
L18	4293	(H01M10/54.cpc. H01M6/52.cpc.) and @ad<"20161020"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/11/19 11:09 PM
L19	162	L18 and (comminut\$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/11/19 11:09 PM
L21	25	"2010149611"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/11/19 11:11 PM
L22	4	"5303872".pn.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/11/19 11:12 PM
L23	15	"5303872"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/11/19 11:13 PM
L24	3	"9160043"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/11/19 11:17 PM
L25	3854	(H01M10/54.cpc.) and @ad<"20161020"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/11/20 08:25 AM
L26	14	L25 and (depressur\$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/11/20 08:25 AM
L27	3854	(H01M10/54.cpc.) and @ad<"20161020"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/11/20 10:19 AM
L28	144	L27 and (agitat\$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/11/20 10:19 AM
L29	35	L27 and (agitat\$4) same3 (pressur\$4 depressur\$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/11/20 10:21 AM
L30	11	"11050097"	(US-PGPUB; USPAT; USOCR; FPRS; EPO;	OR	ON	ON	2021/11/20 12:48 PM

L31	3	"16343224"	JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L32	4328	(H01M10/54.cpc.) and @ad<"20161020"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L33	4839	(H01M10/54.cpc. H01M6/52.cpc.) and @ad<"20161020"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L34	31	L3 and (dry drying) same (pressure mpa hpa) same (temp temperature)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L35	7	"15569484"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L36	173	L3 and (comminut\$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L37	3	L6 and condens\$4 same (dry drying)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L38	22	L6 and (agitat\$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L39	80	Duesenfeld	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L40	320	L3 and (convey\$4 integrated adj3 system)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L41	0	L10 and (dustfree dust adj free)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L42	36	L10 and (dust)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L43	7055	(C22B1/005.cpc. C22B7/00,001.cpc.) and @ad<"20161020"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	ON	ON	2024/03/22 04:42 PM

L44	70	L14 and (MPA HPA hectopascal megapascal)	IBM_TDB) (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L45	4839	(H01M10/54.cpc. H01M6/52.cpc.) and @ad<"20161020"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L46	173	L18 and (comminut\$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
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L48	4	"5303872".pn.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L49	15	"5303872"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
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L51	4328	(H01M10/54.cpc.) and @ad<"20161020"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L52	14	L25 and (depressur\$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L53	4328	(H01M10/54.cpc.) and @ad<"20161020"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L54	152	L27 and (agitat\$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L55	35	L27 and (agitat\$4) same3 (pressur\$4 depressur\$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L56	15	"11050097"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM

L57	805	(H01M10/54.cpc. H01M6/52.cpc. Y02/10/20.cpc. Y02W30/84.cpc.) AND @ad<"20171012"	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/22 04:49 PM
L58	135	L57 AND carbonate WITH (pressur\$4 temperature vapor\$4 vaporiz\$4 remov\$4)	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/22 04:50 PM
L59	52	L58 AND (dimethyl ethyl methylcarbonate)	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/22 04:50 PM
L60	50	L59 AND (temperature pressure)	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/22 04:51 PM
L61	26	L60 AND (fluorine)	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/22 04:55 PM
L62	1688	(H01M10/54.cpc. H01M6/52.cpc. Y02/10/20.cpc. Y02W30/84.cpc. C22B1/005.cpc. C22B7/00,001.cpc.) AND @ad<"20171012"	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/22 05:27 PM
L63	115	L62 AND (comminut\$4 (break\$4 shred\$4) WITH (electrode positive negative cathode anode) WITH (small shards fragment\$4 piec\$4))	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/22 05:29 PM
L64	115	L63 AND @ad<"20171012"	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/22 05:29 PM
L65	69	L63 AND (batter\$4 electrochemical lithium)	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/22 05:30 PM
L66	63	L65 AND (pressur\$4 temperature)	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/22 05:31 PM
L67	15	L66 AND carbonate WITH (pressur\$4 temperature vapor\$4 vaporiz\$4 remov\$4)	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/22 05:31 PM
L68	2	"15569484"	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/22 06:29 PM
L69	409	(C22B1/005.cpc.) AND @ad<"20171012"	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/23 01:23 PM
L70	112	L69 AND (fluor\$4 carbonate)	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/23 01:23 PM
L71	50	L70 AND (pressure same2 (temp temperature))	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/23 01:24 PM
L72	13256	(Y02P10/20.cpc.) AND @ad<"20171012"	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/23 02:01 PM
L73	1596	L72 AND (lithium li)	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/23 02:01 PM

L74	701	L73 AND (comminut\$4 crush\$4 Break\$4 shred\$4)	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/23 02:02 PM
L75	72	L74 AND (carbonate same3 fluori\$4)	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/23 02:02 PM
L76	12	"1903082"	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/25 01:41 PM
L77	2	"1841078"	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/27 02:55 PM
L78	10	"2741357"	(US-PGPUB; USPAT)	OR	ON	ON	2024/06/13 05:58 PM
L79	57	"2741357"	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/06/13 05:58 PM
L80	1	("20100230518").pn.	(US-PGPUB; USPAT)	OR	ON	ON	2024/06/13 06:15 PM
L81	4	"16343224"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L82	4338	(H01M10/54.cpc.) and @ad<"20161020"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L83	4849	(H01M10/54.cpc. H01M6/52.cpc.) and @ad<"20161020"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L84	31	L3 and (dry drying) same (pressure mpa hpa) same (temp temperature)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L85	7	"15569484"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L86	173	L3 and (comminut\$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM

L87	3	L6 and condens\$4 same (dry drying)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L88	22	L6 and (agitat\$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L89	82	Duesenfeld	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L90	324	L3 and (convey\$4 integrated adj3 system)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L91	0	L10 and (dustfree dust adj free)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L92	37	L10 and (dust)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L93	7061	(C22B1/005.cpc. C22B7/00,001.cpc.) and @ad<"20161020"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L94	70	L14 and (MPA HPA hectopascal megapascal)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L95	4849	(H01M10/54.cpc. H01M6/52.cpc.) and @ad<"20161020"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L96	173	L18 and (comminut\$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L97	31	"2010149611"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L98	4	"5303872".pn.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L99	15	"5303872"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L100	4	"9160043"	(US-PGPUB; USPAT;	OR	ON	ON	2024/08/09

L101	4338	(H01M10/54.cpc.) and @ad<"20161020"	USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	02:08 PM 2024/08/09 02:08 PM
L102	14	L25 and (depressur\$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L103	4338	(H01M10/54.cpc.) and @ad<"20161020"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L104	152	L27 and (agitat\$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L105	35	L27 and (agitat\$4) same3 (pressur\$4 depressur\$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L106	16	"11050097"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L107	4	"16343224"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L108	4338	(H01M10/54.cpc.) and @ad<"20161020"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L109	4849	(H01M10/54.cpc. H01M6/52.cpc.) and @ad<"20161020"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L110	31	L3 and (dry drying) same (pressure mpa hpa) same (temp temperature)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L111	7	"15569484"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L112	173	L3 and (comminut\$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L113	3	L6 and condens\$4 same (dry drying)	(US-PGPUB; USPAT; USOCR; FPRS; EPO;	OR	ON	ON	2024/08/09 02:08 PM

L114	22	L6 and (agitat\$4)	JPO; DERWENT; IBM_TDB) (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L115	82	Duesenfeld	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L116	324	L3 and (convey\$4 integrated adj3 system)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L117	0	L10 and (dustfree dust adj free)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L118	37	L10 and (dust)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L119	7061	(C22B1/005.cpc. C22B7/00,001.cpc.) and @ad<"20161020"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L120	70	L14 and (MPA HPA hectopascal megapascal)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L121	4849	(H01M10/54.cpc. H01M6/52.cpc.) and @ad<"20161020"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L122	173	L18 and (comminut\$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L123	31	"2010149611"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L124	4	"5303872".pn.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L125	15	"5303872"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L126	4	"9160043"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	ON	ON	2024/08/09 02:08 PM

L127	4338	(H01M10/54.cpc.) and @ad<"20161020"	IBM_TDB) (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L128	14	L25 and (depressur\$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L129	4338	(H01M10/54.cpc.) and @ad<"20161020"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L130	152	L27 and (agitat\$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L131	35	L27 and (agitat\$4) same3 (pressur\$4 depressur\$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L132	16	"11050097"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L133	806	(H01M10/54.cpc. H01M6/52.cpc. Y02/10/20.cpc. Y02W30/84.cpc.) AND @ad<"20171012"	(US-PGPUB; USPAT)	OR	ON	ON	2024/08/09 02:08 PM
L134	134	L57 AND carbonate WITH (pressur\$4 temperature vapor\$4 vaporiz\$4 remov\$4)	(US-PGPUB; USPAT)	OR	ON	ON	2024/08/09 02:08 PM
L135	52	L58 AND (dimethyl ethyl methylcarbonate)	(US-PGPUB; USPAT)	OR	ON	ON	2024/08/09 02:08 PM
L136	50	L59 AND (temperature pressure)	(US-PGPUB; USPAT)	OR	ON	ON	2024/08/09 02:08 PM
L137	26	L60 AND (fluorine)	(US-PGPUB; USPAT)	OR	ON	ON	2024/08/09 02:08 PM
L138	1689	(H01M10/54.cpc. H01M6/52.cpc. Y02/10/20.cpc. Y02W30/84.cpc. C22B1/005.cpc. C22B7/00,001.cpc.) AND @ad<"20171012"	(US-PGPUB; USPAT)	OR	ON	ON	2024/08/09 02:08 PM
L139	116	L62 AND (comminut\$4 (break\$4 shred\$4) WITH (electrode positive negative cathode anode) WITH (small shards	(US-PGPUB; USPAT)	OR	ON	ON	2024/08/09 02:08 PM

L140	116	fragment\$4 piec\$4)) L63 AND @ad<"20171012"	(US-PGPUB; USPAT)	OR	ON	ON	2024/08/09 02:08 PM
L141	70	L63 AND (batter\$4 electrochemical lithium)	(US-PGPUB; USPAT)	OR	ON	ON	2024/08/09 02:08 PM
L142	64	L65 AND (pressur\$4 temperature)	(US-PGPUB; USPAT)	OR	ON	ON	2024/08/09 02:08 PM
L143	15	L66 AND carbonate WITH (pressur\$4 temperature vapor\$4 vaporiz\$4 remov\$4)	(US-PGPUB; USPAT)	OR	ON	ON	2024/08/09 02:08 PM
L144	2	"15569484"	(US-PGPUB; USPAT)	OR	ON	ON	2024/08/09 02:08 PM
L145	409	(C22B1/005.cpc.) AND @ad<"20171012"	(US-PGPUB; USPAT)	OR	ON	ON	2024/08/09 02:08 PM
L146	112	L69 AND (fluor\$4 carbonate)	(US-PGPUB; USPAT)	OR	ON	ON	2024/08/09 02:08 PM
L147	50	L70 AND (pressure same2 (temp temperature))	(US-PGPUB; USPAT)	OR	ON	ON	2024/08/09 02:08 PM
L148	13261	(Y02P10/20.cpc.) AND @ad<"20171012"	(US-PGPUB; USPAT)	OR	ON	ON	2024/08/09 02:08 PM
L149	1596	L72 AND (lithium li)	(US-PGPUB; USPAT)	OR	ON	ON	2024/08/09 02:08 PM
L150	701	L73 AND (comminut\$4 crush\$4 Break\$4 shred\$4)	(US-PGPUB; USPAT)	OR	ON	ON	2024/08/09 02:08 PM
L151	72	L74 AND (carbonate same3 fluori\$4)	(US-PGPUB; USPAT)	OR	ON	ON	2024/08/09 02:08 PM
L152	13	"1903082"	(US-PGPUB; USPAT)	OR	ON	ON	2024/08/09 02:08 PM
L153	2	"1841078"	(US-PGPUB; USPAT)	OR	ON	ON	2024/08/09 02:08 PM
L154	10	"2741357"	(US-PGPUB; USPAT)	OR	ON	ON	2024/08/09 02:08 PM
L155	57	"2741357"	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/08/09 02:08 PM
L156	1	("20100230518").pn.	(US-PGPUB; USPAT)	OR	ON	ON	2024/08/09

L157	16	("10396408" "11050097 "20030186110" "2016 0043450" "3671318" "4 118219" "4357215" "56 32863" "6447669" "652 4737" "7101425" "8210 456" "9450277" "95090 25" "9780419" "984307 7").PN.	(US-PGPUB; USPAT)	OR	ON	ON	02:08 PM 2024/08/09 02:09 PM
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PE2E SEARCH - Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
N1	1	(electrochemical battery batteries).clm. AND (comminut\$4 crush\$4 Break\$4 shred\$4).clm. AND (carbonate).clm. AND (fluor\$4 WITH salt).clm. AND (pressure).clm. AND (temperature).clm.	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/23 01:36 PM
N2	5	"20040028585"	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/23 01:51 PM



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www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/343,224	04/18/2019	Christian HANISCH	03101253US	6508
30743	7590	08/13/2024		
WC&F IP 11491 SUNSET HILLS ROAD SUITE 340 RESTON, VA 20190			EXAMINER YANCHUK, STEPHEN J	
			ART UNIT	PAPER NUMBER
			1752	
			MAIL DATE	DELIVERY MODE
			08/13/2024	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.



UNITED STATES PATENT AND TRADEMARK OFFICE

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P.O. Box 1450
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Application No. : 16343224
Applicant : Hanisch
Filing Date : 04/18/2019
Date Mailed : 08/13/2024

NOTICE TO FILE CORRECTED APPLICATION PAPERS

Notice of Allowance Mailed

This application has been accorded an Allowance Date and is being prepared for issuance. The application, however, is incomplete for the reasons below.

Applicant is given two (2) months from the mail date of this Notice within which to respond. This time period for reply is extendable under 37 CFR 1.136(a) for only TWO additional MONTHS.

The informalities requiring correction are indicated in the attachment(s). If the informality pertains to the abstract, specification (including claims) or drawings, the informality must be corrected with an amendment in compliance with 37 CFR 1.121 (or, if the application is a reissue application, 37 CFR 1.173). Such an amendment may be filed after payment of the issue fee if limited to correction of informalities noted herein. See Waiver of 37 CFR 1.312 for Documents Required by the Office of Patent Publication, 1280 Off. Gaz. Patent Office 918 (March 23, 2004). In addition, if the informality is not corrected until after payment of the issue fee, for purposes of 35 U.S.C. 154(b)(1)(iv), “all outstanding requirements” will be considered to have been satisfied when the informality has been corrected. A failure to respond within the above-identified time period will result in the application being ABANDONED.

See attachment(s).

*A copy of this notice **MUST** be returned with the reply. Please address response to
“Mail Stop Issue Fee, Commissioner for Patents,
P.O. Box 1450, Alexandria, VA 22313-1450”.*

/Marsha Palmer-Lee/
Publication Branch
Office of Data Management
(571) 272-4200

IDENTIFICATION OF DRAWING DEFICIENCIES

- ☐ There is a hole or the image thereof within the illustration. FIG(s)
- ☐ The illustration is penetrated or traversed by a solid or broken line that is not intended to be part of the drawing, such as a dark line caused by a flaw in the copying process. FIG(s)
- ☐ An ink stamp or the image thereof obscures part of the illustration. FIG(s)
- ☐ The drawing is marred by black smudges, obliterations, or fax/copier marks (for example, speckles or dots in a substantial portion of the drawing). FIG(s)
- ☐ Figure numbers are duplicated or missing. FIG(s)
- ☐ Drawing sheet or figure is missing. FIG(s)
- ☐ Numbers, letters, or reference characters in the drawing have been crossed out or are illegibly handwritten. FIG(s)
- ☐ The character of the lines, numbers, and letters is poor. FIG(s)
- ☐ The drawing's background shows that the original drawing was made on graph paper or other paper with a pattern or decoration. FIG(s)
- ☐ The FIG. number label is placed in a location that causes the drawing to be read upside down. FIG(s)
- ☒ Data, a reference number, or part of the drawing is truncated or missing, or a lead line has no reference number. FIG(s) 1
- ☐ The drawing and/or the FIG. label contain(s) foreign language. FIG(s)
- ☐ This utility application contains a photograph of a view that is capable of being illustrated as a line drawing. FIG(s)
- ☐ A petition under 37 CFR 1.84(a)(2) to accept color drawings has been granted, but the brief description of the drawings in the specification does not contain (or has not been amended to contain) the paragraph required by 37 CFR 1.84(a)(2)(iii).
- ☐ This reissue application contains added and/or amended drawings that are not labeled as "New" or "Amended" or "Canceled" as required by 37 CFR 1.173(b)(3). FIG(s)
- ☐ This Design reissue application contains a drawing that is labeled as "Canceled" but is not surrounded by brackets, or a drawing that is surrounded by brackets but is not labeled as "Canceled." See 37 CFR 1.173(b)(3). FIG(s)
- ☐ OTHER:
- ☐ COMMENTS:



ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #
16/343,224

RECEIPT DATE / TIME
08/02/2024 04:29:18 PM Z ET

ATTORNEY DOCKET #
03101253US

Title of Invention

RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION

Application Information

APPLICATION TYPE Utility - U.S. National Stage under 35 USC 371

PATENT # -

CONFIRMATION # 6508

FILED BY Michael Whitham

PATENT CENTER # 66634742

FILING DATE 04/18/2019

CUSTOMER # 30743

FIRST NAMED INVENTOR Christian HANISCH

INTL. APPLICATION # -

INTL. FILING DATE -

CORRESPONDENCE ADDRESS -

AUTHORIZED BY -

Documents

TOTAL DOCUMENTS: 1

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
2024-08-02_03101253US__RCE.pdf	1	Request for Continued Examination (RCE)	100 KB

Warning: This is not a USPTO supplied RCE fillable form. Data in the form cannot be automatically loaded to other USPTO systems.

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
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2024-08-
02_03101253US_RCE.pdf

7010BD4E60929B7E18A5EB02F738C28AEE1546EF162B772723
A1B430291D4643148E3182D20637EEB56477E0303C34A57901
87F71EA663A69E9E30ECF8DC1C39

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

**Request
for
Continued Examination (RCE)
Transmittal**

Address to:
Mail Stop RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Application Number	16/345,224
Filing Date	April 18, 2019
First Named Inventor	Hanisch
Art Unit	1752
Examiner Name	Yanchuk
Attorney Docket Number	03101253US

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.

Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. See Instruction Sheet for RCEs (not to be submitted to the USPTO) on page 2.

1. **Submission required under 37 CFR 1.114** Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).
- a. ☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.
- i. ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____
- ii. ☐ Other _____
- b. ☒ Enclosed
- i. ☐ Amendment/Reply
- ii. ☐ Affidavit(s)/ Declaration(s)
- iii. ☒ Information Disclosure Statement (IDS)
- iv. ☐ Other _____
2. **Miscellaneous**
- a. ☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of _____ months. (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(l) required)
- b. ☐ Other _____
3. **Fees** The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.
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APPLICATION #
16/343,224

RECEIPT DATE / TIME
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Title of Invention

RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION

Application Information

APPLICATION TYPE	Utility - U.S. National Stage under 35 USC 371	PATENT #	-
CONFIRMATION #	6508	FILED BY	Michael Whitham
PATENT CENTER #	66634742	AUTHORIZED BY	-
CUSTOMER #	30743	FILING DATE	04/18/2019
INTL. APPLICATION #	-	INTL. FILING DATE	-
CORRESPONDENCE ADDRESS	-	FIRST NAMED INVENTOR	Christian HANISCH

Payment Information

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FEE CODE	DESCRIPTION	ITEM PRICE(\$)	QUANTITY	ITEM TOTAL(\$)
1820	REQUEST FOR CONTINUED EXAMINATION (RCE)- 2ND AND SUBSEQUENT REQUEST (SEE 37 CFR 1.114)	2000.00	1	2000.00
TOTAL AMOUNT:				\$2,000.00

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EXHIBIT 1013

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES
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(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

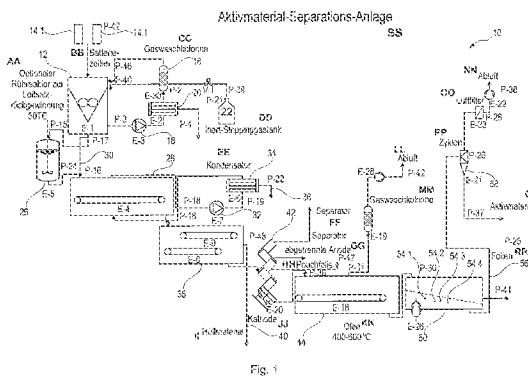


Fig. 1

SS Active material separation installation
 AA Optional stirred reactor for recovering conducting salt
 BB Battery cells
 CC Gas-scrubbing column
 DD Inert stripping-gas tank
 EE Condenser
 FF Separator
 GG Separated anodes
 HH Pouch film
 I Cladding material
 JJ Cathode
 KK Furnace
 LL Exhaust air
 MM Gas-scrubbing column
 NN Exhaust air
 OO Air filter
 PP Cyclone
 QQ Active material
 RR Films

(57) Abstract: The invention relates to a method for reclaiming active material of a galvanic cell that comprises an active material, a carrier for said active material, and a binder for binding the active material and the carrier, said method comprising the following steps: (a) comminuting the cells, particularly under inert gas or in a vacuum, such that solid cell fragments are at least also produced, (b) heating the solid cell fragments to a decomposition temperature (T_d) selected to be high enough that the binder decomposes and/or evaporates, preferably under inert gas or in a vacuum, so as to produce thermally treated cell fragments, and (c) classifying these thermally treated cell fragments, wherein (d) the classification comprises an air-jet sieving process and (e) the air-jet sieving is implemented such that active material is separated from the carrier.

(57) Zusammenfassung: Die Erfindung betrifft ein Verfahren zum Wiedergewinnen von Aktivmaterial einer galvanischen Zelle, die ein Aktivmaterial, einen Träger für das Aktivmaterial und einen Binder zum Verbinden des Aktivmaterials und des Trägers umfasst, mit den Schritten: (a) Zerkleinern der Zellen, insbesondere unter Inertgas oder im Vakuum, so dass zumindest auch feste Zellenfragmente entstehen, (b) Erwärmen der festen Zellenfragmente

[Fortsetzung auf der nächsten Seite]

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Erklärungen gemäß Regel 4.17:

- hinsichtlich der Berechtigung des Anmelders, ein Patent zu beantragen und zu erhalten (Regel 4.17 Ziffer ii)
- Erfindererklärung (Regel 4.17 Ziffer iv)

Veröffentlicht:

- mit internationalem Recherchenbericht (Artikel 21 Absatz 3)
- vor Ablauf der für Änderungen der Ansprüche geltenden Frist; Veröffentlichung wird wiederholt, falls Änderungen eingehen (Regel 48 Absatz 2 Buchstabe h)

auf eine Zersetzungs-Temperatur (T_z), die so hoch gewählt ist, dass der Binder sich zersetzt und/oder verdampft, vorzugsweise unter Intergas oder im Vakuum so dass wärmebehandelte Zellenfragmente entstehen, und (c) Klassieren der wärmebehandelten Zellenfragmente, wobei (d) das Klassieren ein Luftstrahlsieben umfasst und (e) das Luftstrahlsieben so durchgeführt wird, dass Aktivmaterial von dem Träger getrennt wird.

Verfahren zum Wiedergewinnen von Aktivmaterial aus einer galvanischen Zelle und Aktivmaterial-Separationsanlage, insbesondere Aktivmetall-Separationsanlage

- 5 Die Erfindung betrifft ein Verfahren zum Wiedergewinnen von Aktivmaterial, insbesondere von Lithium oder Lithiumverbindungen, aus einer galvanischen Zelle, die ein Aktivmaterial, einen Träger für das Aktivmaterial, einen Binder zum Verbinden des Aktivmaterials und des Trägers und gegebenenfalls einen Elektrolyten umfasst, mit den Schritten: (a) Zerkleinern
- 10 der Zellen, insbesondere unter Inertgas, so dass zumindest auch feste Zellenfragmente entstehen, (b) Erwärmen der festen Zellenfragmente auf eine Zersetzung-Temperatur, die so hoch gewählt ist, dass der Binder sich zersetzt und/oder verdampft, so dass wärmebehandelte Zellenfrag-
- mente entstehen, und (c) Klassieren der wärmebehandelten Zellenfrag-

Gemäß einem zweiten Aspekt betrifft die Erfindung eine Aktivmetall-Separationsanlage, die ausgebildet ist zum Wiedergewinnen von Aktivmaterial, insbesondere Lithium, einer galvanischen Zelle, die ein Aktivmaterial, einen Träger für das Aktivmaterial, einen Binder zum Verbinden des Aktivmaterials und des Trägers und einen Elektrolyten umfasst, mit (a) einer Zellenzerkleinerungsvorrichtung zum Zerkleinern der Zellen, wobei die Zellenzerkleinerungsvorrichtung gasdicht ist und eine Inertgas-Zuführungsvorrichtung umfasst, so dass die Zellen unter Inertgas zu Zellenfragmenten zerkleinerbar sind, und (b) einem Ofen, der zumindest mittelbar mit der Zellenzerkleinerungsvorrichtung verbunden und eingerichtet ist zum Erwärmen der Zellenfragmente auf eine Zersetzungstemperatur, die so hoch gewählt ist, dass der Binder sich zersetzt.

Bestätigungskopie

Beim Recycling von Aktivmaterial, insbesondere von Lithium aus Lithium-Akkumulatoren oder Batterien, besteht das Problem, dass die chemischen Prozesse relativ aufwendig sind. Der Grund dafür ist, dass die Trennung des Aktivmaterials von seinem Träger nur unzureichend gelingt.

5

Aus der US 2005/0241943 A1 ist ein Verfahren bekannt, bei dem die Zellen zunächst zerkleinert und dann einer Wärmebehandlung unterzogen werden. Danach werden die Zellen geschreddert und auf die Zersetzungstemperatur erwärmt. Anschließend werden die wärmebehandelten Zellenfragmente durch Vibrationssieben getrennt. Es hat sich jedoch gezeigt, dass dieses Verfahren aufwendig ist. Der Erfindung liegt die Aufgabe zugrunde, das Wiedergewinnen von Aktivmaterial, insbesondere von Lithium oder Lithiumverbindungen, aus alten Batterien oder Akkumulatoren zu verbessern.

15

Aus der DE 199 54 998 A1 ist eine Schneidmühle bekannt, bei der das

von einem Schneidrotor geschnittene Gut kontinuierlich so durch ein Sieb, insbesondere ein Luftstrahlsieb, gefördert wird, das nur diejenigen Partikel die Vorrichtung verlassen können, die eine vorgegebene Größe unterschreiten.

Aus der DE 29 803 442 U1 ist ein Luftstrahlsieb für die Analyse bekannt, mit dem eine hohe Zahl an Analysen in kurzer Zeit durchführbar ist und das zu diesem Zweck mehrere gegeneinander abgetrennte Siebflächen aufweist. Dieses Luftsieb wird zur Bestimmung von Korngrößenverteilungen im Feinkornbereich eingesetzt.

Aus der AT 386 769 B ist eine Luftstrahl-Mehrdeck-Siebmaschine bekannt, mittels der trockene, rieselförmige Schuttgüter kleiner Korngröße in bis zu 25 Fraktionen in einem Arbeitsgang klassifiziert werden können.

Die Erfindung löst das Problem durch ein gattungsgemäßes Verfahren, bei dem das Klassieren ein Luftstrahlsieben umfasst. Gemäß einem zweiten Aspekt löst die Erfindung das Problem durch eine Aktivmetall-Separationsanlage, die eine Luftstrahlsiebvorrichtung besitzt, die zumindest unmittelbar mit dem Ofen verbunden und eingerichtet ist zum Klassieren von Aktivmaterial und Träger, insbesondere Trägerfolie.

Vorteilhaft an der Erfindung ist, dass das Aktivmaterial in hoher Reinheit gewonnen werden kann. Der Grund dafür ist, dass beim Luftstrahlsieben sehr kleine Maschenweiten einsetzbar sind, so dass auch kleine Verunreinigungspartikel ferngehalten werden.

Vorteilhafterweise kann auch das Trägermaterial in hoher Reinheit zurückgewonnen werden kann. Beispielsweise wird als Träger häufig Aluminiumfolie verwendet, die nur dann effizient recycelt werden kann, wenn sie gewisse Mindestanforderungen hinsichtlich der Reinheit erfüllt. Beispielswei-

se eignet sich eine Trägerfolie mit mehr als 0,03 % Verunreinigungen nur wenig zum Recyceln. In der weiteren hydrometallurgischen Aufarbeitung neigen Übergangsmetallsalzlösungen aus einer sauren Lithiumlösung zur Agglomeration, wenn diese die bei der konventionellen Trennung üblichen ca. 1 Massen-% Aluminiumkontamination enthalten. Dieser Aspekt liegt darin begründet, dass sich Aluminiumhydroxid-Komplexe bilden, welche die Agglomerate fest verbinden. Diese festen Agglomerate lassen sich in einem herkömmlichen Prozess nicht vollständig vermahlen, was zu einem Materialverlust führt. Entsprechend hergestellte Aluminium-kontaminierte Übergangsmetallsalzlösungen müssten so vor der Vermahlung kostenintensiv aufgereinigt werden. Bei einer Reduktion des Aluminiumgehalts auf unter 0,1 % ist dieser Effekt nicht mehr zu beobachten. Mit dem erreichten Resultat einer Al-Kontamination von nur 0,05-0,06 Massen-% lassen sich die Materialien demnach ökologisch und ökonomisch vorteilhaft recyceln. Dadurch, dass beim Aufprall auf das Sieb beim Luftstrahlsieben Aktivmaterial abgeklopft wird, lassen sich sehr hohe Reinheiten für den

Träger, insbesondere die Trägerfolie, erreichen.

Der Erfindung liegt die Erkenntnis zugrunde, dass das Erwärmen der Zellenfragmente auf die Zersetzungstemperatur zwar theoretisch ausreichen müsste, um den Binder so weit zu zerstören, dass das Aktivmaterial freigesetzt wird, dass aber dennoch das Aktivmaterial nur schwer vom Träger zu lösen ist. Aufgrund welchen Effekts das Aktivmaterial auch ohne Binder am Träger anhaftet, ist bislang noch ungeklärt.

- 10 Beim Luftstrahlsieben kommt es zu einem heftigen Aufprall des Trägers mit noch anhaftendem Aktivmaterial auf das Sieb. Dieser Aufprall löst noch anhaftendes Aktivmaterial ab, so dass es wiedergewonnen werden kann.

rieren bezeichnet werden. Analog kann die Luftstrahlsiebvorrichtung auch als Prallsepariervorrichtung und das Luftstrahlsieb auch als Prallseparator bezeichnet werden.

20

Erfindungsgemäß ist damit auch eine Aktivmaterial-Separationsanlage, die eine Prallseparationsvorrichtung, die zumindest mittelbar mit dem Ofen verbunden und eingerichtet ist zum Klassieren von Aktivmaterial und Träger, indem das Luftstrahlsieben so durchgeführt wird, dass das

25 Aktivmaterial zumindest auch durch einen Aufprall auf ein Sieb der Prallseparationsvorrichtung und/oder auf eine Prallplatte von dem Träger getrennt wird.

30

Das Luftstrahlsieben ist bekannt als Laborverfahren zum Trennen von kleinen Partikeln von anderen kleinen Partikeln. Die wärmebehandelten Zellenfragmente haben jedoch einen um Größenordnungen größeren Durchmesser als die Partikel des Aktivmaterials, so dass die Fähigkeit des

Luftstrahlsiebens zur Trennung von zwei Arten von Partikeln mit jeweils kleinen Durchmessern für das erfindungsgemäße Verfahren irrelevant ist. Im erfindungsgemäßen Verfahren wird das Luftstrahlsieben auch als zusätzlicher Trennschritt eingesetzt.

5

Im Rahmen der vorliegenden Beschreibung wird unter dem Zerkleinern der Zellen insbesondere ein Zerschneiden, Zerschlagen, Zerhackeln oder Zerdrücken verstanden. Das kann bei Temperaturen zwischen -195,79 °C -100 °C erfolgen, so dass nur geringe Anforderungen hinsichtlich des

10 Temperaturregimes bestehen.

Unter dem Erwärmen der festen Zellenfragmente wird insbesondere ein Erwärmen in einem gasdichten Behälter verstanden, so dass beispielsweise Sauerstoff am Zutritt gehindert wird. Insbesondere erfolgt das Erwär-

15 men unter Inertgas oder im Vakuum.

Unter dem Aktivmaterial wird insbesondere eine Verbindung verstanden, welche Lithiumionen reversibel aufnehmen und abgeben kann. Auf der Kathodenseite beispielsweise Lithiumnickelmangankobaltoxid, Lithiumnickelaluminiumoxid und Lithiumeisenphosphat, auf der Anodenseite beispielsweise Graphit.

Unter dem Träger für das Aktivmaterial wird insbesondere eine Trägerfolie verstanden, auf der das Aktivmaterial in Form von Partikeln aufgebracht ist. Beispielsweise handelt es sich bei der Trägerfolie um Aluminiumfolie. Bei dem Binder handelt es sich beispielsweise um Polyvinylidenfluorid (PVDF).

Das Zerkleinern der Zellen und/oder das Erwärmen der festen Zellenfragmente erfolgt bevorzugt unter Inertgas, beispielsweise unter Stickstoff. Günstig ist es, wenn das Zerkleinern der Zellen unter Umgebungstemperatur, insbesondere unter bei höchstens 30°, erfolgt, wobei es vorteilhaft

sein kann, wenn die Zerkleinerungsvorrichtung, mit der die Zellen zerkleinert werden, gekühlt wird, so dass der Wärmeeinfluss auf die Zellen gering bleibt.

- 5 Das erfindungsgemäße Verfahren wird vorzugsweise als kontinuierlicher Prozess durchgeführt, also nicht chargenweise.

Vorzugsweise beträgt der Durchsatz mehr als 100 Tonnen pro Jahr. Das Luftstrahlsieben wird bislang im Labormaßstab eingesetzt, wo es zur chargenweisen Bearbeitung von Proben genutzt wird. Diese Proben sind zudem sehr klein. Der Einsatz des Luftstrahlsiebens in einem Massenverfahren ist bislang unbekannt.

10

Gemäß einer bevorzugten Ausführungsform werden galvanische Zellen verwendet, deren Aktivmaterial aus Partikeln besteht, die eine Partikeldurchmesserverteilung haben und wobei diese Partikel-

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- durchmesserverteilung einen 90%-Durchmesser besitzt, der demjenigen Durchmesser entspricht, der größer ist als der Durchmesser von 90 % aller Partikel und der kleiner ist als der Durchmesser von 10 % aller Partikel, wobei das Luftstrahlsieben mit einem Sieb erfolgt, dessen Maschenweite maximal dem 200-fachen des 90 %-Durchmessers entspricht. Der angegebene Partikeldurchmesser ist derjenige, der durch Siebung erhalten wird.
- 25 Vorzugsweise beträgt die Maschenweite des Siebs höchstens 250 μm , insbesondere höchstens 100 μm . Moderne Lithium-Ionen-Batterien besitzen ein Aktivmaterial, das aus Partikeln mit einem Durchmesser von weniger als 200 μm aufgebaut ist. Bei klassischen Siebverfahren, beispielsweise dem Vibrationssieben, muss eine deutlich größere Maschenweite gewählt werden, damit nicht die Siebzeit so groß wird, dass das Verfahren unwirtschaftlich wird. Eine größere Maschenweite jedoch hat zur Folge, dass mehr Schmutzpartikel durch das Sieb gelangen, so dass die Reinheit

des gewonnenen Aktivmaterials sinkt.

Vorzugsweise umfassen die galvanischen Zellen je zumindest eine Anode und zumindest eine Kathode, wobei die Anoden und Kathoden gemeinsam erwärmt und die entstehenden wärmebehandelten Zellenfragmente in einem gemeinsamen Luftstrahlsieb klassiert werden. Unter dem Merkmal, dass die Anoden und die Kathoden gemeinsam erwärmt werden, wird verstanden, dass ein Gemisch aus beiden in ein und derselben Vorrichtung erwärmt wird. Das ist möglich, da das Luftstrahlsieben zu einer hinreichend sortenreinen Trennung von Stromsammelfolie und Beschichtungs-
partikeln führt.

Vorzugsweise umfasst das Verfahren den Schritt, dass vor dem Erwärmen der Zellenfragmente auf die Zersetzungstemperatur die Zellenfragmente bei einer Trocknungs-Temperatur getrocknet werden, so dass trockene Zellenfragmente und Trocknungsdämpfe entstehen, wobei zumindest ein

Teil der Trocknungsdämpfe kondensiert wird. Das hat den Vorteil, dass das Elektrolytlöschungsmittel zurückgewonnen werden kann. Es ist dabei vorteilhaft, wenn die Trocknungs-Temperatur unter 100 °C liegt, insbesondere unter 80 °C.

Vorzugsweise wird das Erwärmen der Zellenfragmente auf die Zersetzung-Temperatur unter Inertgas oder im Vakuum durchgeführt. Das hat den Vorteil, dass Kupfer dann nicht oxidiert, so dass sowohl die Anode als auch die Kathode gemeinsam verarbeitet werden können. Das wiederum führt zu einem besonders einfachen Trennverfahren, das dennoch hochsortenreine Recyclingprodukte zur Verfügung stellt. Unter Inertgas wird ein Gas oder Gasgemisch verstanden, das unter den vorliegenden Umgebungsbedingungen weder mit Kupfer noch mit Aluminium (Stromsammel-

folien) reagiert. Das Kupfer kann so als wertvolle Komponente in hoher Reinheit zurückgewonnen werden.

Vorzugsweise umfasst das Verfahren den Schritt eines Behandeln der trockenen Zellfragmente mittels Magnetabscheider, so dass eisenfreie Zellfragmente entstehen. Günstig ist es, wenn diese eisenfreien Zellfragmente gesichtet werden, beispielsweise durch einen Zickzacksichter.

- 5 Die eisenfreien Zellfragmente werden dann auf die Zersetzungstemperatur des Binders erhitzt.

- Die Zersetzungstemperatur beträgt vorzugsweise zumindest 350 °C und höchstens 800 °C. Es hat sich herausgestellt, dass bei diesen Temperaturen der Binder sicher zersetzt wird.
- 10

Vorzugsweise wird beim Zerkleinern der Zellen unter Inertgas zumindest auch das Elektrolytmittel abgezogen. Das steigert die Recyclingquote.

- 15 Gemäß einer bevorzugten Ausführungsform wird das Element EX1002 so durchgeführt, dass der Median der längsten Durchmesser der resul-

20 tierenden Folienfragmente 200 µm nicht unterschreitet. Gemäß einer bevorzugten Ausführungsform wird das Zerkleinern der Zellen so durchgeführt, dass die Folienfragmente zu zumindest 80% einen Durchmesser von über 200 µm haben, wobei der Durchmesser durch Siebung bestimmt wird.

25 Gemäß einer bevorzugten Ausführungsform erfolgt das Luftstrahlsieben so, dass ein Luftdurchsatz von mindestens 250 Kubikmeter Luft pro Stunden und Quadratmeter Siebfläche erreicht wird, insbesondere mindestens 500 Kubikmeter Luft pro Stunden und Quadratmeter Siebfläche. Besonders günstig sind mindestens 750 Kubikmeter Luft pro Stunden und Quadratmeter Siebfläche. Es ergibt sich dann eine so hohe Partikelgeschwindigkeit, dass der Aufprall zu einem hohen Separationsgrad führt.

30

Vorzugsweise ist hinter dem Luftstrahlsieb ein Zyklon angeordnet. Günstig ist es zudem, wenn die Trägerluft hinter dem Luftstrahlsieb abge-

saugt wird.

Für einen möglichst geringen Energieverbrauch ist es günstig, wenn das Sieb zumindest weitgehend vollflächig mit dem partikelhaltigen Luftstrom beaufschlagt wird.

Die Aktivmaterial-Separationsanlage besitzt vorzugsweise einen Vortrockner, der im Materialfluss hinter der Zellenzerkleinerungsvorrichtung und vor dem Ofen angeordnet ist. Der Vortrockner ist eingerichtet, um die Zellenfragmente auf die Trocknungs-Temperatur zu erwärmen.

Vorzugsweise umfasst die Aktivmaterial-Separationsanlage zudem einen Magnetabscheider im Materialfluss hinter dem Vortrockner und vor dem Ofen.

Günstig ist es, wenn die Aktivmaterial-Separationsanlage einen Rührreak-

tor zur Leitsalzurückgewinnung aufweist, der mit der Zellenzerkleinerungsvorrichtung verbunden ist und aus der Zellenzerkleinerungsvorrichtung zumindest einen Teil der Flüssigfraktion abzieht.

20

Unter dem Verfahren zum Wiedergewinnen von Aktivmaterial der galvanischen Zelle wird insbesondere auch ein Verfahren verstanden, bei dem Elektroden aus der Elektrodenproduktion bearbeitet werden, ohne dass die Elektroden in eine galvanische Zelle eingebaut worden sind, jedoch in
25 eine galvanische Zelle eingebaut werden könnten. In anderen Worten kann es sich bei dem Verfahren auch um ein Verfahren zum In-Prozess-Recycling handeln.

30

Gemäß einer bevorzugten Ausführungsform ist bezüglich eines Luft- und Zellfragmentstroms hinter dem Sieb eine Prallplatte angeordnet. Diese führt dazu, dass sich die Partikel aus Aktivmaterial, die nur eine schwache Kollision mit dem Sieb hatten, beim Aufprall auf die Prallplatte vom

Träger lösen, was die Trennwirkung erhöht.

Gemäß einer bevorzugten Ausführungsform umfasst die Zellenzerkleinerungsvorrichtung zumindest eine Prallmühle. Durch die Vielzahl an
5 Zusammenprallvorgängen in der Prallmühle wird die Bindung zwischen Aktivmaterial und Träger gelockert. Vorzugsweise umfasst die Zellenzerkleinerungsvorrichtung zudem zumindest einen Schredder und/oder eine Zerschneidvorrichtung, die besonders günstig in Materialflussrichtung vor der Prallmühle angeordnet ist.

10

Erfindungsgemäß ist zudem die Verwendung eines Luftstrahlsiebs in einem Verfahren, insbesondere einem kontinuierlichen Verfahren, zum Wiedergewinnen von Aktivmaterial, insbesondere von Lithium und/oder Lithiumverbindungen, beispielsweise aus gebrauchten Batterien und/oder

15 Akkumulatoren sowie aus Ausschuss bei der Herstellung von Akkumulatoren und/oder Akkumulatoren.

Im Folgenden wird die Erfindung anhand der beigefügten Zeichnungen näher erläutert. Dabei zeigt

Figur 1 ein Flussdiagramm einer erfindungsgemäßen Aktivmaterial-Separationsanlage zum Durchführen eines erfindungsgemäßen Verfahrens und

Figur 2 eine Explosionszeichnung einer Ausführungsform eines Prallseparators der Aktivmaterial-Separationsanlage nach Figur 1.

10

Figur 1 zeigt ein Flussdiagramm einer erfindungsgemäßen Aktivmaterial-Separationsanlage 10, die eine Zellenzerkleinerungsvorrichtung 12 besitzt, der galvanische Zellen 14.1, 14.2, ... zugeführt werden. Die Zellenzerkleinerungsvorrichtung 12 ist gasdicht und umfasst eine Gaswaschkolonne

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16, eine Umwälzpumpe 18 und einen Kondensator 20, mittels denen ein Inertgas, beispielsweise Stickstoff, umgewälzt und gereinigt wird. Die Zel-

lenzerkleinerungsvorrichtung umfasst zudem einen Inertgastank 22 zum Einstellen eines Inertgasdrucks in der Zellenzerkleinerungsvorrichtung 12. Der Kondensator 20 besitzt einen Elektrolytabzug 24, über den kondensierter Elektrolyt abgezogen werden kann.

In Materialstromrichtung hinter der Zellenzerkleinerungsvorrichtung 12 kann ein Rührreaktor 26 angeordnet sein, der zum Abziehen einer Flüssigfraktion aus der Zellenzerkleinerungsvorrichtung 12 und zum Rühren derselben angeordnet ist, so dass Leitsalz aus den galvanischen Zellen 14 (Bezugszeichen ohne Zähsuffix bezeichnen das Objekt als solches) zurückgewonnen werden kann.

In Materialflussrichtung hinter der Zellenzerkleinerungsvorrichtung 12 ist ein Vortrockner 28 angeordnet, der über eine Leitung 30 mit der Zellenzerkleinerungsvorrichtung 12 verbunden ist. Beim Zerkleinern der galvanischen Zellen 14 entstandene Zellenfragmente gelangen durch die Leitung

30 in den Vortrockner 28. Dort herrscht eine Trocken-Temperatur T_t von vorzugsweise $T_t = 80^\circ\text{C}$. Der Vortrockner 28 umfasst eine Umwälzpumpe 32 und einen Kondensator 34 zum Abkondensieren von Elektrolyt, der über eine Leitung 36 abgezogen werden kann. Der Vortrockner 28 ist gasdicht ausgebildet und wird mit Inertgas durch die Umwälzpumpe 32 gespült.

In Materialstromrichtung hinter dem Vortrockner 28 ist ein Abscheider 38 angeordnet, der einen Magnetabscheider und gegebenenfalls zusätzlich einen Wirbelstromabscheider umfasst. Das magnetische Material wird über eine Ableitung 40 abgezogen. Das nicht magnetische Material gelangt in einen Siebtrichter 42, beispielsweise einen Zickzacksiebtrichter. Der Siebtrichter 42 ist wie der Abscheider 38 optional und besonders dann vorteilhaft, wenn wie im vorliegenden Fall nur die Kathode der galvanischen Zellen weiterverwendet werden soll. Die Anoden werden ebenso wie gegebenenfalls vorliegende Pouchfolien abgezogen.

20 In Materialflussrichtung hinter dem Siehter 42 ist ein Ofen 44 angeordnet, in dem eine Zersetzungstemperatur T_z von 400 bis 600 °C herrscht. Dadurch zersetzt sich der Binder, beispielsweise Polyvinylidenfluorid (PVDF). Das Zersetzungsprodukt wird über eine Ableitung 46 abgeleitet und in eine Gaswaschkolonne 48 geführt.

25 In Materialflussrichtung hinter dem Ofen 44 ist ein Luftstrahlsieb 50 angeordnet. Das Luftstrahlsieb 50 umfasst ein Siebelement 52. Die aus dem Ofen 44 kommenden wärmebehandelten Zellenfragmente werden auf ein Luftstrahlsieb gefördert. Dieses ist dadurch charakterisiert, dass ober- oder unterhalb des feinmaschigen Siebelements (20-200 µm) ein Luftstrom zugeführt wird. Dieser wird unterhalb des Siebes abgezogen. Durch
30 die Luftströmung werden die Elektrodenfragmente aufgewirbelt und dann mechanisch beansprucht. Diese Beanspruchung unterstützt die Separation von Trägerfolie und Beschichtung. Die Aktivmaterial-Partikel werden so im Luftstrom durch die Maschen abgezogen und im Folgenden durch einen Zyk-

lon aus dem Luftstrom abgetrennt. Die Folienfraktion (Aluminium und Kupfer) wird durch das Siebelement zurückgehalten und kann als Metallfraktion gewonnen und wieder verwendet werden.

- 5 Figur 2 zeigt eine Explosionsansicht eines Prallseparators oder Luftstrahlsiebs. Die zu trennenden wärmebehandelten Zellenfragmente werden auf eine Seite des Siebs zugeführt, von der anderen Seite wird ein sich bewegend
- 10 Luftstrahl, beispielsweise durch eine sich bewegende Düsenleiste in Richtung auf das Sieb geblasen. Dadurch werden die Zellenfragmente gegen die Prallplatte in Form des Pralldeckels geschleudert und trennen sich dort in den Träger und die Beschichtung.

- Auf der Seite des Siebs, von der der Luftstrahl auf das Sieb geblasen wird, befindet sich ein Ansaugstutzen, mittels dem die eingeblasene Luft zusammen mit der Beschichtung abgezogen wird. Asien Elements EX1002 Page 86
- 15 Distanzringe vom Sieb beabstandet gehalten.

Bezugszeichenliste

10	Aktivmaterial-	40	Ableitung
	Separationsanlage	42	Sichter
12	Zellenzerkleinerungsvorrichtung	44	Ofen
14	galvanische Zelle	46	Ableitung
16	Gaswaschkolonne	48	Gaswaschkolonne
18	Umwälzpumpe		

20	Kondensator	50	Luftstrahlsieb
22	Inertgastank	52	Siebelement
24	Elektrolytabzug	54	Partikel
26	Rührreaktor	56	Ableitung
28	Vortrockner	58	Zyklon

30	Leitung	T_t	Trocken-Temperatur
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32 Umwälzpumpe
34 Kondensator
36 Leitung
38 Abscheider

T_z Zersetzungs-Temperatur

Patentansprüche:

1. Verfahren zum Wiedergewinnen von Aktivmaterial einer galvanischen Zelle, die ein Aktivmaterial, einen Träger für das Aktivmaterial und einen Binder zum Verbinden des Aktivmaterials und des Trägers umfasst,
5 mit den Schritten:
 - (a) Zerkleinern der Zellen, insbesondere unter Inertgas oder im Vakuum, so dass zumindest auch feste Zellenfragmente entstehen,
 - 10 (b) Erwärmen der festen Zellenfragmente auf eine Zersetzungstemperatur (T_z), die so hoch gewählt ist, dass der Binder sich zersetzt und/oder verdampft, vorzugsweise unter Inertgas oder im Vakuum so dass wärmebehandelte Zellenfragmente entstehen, und

- 15 (c) Klassieren der wärmebehandelten Zellenfragmente,

dadurch gekennzeichnet, dass

- (d) das Klassieren ein Luftstrahlsieben umfasst,
- (e) wobei das Luftstrahlsieben so durchgeführt wird, dass Aktivmaterial von dem Träger getrennt wird.

20

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, dass
 - galvanische Zellen (14) verwendet werden, deren Aktivmaterial aus Partikeln gebildet ist,
 - die Partikel eine Partikeldurchmesserverteilung haben, wobei die
- 25
- Partikeldurchmesserverteilung einen 90%-Durchmesser besitzt, der demjenigen Durchmesser entspricht, der größer ist als der Durchmesser von 90% aller Partikel und der kleiner ist als der Durchmesser von 10% aller Partikel, und
- das Luftstrahlsieben mit einem Sieb erfolgt, dessen Maschen-
- 30
- weite maximal dem 200-fachen des 90%-Durchmessers entspricht.

3. Verfahren nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, dass die Maschenweite des Siebs höchstens 200 μm beträgt.
- 5 4. Verfahren nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, dass die galvanischen Zellen (14) je zumindest eine Anode und zumindest eine Kathode umfassen und die Anoden und Kathoden gemeinsam erwärmt werden und die entstehenden wärmebehandelten Zellenfragmente in einem gemeinsamen Luftstrahlsieb
10 (50) klassiert werden.
5. Verfahren nach einem der vorstehenden Ansprüche, gekennzeichnet durch den Schritt:
(a2) vor dem Erwärmen der Zellenfragmente auf die eine Zersetzungs-Temperatur (T_z)
15 - Trocknen der Zellenfragmente bei einer Trocknungs-Tempe-

ratur (T_1), so dass trockene Zellenfragmente und Trocknungs-
dämpfe entstehen und

- Kondensieren zumindest eines Teils der Trocknungsdämpfe
zum Zweck der Rückgewinnung der Elektrolytlösemittel.

20

6. Verfahren nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, dass das Erwärmen der Zellenfragmente auf die Zersetzungstemperatur (T_2) unter Inertgas oder in einem Vakuum durchgeführt wird.

25

7. Verfahren nach einem der vorstehenden Ansprüche, gekennzeichnet durch die Schritte:

(a3) Behandeln der trockenen Zellenfragmente mittels Magnetab-

30

scheidung, so dass eisenfreie Zellenfragmente entstehen, und

(a4) Sichten der eisenfreien Zellenfragmente.

8. Verfahren nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, dass die galvanischen Zellen (14) einen Elektrolyten aufweisen und/oder beim Zerkleinern der Zellen unter Inertgas zumindest auch der Elektrolyt abgezogen wird.

5

9. Verfahren nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, dass das Zerkleinern der Zellen so durchgeführt wird, dass der Median der längsten Durchmesser der resultierenden Folienfragmente 200 µm nicht unterschreitet.

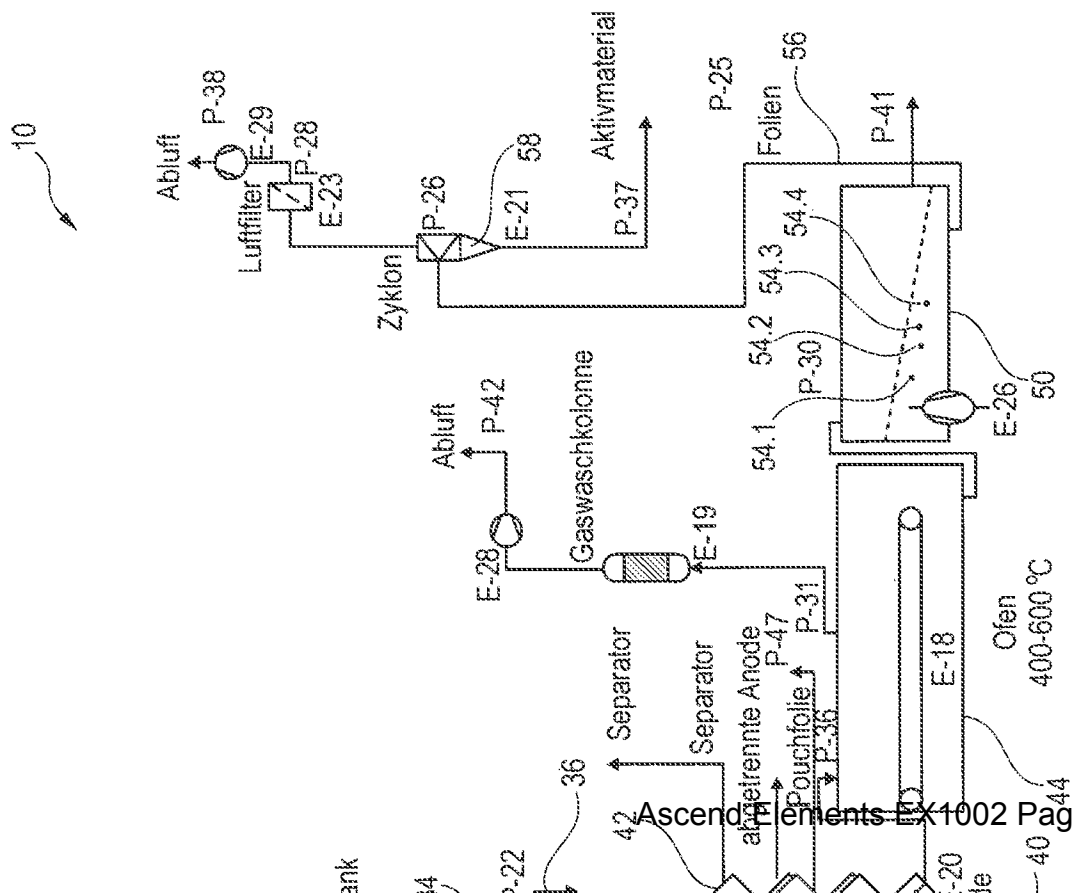
10

10. Aktivmaterial-Separationsanlage, insbesondere Aktivmetall-Separationsanlage (10), die ausgebildet ist zum Wiedergewinnen von Aktivmaterial, insbesondere Lithium, einer galvanischen Zelle (14), die ein Aktivmaterial, einen Träger für das Aktivmaterial, einen Binder zum Verbinden des Aktivmaterials und des Trägers, einen Elektrolyten umfasst, mit

15

- 20 (a) einer Zellenzerkleinerungsvorrichtung (12) zum Zerkleinern der Zellen, wobei die Zellenzerkleinerungsvorrichtung gasdicht ist und eine Inertgaszufuhrvorrichtung umfasst, so dass die Zellen unter Inertgas zu Zellenfragmenten zerkleinerbar sind, und
- (b) einem Ofen (44), der zumindest mittelbar mit der Zellenzerkleinerungsvorrichtung (12) verbunden und eingerichtet ist zum Erwärmen der Zellenfragmente auf eine Zersetzungs-Temperatur (T_z), die so hoch gewählt ist, dass der Binder sich zersetzt,
- 25 gekennzeichnet durch
- (c) eine Luftstrahlsiebvorrichtung, die zumindest mittelbar mit dem Ofen (44) verbunden und eingerichtet ist zum Klassieren von Aktivmaterial und Träger, indem das Luftstrahlsieben so durchgeführt wird, dass das Aktivmaterial von dem Träger getrennt wird.

11. Aktivmaterial-Separationsanlage nach Anspruch 10, dadurch gekennzeichnet, dass die Luftstrahlsiebvorrichtung ein Sieb, eine Prallplatte und eine Düsenleiste aufweist, wobei das Sieb bezüglich eines Luftstroms durch die Luftstrahlsiebvorrichtung zwischen Düsenleiste und Prallplatte angeordnet ist.
12. Aktivmaterial-Separationsanlage nach Anspruch 11, dadurch gekennzeichnet, dass die Prallplatte einen Abstand von mindestens 30 Millimetern, insbesondere mindestens 40 Millimetern, vom Sieb hat.
13. Aktivmaterial-Separationsanlage nach Anspruch 11 oder 12, dadurch gekennzeichnet, dass die Prallplatte einen Abstand von höchstens 250 Millimetern, insbesondere mindestens 200 Millimetern, vom Sieb hat.



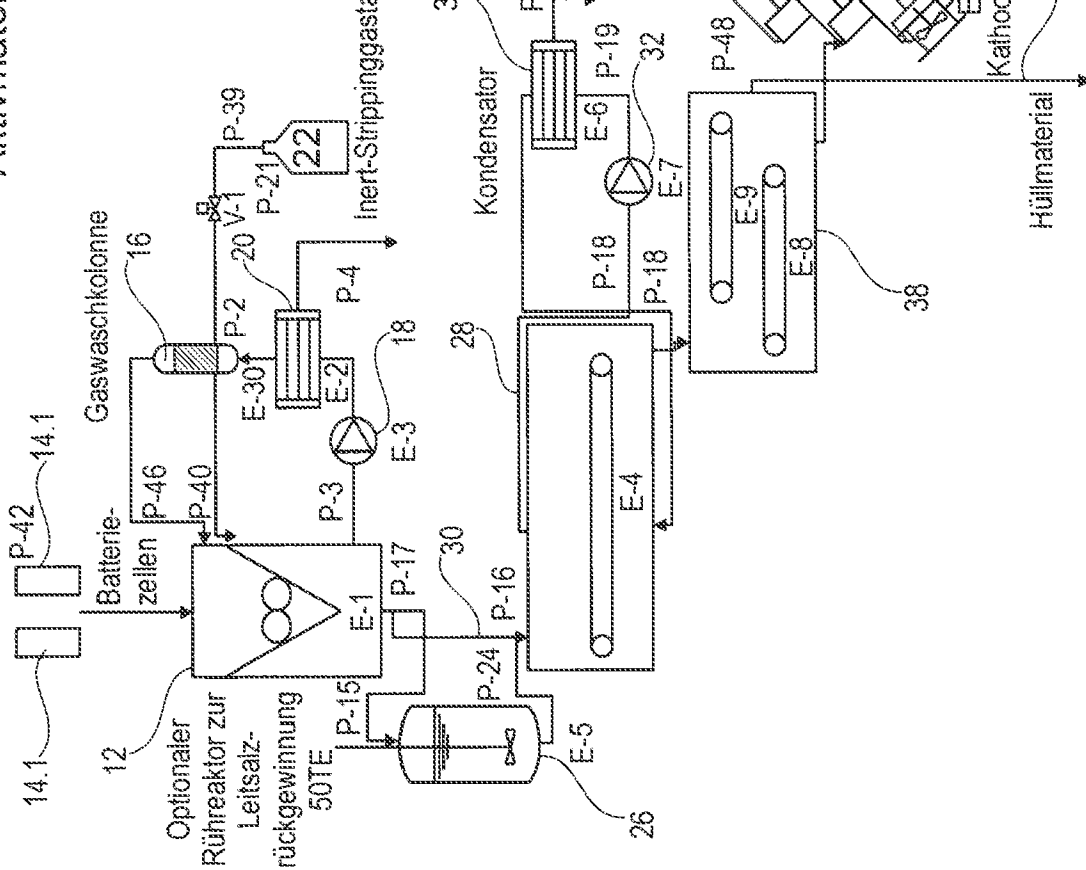
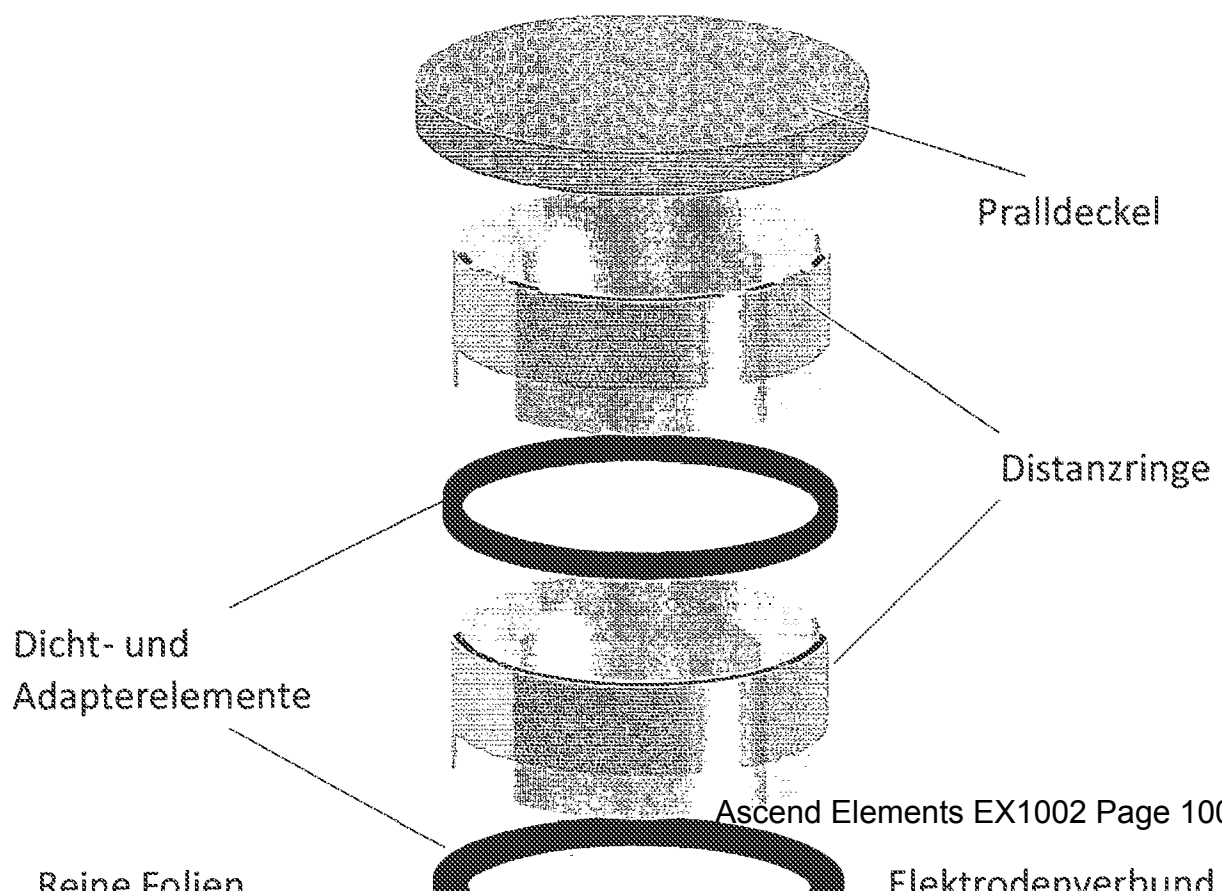


Fig.

2/2



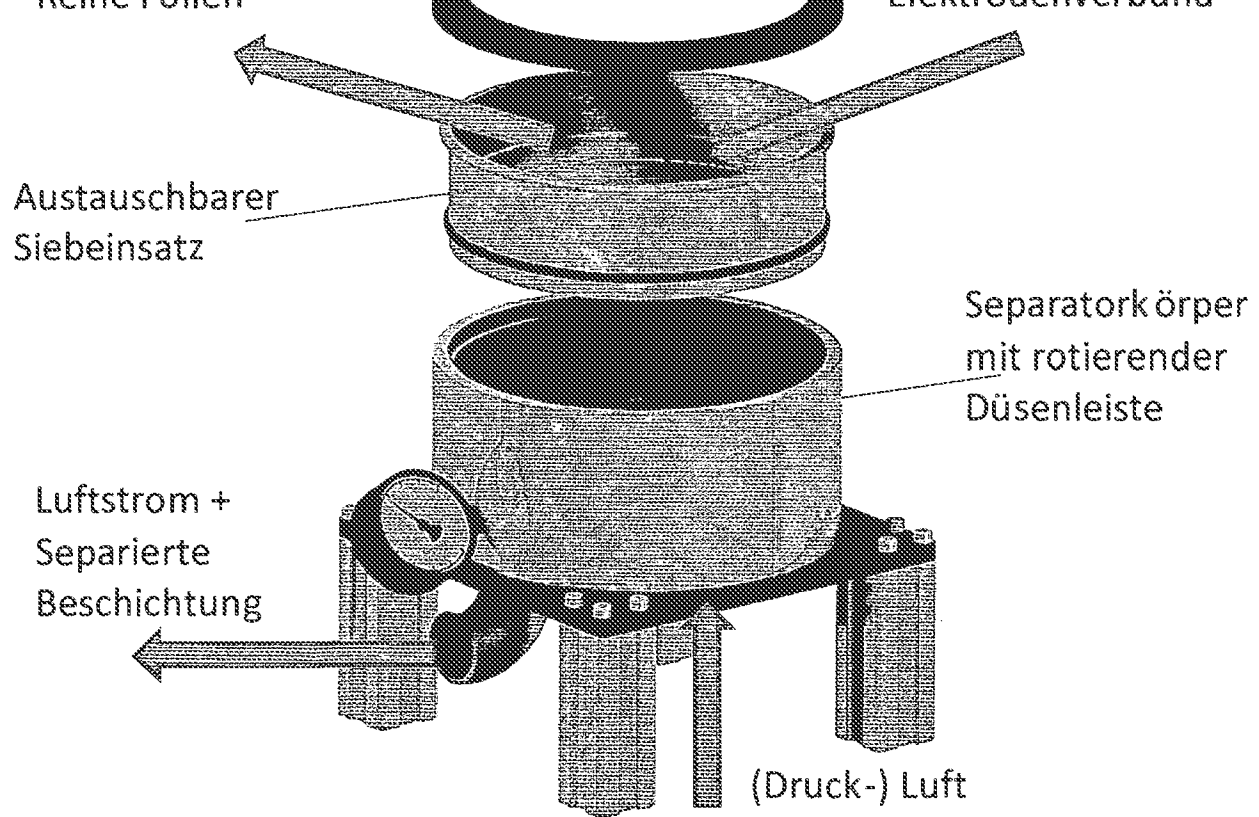


Fig. 2

INTERNATIONAL SEARCH REPORT

International application No

PCT/DE2012/000811

A. CLASSIFICATION OF SUBJECT MATTER

INV. H01M10/54 B07B4/08

ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H01M B07B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 198 42 658 A1 (TOSHIBA KAWASAKI KK [JP]) 1 April 1999 (1999-04-01) page 4, line 10 - line 15 page 4, line 36 - line 37 page 7, line 19 - line 24 page 9, line 50 - line 60 figure 1	1-13
A	EP 1 215 742 A1 (TOSHIBA KK [JP])	1-13

A	<p>EP 1 115 742 A1 (ROHMBA KK [01]) 19 June 2002 (2002-06-19) paragraphs [0106], [0107]</p> <p>-----</p> <p>DE 298 03 442 U1 (RHEINISCHE WERKZEUG & MASCHF [DE]) 12 November 1998 (1998-11-12) cited in the application the whole document</p> <p>-----</p> <p>-/--</p>	1-13		
<div style="display: flex; justify-content: space-between;"> <div> ☒ Further documents are listed in the continuation of Box C. </div> <div> ☒ See patent family annex. </div> </div>				
<p>* Special categories of cited documents :</p> <table border="0" style="width: 100%;"> <tr> <td style="vertical-align: top; width: 50%;"> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </td> <td style="vertical-align: top; width: 50%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&" document member of the same patent family</p> </td> </tr> </table>			<p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&" document member of the same patent family</p>
<p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&" document member of the same patent family</p>			
<p>Date of the actual completion of the international search</p> <p style="text-align: center; font-size: 1.2em;">3 December 2012</p>		<p>Date of mailing of the international search report</p> <p style="text-align: center; font-size: 1.2em;">11/12/2012</p>		
<p>Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel: (+31-70) 340-2040, Fax: (+31-70) 340-3016</p>		<p>Authorized officer</p> <p style="text-align: center; font-size: 1.2em;">Schwake, Andree</p>		

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No

PCT/DE2012/000811

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>CHRISTIAN HANISCH ET AL: "Recovery of Active Materials from Spent Lithium-Ion Electrodes", GLOCALIZED SOLUTIONS FOR SUSTAINABILITY IN MANUFACTURING-PROCEEDINGS OF THE 18TH CIRP INTERNATIONAL CONFERENCE ON LIFE CYCLE ENGINEERING; PROCEEDINGS OF THE 18TH CIRP INTERNATIONAL CONFERENCE ON LIFE CYCLE ENGINEERING, SPRINGER, BERLIN, DE; TECHNISCH, 1 January 2011 (2011-01-01), pages 85-89, XP008158000, DOI: 10.1007/978-3-642-19692-8_15 ISBN: 978-3-642-19691-1 the whole document</p> <p style="text-align: center;">-----</p>	1-13
A	<p>KRUEGER S ET AL: "Recycling Of Lithium-Ion Batteries", 18TH INTERNATIONAL CONFERENCE ON SOLID STATE IONICS (SSI-18), WARSAW UNIVERSITY OF TECHNOLOGY, WARSZAWA, POLAND, 1 January 2011 (2011-01-01), XP008158002, the whole document</p> <p style="text-align: center;">-----</p>	1-13

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Form PCT/ISA/210 (continuation of second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/DE2012/000811

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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			JP 3452769 B2	29-09-2003
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			US 6811923 B1	02-11-2004
			WO 0079621 A1	28-12-2000
DE 29803442	U1	12-11-1998	NONE	

Form PCT/ISA/210 (patent family annex) (April 2005)

INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen

PCT/DE2012/000811

A. KLASSIFIZIERUNG DES ANMELDUNGSGEGENSTANDES

INV. H01M10/54 B07B4/08

ADD.

Nach der internationalen Patentklassifikation (IPC) oder nach der nationalen Klassifikation und der IPC

B. RECHERCHIERTE GEBIETE

Recherchierter Mindestprüfstoff (Klassifikationssystem und Klassifikationssymbole)

H01M B07B

Recherchierte, aber nicht zum Mindestprüfstoff gehörende Veröffentlichungen, soweit diese unter die recherchierten Gebiete fallen

Während der internationalen Recherche konsultierte elektronische Datenbank (Name der Datenbank und evtl. verwendete Suchbegriffe)

EPO-Internal, WPI Data

C. ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie*	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
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A	DE 198 42 658 A1 (TOSHIBA KAWASAKI KK [JP]) 1. April 1999 (1999-04-01) Seite 4, Zeile 10 - Zeile 15 Seite 4, Zeile 36 - Zeile 37 Seite 7, Zeile 19 - Zeile 24 Seite 9, Zeile 50 - Zeile 60 Abbildung 1	1-13
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Ascend Elements EX1002 Page 108

A	EP 1 215 742 A1 (TOSHIBA KK [JP])	1-13
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A	<p>EP 1 157 42 A1 (TOSHIBA KK [01]) 19. Juni 2002 (2002-06-19) Absätze [0106], [0107]</p> <p>-----</p> <p>DE 298 03 442 U1 (RHEINISCHE WERKZEUG & MASCHF [DE]) 12. November 1998 (1998-11-12) in der Anmeldung erwähnt das ganze Dokument</p> <p>-----</p> <p>-/-</p>	1-13
☒ Weitere Veröffentlichungen sind der Fortsetzung von Feld O zu entnehmen ☒ Siehe Anhang Patentfamilie		
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Name und Postanschrift der Internationalen Recherchenbehörde Europäisches Patentamt, P.B. 5816 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Bevollmächtigter Bediensteter Schwake, Andree

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INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen

PCT/DE2012/000811

C. (Fortsetzung) ALS WESENTLICH ANGESEHENE UNTERLAGEN		
Kategorie*	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
A	<p>CHRISTIAN HANISCH ET AL: "Recovery of Active Materials from Spent Lithium-Ion Electrodes", GLOCALIZED SOLUTIONS FOR SUSTAINABILITY IN MANUFACTURING-PROCEEDINGS OF THE 18TH CIRP INTERNATIONAL CONFERENCE ON LIFE CYCLE ENGINEERING; PROCEEDINGS OF THE 18TH CIRP INTERNATIONAL CONFERENCE ON LIFE CYCLE ENGINEERING, SPRINGER, BERLIN, DE; TECHNISCH, 1. Januar 2011 (2011-01-01), Seiten 85-89, XP008158000, DOI: 10.1007/978-3-642-19692-8_15 ISBN: 978-3-642-19691-1 das ganze Dokument</p> <p>-----</p>	1-13
A	<p>KRUEGER S ET AL: "Recycling Of Lithium-Ion Batteries", 18TH INTERNATIONAL CONFERENCE ON SOLID STATE IONICS (SSI-18), WARSAW UNIVERSITY OF TECHNOLOGY, WARSZAWA, POLAND, 1. Januar 2011 (2011-01-01), XP008158002, das ganze Dokument</p> <p>-----</p>	1-13

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Im Recherchenbericht angeführtes Patentdokument		Datum der Veröffentlichung	Mitglied(er) der Patentfamilie		Datum der Veröffentlichung
DE 19842658	A1	01-04-1999	DE	19842658 A1	01-04-1999
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APPLICATION #
16/343,224

RECEIPT DATE / TIME
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ATTORNEY DOCKET #
03101253US

Title of Invention

RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION

Application Information

APPLICATION TYPE	Utility - U.S. National Stage under 35 USC 371	PATENT #	-
CONFIRMATION #	6508	FILED BY	Sam Cook
PATENT CENTER #	66634358	AUTHORIZED BY	Michael Whitham
CUSTOMER #	30743	FILING DATE	04/18/2019
INTL. APPLICATION #	-	INTL. FILING DATE	-
CORRESPONDENCE ADDRESS	-	FIRST NAMED INVENTOR	Christian HANISCH

Payment Information

PAYMENT METHOD CARD / 6511	PAYMENT TRANSACTION ID E202482G25038050	PAYMENT AUTHORIZED BY Sam Cook
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INTL. APPLICATION #	-	INTL. FILING DATE	-
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Michael Whitham

Documents

TOTAL DOCUMENTS: 14

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
CN105552470AEnglish.pdf	4	Foreign Reference	196 KB
CN105552470A_Original_document_20240802213906.pdf	5	Foreign Reference	287 KB
2024-08-02_03101253US_IDS07.pdf	6	Information Disclosure Statement (IDS) Form (SB08)	1012 KB
WO2016174156A1_Original_document_20240802213452.pdf	31	Foreign Reference	1871 KB

EP0794587A2_Original_document_20240802213727.pdf	32	Foreign Reference	2921 KB
EP1041659A1_Original_document_20240802214325.pdf	52	Foreign Reference	4462 KB
EP1760821A1_Original_document_20240802214429.pdf	34	Foreign Reference	3139 KB
WO2013023640A1.pdf	57	Foreign Reference	2928 KB
NPLDin.pdf	10	Non Patent Literature	11268 KB
LithoRecEnglish.pdf	239	Non Patent Literature	18998 KB
Perrys_Part2.pdf	988	Non Patent Literature	17073 KB
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Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
CN105552470AEnglish.pdf	1B06C4DE9DF447E4AFEE78A638F304A98CB581644B7CCB425BFD91449C13D6B1B8B4C92EEB6987F5ECF2C937DD8C632029F5C7A26021565C54B7D0F2632E2627
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NPLDin.pdf 659CB274DB79B12586FEE86E433971D94A465432423C1AEC97142F044FCF782FA4F2EC0DDC05A0012FB7F1A8E660D76AF4B A7FEDD8EB5D58EB695A8B8117CF7B

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Perrys_Part2.pdf 53F6D7102AB33A85577FE7F369B5B3A620F1E23371E37D39DC838AA87E7BDD2EB56FEAF7D5D328DAAC5F904EBFE7950DC D8B826AFEDEC2288E30D1FFAB8E5CE5

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A1D75EC943CFA6694C39832EB95FA8

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		16343224
	Filing Date		2019-04-18
	First Named Inventor	Christian Hanisch	
	Art Unit		
	Examiner Name		
	Attorney Docket Number	03101253US	

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Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	
	1	11050097	B2	2021-06-29	DUESENFELD GMBH	Corresponding with WO2016174156A1	
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	8	10396408	B2	2019-08-27	KOREA INST GEOSCIENCE & MINERAL RESOURCES		

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	16343224
Filing Date	2019-04-18
First Named Inventor	Christian Hanisch
Art Unit	
Examiner Name	
Attorney Docket Number	03101253US

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10	3671318	A	1972-06-20	MC DONNELL DOUGLAS CORP	
11	4118219	A	1978-10-03	GOULD INC	
12	6524737	B1	2003-02-25	MITSUBISHI HEAVY IND LTD	
13	9450277	B2	2016-09-20	RECYCLING COORDINATORS INC	
14	7101425	B2	2006-09-05	THERMOSELECT AG	Corresponding with DE10118961B4
15	6524737	B1	2003-02-25	MITSUBISHI HEAVY IND LTD	Corresponding with EP1041659A1

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	1	20030186110	A1	2003-10-02	Steven E. Sloop	
	2	20160043450	A1	2016-02-11	Steven E. Sloop	

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Examiner Name	
Attorney Docket Number	03101253US

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	1	2013023640	WO	A1	2013-02-21	Technische Universitat Braunschweig Carolo-Wilhelm		☐
	2	2016174156	WO	A1	2016-11-03	LION ENG GMBH		☐
	3	0794587	EP	A2	1997-09-10	CANON KK		☐
	4	105552470	CN	A	2016-05-04	ZHOU HU		☐
	5	10118961	DE	B4	2006-08-31	THERMOSELECT AG		☐
	6	1041659	EP	A1	2000-10-04	MITSUBISHI HEAVY IND LTD		☐
	7	1760821	EP	A1	2007-03-07	TOYOTA MOTOR CO LTD		☐

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵
	1	Carolo-Wilhelmina University of Technology in Braunschweig Final report "Joint project as part of the "Renewably Mobile" funding program of the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety", July 01, 2012 - March 31, 2016	☒

**INFORMATION DISCLOSURE
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Art Unit	
Examiner Name	
Attorney Docket Number	03101253US

2	Kwade, A. et al., "LithoRec Recycling von Lithium-Ionen-Batterien " LithoRec, 2012	☒
3	Perry, R. & Green, D., "Perry's Chemical Engineer's Handbook, Seventh Edition", 1997	☐
4	Vacuum Technology; Terms and Definitions; General Terms." DIN 28400-1, German Institute for Standards e.V., 1990.	☐

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	First Named Inventor	Christian Hanisch
	Art Unit	
	Examiner Name	
	Attorney Docket Number	03101253US

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☐ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

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Signature	/Michael E. Whitham/	Date (YYYY-MM-DD)	2024-08-02
Name/Print	Michael E. Whitham	Registration Number	32635

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/343,224	04/18/2019	Christian HANISCH	03101253US	6508
30743	7590	07/16/2024		
WC&F IP 11491 SUNSET HILLS ROAD SUITE 340 RESTON, VA 20190			EXAMINER YANCHUK, STEPHEN J	
			ART UNIT	PAPER NUMBER
			1752	
			MAIL DATE	DELIVERY MODE
			07/16/2024	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of Allowability	Application No. 16/343,224	Applicant(s) HANISCH, Christian	
	Examiner STEPHEN J YANCHUK	Art Unit 1752	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 06/17/2024.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☒ The allowed claim(s) is/are 1-8,17 and 21-25. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a) ☒ All b) ☐ Some* c) ☐ None of the:

1. ☒ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. _____.

3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892) 2. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date <u>05/31/2024, 4/19/19</u> . 3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____. 4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.	5. ☐ Examiner's Amendment/Comment 6. ☐ Examiner's Statement of Reasons for Allowance 7. ☐ Other _____.
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/STEPHEN J YANCHUK/ Primary Examiner, Art Unit 1752	
--	--

Issue Classification 	Application/Control No. 16/343,224	Applicant(s)/Patent Under Reexamination HANISCH, Christian
	Examiner STEPHEN J YANCHUK	Art Unit 1752

CPC						
Symbol					Type	Version
H01M	/	10	/	54	F	2013-01-01
C22B	/	1	/	005	I	2013-01-01
C22B	/	7	/	001	I	2013-01-01
H01M	/	6	/	52	I	2013-01-01
C22B	/	7	/	00	I	2013-01-01
Y02W	/	30	/	84	A	2015-05-01
Y02P	/	10	/	20	A	2015-11-01

CPC Combination Sets				
Symbol		Type	Set	Version
	/			

NONE	Total Claims Allowed:	
(Assistant Examiner)	(Date)	14
/STEPHEN J YANCHUK/ Primary Examiner, Art Unit 1752	13 July 2024	O.G. Print Claim(s)
(Primary Examiner)	(Date)	1

Issue Classification 	Application/Control No. 16/343,224	Applicant(s)/Patent Under Reexamination HANISCH, Christian
	Examiner STEPHEN J YANCHUK	Art Unit 1752

INTERNATIONAL CLASSIFICATION			
CLAIMED			
H01M	/	10	/ 54
NON-CLAIMED			
	/		/

US ORIGINAL CLASSIFICATION	
CLASS	SUBCLASS

CROSS REFERENCES(S)						
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	14	
/STEPHEN J YANCHUK/ Primary Examiner, Art Unit 1752	13 July 2024	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

Issue Classification 	Application/Control No. 16/343,224	Applicant(s)/Patent Under Reexamination HANISCH, Christian
	Examiner STEPHEN J YANCHUK	Art Unit 1752

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47															
CLAIMS															
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1		10		19										
2	2		11		20										
3	3		12	10	21										
4	4		13	11	22										
5	5		14	12	23										
6	6		15	13	24										
7	7		16	14	25										
8	8	9	17												
	9		18												

NONE	Total Claims Allowed:	
(Assistant Examiner)	(Date)	14
/STEPHEN J YANCHUK/ Primary Examiner, Art Unit 1752	13 July 2024	O.G. Print Claim(s)
(Primary Examiner)	(Date)	1
		O.G. Print Figure
		1

Doc code: IDS

PTO/SB/08a (02-18)

Doc description: Information Disclosure Statement (IDS) Filed

Approved for use through 11/30/2020. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		16343224	
	Filing Date		2019-04-18	
	First Named Inventor	Christian HANISCH		
	Art Unit			
	Examiner Name			
	Attorney Docket Number		03101253US	

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Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20100230518	A1	2010-09-16	GOWLING LAFLEUR HENDERSON LLP	

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	1	2000243396	JP	A	2000-09-08			☐
	2	2741357	EP	A1	2014-06-11	TSR KAT GMBH		☐
	3	2005515605	JP	A	2005-05-26			☐

/STEPHEN J YANCHUK/

06/13/2024

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Art Unit		
Examiner Name		
Attorney Docket Number	03101253US	

	4	2013229326	JP	A	2013-11-07	mitsubishi materials corp		☐
	5	2016512165	JP	A	2016-04-25	トランスター グループ		☐
	6	2007531977	JP	A	2007-11-08			☐

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NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵
	1		☐

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EXAMINER SIGNATURE

Examiner Signature	/STEPHEN J YANCHUK/	Date Considered	06/13/2024
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*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

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Examiner Name	
Attorney Docket Number	03101253US

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☒ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Michael E. Whitham/	Date (YYYY-MM-DD)	2024-05-31
Name/Print	Michael E. Whitham	Registration Number	32635

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. **DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

/STEPHEN J YANCHUK/

06/13/2024

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The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

/STEPHEN J YANCHUK/

06/13/2024

Doc code: IDS

PTO/SB/08a (02-18)

Doc description: Information Disclosure Statement (IDS) Filed

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Filing Date	2019-04-18
First Named Inventor	Christian HANISCH
Art Unit	
Examiner Name	
Attorney Docket Number	03101253US

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	1	20050241943	A1	2005-11-03	Kakuta et al.		

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	1	10 2011 110 083	DE	A1	2013-02-14	Technische Universitaet Braunschweig Carolo . . .		×
	2	2010/102377	WO	A1	2010-09-16	Wayne C. Stevens		□
	3	10 2012 024 876	DE	A1	2014-06-26	Electrocycling GmbH; Volkswagen Aktiengesellschaft		☒

**INFORMATION DISCLOSURE
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Art Unit		
Examiner Name		
Attorney Docket Number	03101253US	

4	2016/174156	WO	A1	2016-04-28	Lion Engineering GmbH	☐
5	2016/164752	WO	A1	2016-10-13	Energizer Brands, LLC	☐
6	101394015	CN	A	2009-03-25	Shenzhen Bak Battery Co Ltd	☒
7	10 2015 207 843	DE	A1	2016-11-03	Lion Engineering GMBH	☒
8	60 2005 001 937	DE	T2	2008-05-29	Recuply S.A.	☐

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NON-PATENT LITERATURE DOCUMENTS

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Examiner Signature	/STEPHEN J YANCHUK/	Date Considered	05/22/2021
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Name/Print	Michael E. Whitham	Registration Number	32635

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/STEPHEN J YANCHUK/

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4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

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a) ☒ All b) ☐ Some* c) ☐ None of the:

1. ☐ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. _____.

3. ☒ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.

☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892) 2. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date <u>5/31/2024</u> . 3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____. 4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.	5. ☐ Examiner's Amendment/Comment 6. ☐ Examiner's Statement of Reasons for Allowance 7. ☐ Other _____.
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/STEPHEN J YANCHUK/
 Primary Examiner, Art Unit 1752

Doc code: IDS

PTO/SB/08a (02-18)

Doc description: Information Disclosure Statement (IDS) Filed

Approved for use through 11/30/2020. OMB 0651-0031

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		16343224	
	Filing Date		2019-04-18	
	First Named Inventor	Christian HANISCH		
	Art Unit			
	Examiner Name			
	Attorney Docket Number	03101253US		

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	1	20100230518	A1	2010-09-16	GOWLING LAFLEUR HENDERSON LLP	

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	1	2000243396	JP	A	2000-09-08			☐
	2	2741357	EP	A1	2014-06-11	TSR KAT GMBH		☐
	3	2005515605	JP	A	2005-05-26			☐

/STEPHEN J YANCHUK/

06/13/2024

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Art Unit		
Examiner Name		
Attorney Docket Number	03101253US	

	4	2013229326	JP	A	2013-11-07	mitsubishi materials corp		☐
	5	2016512165	JP	A	2016-04-25	トランスター グループ		☐
	6	2007531977	JP	A	2007-11-08			☐

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**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	16343224
Filing Date	2019-04-18
First Named Inventor	Christian HANISCH
Art Unit	
Examiner Name	
Attorney Docket Number	03101253US

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☒ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Michael E. Whitham/	Date (YYYY-MM-DD)	2024-05-31
Name/Print	Michael E. Whitham	Registration Number	32635

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. **DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

/STEPHEN J YANCHUK/

06/13/2024

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The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

/STEPHEN J YANCHUK/

06/13/2024

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	Filing Date		2019-04-18
	First Named Inventor	Christian HANISCH	
	Art Unit		
	Examiner Name		
	Attorney Docket Number	03101253US	

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5	2016512165	JP	A	2016-04-25	トランスター グループ		☐
6	2007531977	JP	A	2007-11-08			☐

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Signature	/Michael E. Whitham/	Date (YYYY-MM-DD)	2024-05-31
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ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #
16/343,224

RECEIPT DATE / TIME
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ATTORNEY DOCKET #
03101253US

Title of Invention

RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION

Application Information

APPLICATION TYPE	Utility - U.S. National Stage under 35 USC 371	PATENT #	-
CONFIRMATION #	6508	FILED BY	Sam Cook
PATENT CENTER #	65748734	FILING DATE	04/18/2019
CUSTOMER #	30743	FIRST NAMED INVENTOR	Christian HANISCH
INTL. APPLICATION #	-	INTL. FILING DATE	-
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Michael Whitham

Documents

TOTAL DOCUMENTS: 13

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
JP2007531977AAbstrEngl.pdf f	1	Foreign Reference	35 KB
EP2741357A1AbstrEngl.pdf	2	Foreign Reference	119 KB
JP2016512165AbstrEngl.pdf	2	Foreign Reference	147 KB
JP2000243396AAbstrEngl.pdf f	2	Foreign Reference	136 KB
JP2005515605AAbstrEngl.pdf f	1	Foreign Reference	130 KB

JP2013229236AAbstrEngl.pdf	1	Foreign Reference	88 KB
JP2013229326A000.pdf	12	Foreign Reference	1090 KB
JP2007531977A000.pdf	19	Foreign Reference	1364 KB
EP2741357A1000.pdf	12	Foreign Reference	1545 KB
JP2005515605A000.pdf	19	Foreign Reference	1624 KB
JP2016512165A000.pdf	31	Foreign Reference	2663 KB
JP2000243396A000.pdf	20	Foreign Reference	3564 KB
2024-05-31_03101253US_IDS06.pdf	4	Information Disclosure Statement (IDS) Form (SB08)	1013 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
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2024-05- 31_03101253US_IDS06.pdf	3BE7E97D50434C8B9B4793D4861ABFD6807A5632DF4ABA04E 0962525FA8EFFD27F6B07A1E6D14C98E1A8CCFEE7894D7C6 D4B48DE0C740C821A77A7737721DF9E

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National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.



UNITED STATES
PATENT AND TRADEMARK OFFICE

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Alexandria, VA 22313 - 1450
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ELECTRONIC PAYMENT RECEIPT

APPLICATION #
16/343,224

RECEIPT DATE / TIME
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CORRESPONDENCE ADDRESS	-	FIRST NAMED INVENTOR	Christian HANISCH

Payment Information

PAYMENT METHOD DA / 502041	PAYMENT TRANSACTION ID E20245UA56535929	PAYMENT AUTHORIZED BY Sam Cook
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FEE CODE	DESCRIPTION	ITEM PRICE(\$)	QUANTITY	ITEM TOTAL(\$)
1806	SUBMISSION OF AN INFORMATION DISCLOSURE STATEMENT	260.00	1	260.00
TOTAL AMOUNT:				\$260.00

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement

Receipt will establish the filing date of the application

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.



UNITED STATES PATENT AND TRADEMARK OFFICE

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NOTICE OF ALLOWANCE AND FEE(S) DUE

30743 7590 05/06/2024
WC&F IP
11491 SUNSET HILLS ROAD
SUITE 340
RESTON, VA 20190

EXAMINER	
YANCHUK, STEPHEN J	
ART UNIT	PAPER NUMBER
1752	

DATE MAILED: 05/06/2024

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/343,224	04/18/2019	Christian HANISCH	03101253US	6508

TITLE OF INVENTION: RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1200	\$0.00	\$0.00	\$1200	08/06/2024

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 40% the amount of undiscounted fees, and micro entity fees are 20% the amount of undiscounted fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via the USPTO patent electronic filing system.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications. **Because electronic patent issuance may occur shortly after issue fee payment, any desired continuing application should preferably be filed prior to payment of this issue fee in order not to jeopardize copendency.**

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via the USPTO patent electronic filing system or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

30743 7590 05/06/2024
WC&F IP
11491 SUNSET HILLS ROAD
SUITE 340
RESTON, VA 20190

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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16/343,224

04/18/2019

Christian HANISCH

03101253US

6508

TITLE OF INVENTION: RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1200	\$0.00	\$0.00	\$1200	08/06/2024

EXAMINER	ART UNIT	CLASS-SUBCLASS
YANCHUK, STEPHEN J	1752	429-049000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/AIA/122 or PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/AIA/47 or PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,

1 _____

(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

2 _____

3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. Fees submitted: ☐ Issue Fee ☐ Publication Fee (if required)

4b. Method of Payment: (Please first reapply any previously paid fee shown above)

☐ Electronic Payment via the USPTO patent electronic filing system ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. Change in Entity Status (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/343,224	04/18/2019	Christian HANISCH	03101253US	6508
30743	7590	05/06/2024	EXAMINER	
WC&F IP 11491 SUNSET HILLS ROAD SUITE 340 RESTON, VA 20190			YANCHUK, STEPHEN J	
			ART UNIT	PAPER NUMBER
			1752	

DATE MAILED: 05/06/2024

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. The United States Patent and Trademark Office (USPTO) collects the information in this record under authority of 35 U.S.C. 2. The USPTO's system of records is used to manage all applicant and owner information including name, citizenship, residence, post office address, and other information with respect to inventors and their legal representatives pertaining to the applicant's/owner's activities in connection with the invention for which a patent is sought or has been granted. The applicable Privacy Act System of Records Notice for the information collected in this form is COMMERCE/PAT-TM-7 Patent Application Files, available in the Federal Register at 78 FR 19243 (March 29, 2013).

<https://www.govinfo.gov/content/pkg/FR-2013-03-29/pdf/2013-07341.pdf>

Routine uses of the information in this record may include disclosure to:

- 1) law enforcement, in the event that the system of records indicates a violation or potential violation of law;
- 2) a federal, state, local, or international agency, in response to its request;
- 3) a contractor of the USPTO having need for the information in order to perform a contract;
- 4) the Department of Justice for determination of whether the Freedom of Information Act (FOIA) requires disclosure of the record;
- 5) a Member of Congress submitting a request involving an individual to whom the record pertains, when the individual has requested the Member's assistance with respect to the subject matter of the record;
- 6) a court, magistrate, or administrative tribunal, in the course of presenting evidence, including disclosures to opposing counsel in the course of settlement negotiations;
- 7) the Administrator, General Services Administration (GSA), or their designee, during an inspection of records conducted by GSA under authority of 44 U.S.C. 2904 and 2906, in accordance with the GSA regulations and any other relevant (i.e., GSA or Commerce) directive, where such disclosure shall not be used to make determinations about individuals;
- 8) another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c));
- 9) the Office of Personnel Management (OPM) for personnel research purposes; and
- 10) the Office of Management and Budget (OMB) for legislative coordination and clearance.

If you do not furnish the information requested on this form, the USPTO may not be able to process and/or examine your submission, which may result in termination of proceedings, abandonment of the application, and/or expiration of the patent.

Notice of Allowability	Application No. 16/343,224	Applicant(s) HANISCH, Christian	
	Examiner STEPHEN J YANCHUK	Art Unit 1752	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 03/23/2023.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☒ The allowed claim(s) is/are 1-17 and 21-25. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a) ☒ All b) ☐ Some* c) ☐ None of the:

1. ☐ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. _____.

3. ☒ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892) 2. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date <u>10/19/2022, 12/19/2022</u> . 3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____. 4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.	5. ☐ Examiner's Amendment/Comment 6. ☒ Examiner's Statement of Reasons for Allowance 7. ☐ Other _____.
---	--

/STEPHEN J YANCHUK/
Primary Examiner, Art Unit 1752

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 02/18/2022 has been entered.

Reasons for Allowance

The following is an examiner's statement of reasons for allowance:

Amendments filed 02/18/2022 overcome the previously applied prior art and USC 112 rejections. Arguments filed 02/18/2022 pertaining to the method further clarify the scope of the invention in relationship to rejections previously made. After further search and consideration, the combination of features pertaining to the method claim of independent claim 1 are found allowable. The dependent claims depending thereon are hereby allowed as well. The prior art is silent to teach or obviate the combination of features presented by the scope of instant claim 1.

Iida et al - PGPUB 2014/0017621 - is herein included on the record. Iida teaches a process of recycling and treating battery packs. The device [Fig 1] and method [Fig 7] do not teach the limitations of instant claim 1. The prior art teaches a carbon dioxide gas to be added to the material (s18) [0070] which causes a precipitate of carbonate; this is materially different than applicant's vaporization. As it pertains to the fluorine consideration, the prior art teaches material change to the fluorine components which are outside the scope of the instant claimed invention [0039-0040].

Chiang et al – PGPUB 2016/0372802 – is herein included on the record. Chiang teaches a method for electrochemical cell remediation. The process of remediation is shown in Fig 1a-Fig 1b. The prior art teaches a processing of the SEI to be performed by an acid step [0106].

Cardarellie et al – USPAT 7192564 – is herein included on the record. Cardarelli teaches a method for recycling spent lithium metal batteries and related materials. The method of processing the comminuted material is shown in figure 1A. Acid and extreme heat are utilized in a manner that is outside the scope of the instant claim.

The above close prior art teaches processing of a battery cell to salvage materials therefrom. The instant claim lays weight to explicit method steps which the prior art does not teach. The prior art does not recognize the relationship of a temperature and pressure which is capable of vaporizing organic carbonate while not decomposing fluorine salt in the comminuted material. The combination of features of the instant claim are not taught or obviated by the prior art and therefore the instant claim is found allowable.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled “Comments on Statement of Reasons for Allowance.”

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to STEPHEN J YANCHUK whose telephone number is (571)270-7343. The examiner can normally be reached M-Th 10a-8p.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Pamela Weiss can be reached on 571-270-7057. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of published or unpublished applications may be obtained from Patent Center. Unpublished application information in Patent Center is available to registered users. To file and manage patent submissions in Patent Center, visit: <https://patentcenter.uspto.gov>. Visit <https://www.uspto.gov/patents/apply/patent-center> for more information about Patent Center and <https://www.uspto.gov/patents/docx> for information about filing in DOCX format. For additional questions, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/STEPHEN J YANCHUK/
Primary Examiner, Art Unit 1752

Notice of References Cited	Application/Control No. 16/343,224		Applicant(s)/Patent Under Reexamination HANISCH, Christian	
	Examiner STEPHEN J YANCHUK		Art Unit 1752	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date YYYY-MM-DD	Name	CPC Classification	US Classification
*	A	US-20140017621-A1	2014-01-16	Iida; Shuji	H01M10/54	432/13
*	B	US-20160372802-A1	2016-12-22	CHIANG; Yet-Ming	H01M6/52	1/1
*	C	US-7192564-B2	2007-03-20	Cardarelli; Francois	H01M6/52	75/693
	D					
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

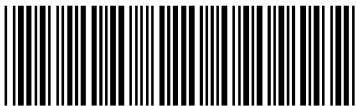
FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date YYYY-MM-DD	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in YYYY-MM-DD format are publication dates. Classifications may be US or foreign.

Search Notes 	Application/Control No. 16/343,224	Applicant(s)/Patent Under Reexamination HANISCH, Christian
	Examiner STEPHEN J YANCHUK	Art Unit 1752

CPC - Searched*		
Symbol	Date	Examiner
H01M: 10/54, 6/52	05/22/2021	SJY
C22B: 1/005, 7/00,001	05/22/2021	SJY
H01M10/54.cpc. H01M6/52.cpc. Y02P10/20.cpc. Y02W30/84.cpc. C22B1/005.cpc. C22B7/00,001.cpc.*	03/23/2024	SJY

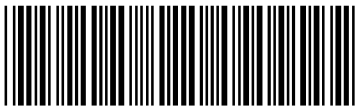
CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
Inventor Search	05/22/2021	SJY
IDS Review	05/22/2021	SJY
App history review: 15/569484	05/22/2021	SJY
East Word Search	05/22/2021	SJY
Updated Search Notes	11/20/2021	SJY
NPL Review: drying comminuted electrolyte	11/20/2021	SJY
Updated SEARCH: Carbonate vaporization with fluorine maintance	03/23/2024	SJY

/STEPHEN J YANCHUK/ Primary Examiner, Art Unit 1723	
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<i>Search Notes</i> 	Application/Control No. 16/343,224	Applicant(s)/Patent Under Reexamination HANISCH, Christian
	Examiner STEPHEN J YANCHUK	Art Unit 1752

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
H01M	10/54, 6/52	03/23/2024	SJY
Y02P	10/20	03/23/2024	SJY
Y02W	30/84	03/23/2024	SJY
C22B	1/005 7/00,001	03/23/2024	SJY

/STEPHEN J YANCHUK/ Primary Examiner, Art Unit 1723	
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Issue Classification 	Application/Control No. 16/343,224	Applicant(s)/Patent Under Reexamination HANISCH, Christian
	Examiner STEPHEN J YANCHUK	Art Unit 1752

CPC						
Symbol					Type	Version
H01M	/	10	/	54	F	2013-01-01
C22B	/	1	/	005	I	2013-01-01
C22B	/	7	/	001	I	2013-01-01
H01M	/	6	/	52	I	2013-01-01
C22B	/	7	/	00	I	2013-01-01
Y02W	/	30	/	84	A	2015-05-01
Y02P	/	10	/	20	A	2015-11-01

CPC Combination Sets				
Symbol		Type	Set	Version
	/			

NONE	Total Claims Allowed:	
(Assistant Examiner)	(Date)	14
/STEPHEN J YANCHUK/ Primary Examiner, Art Unit 1752	23 March 2024	O.G. Print Claim(s)
(Primary Examiner)	(Date)	1

Issue Classification 	Application/Control No. 16/343,224	Applicant(s)/Patent Under Reexamination HANISCH, Christian
	Examiner STEPHEN J YANCHUK	Art Unit 1752

INTERNATIONAL CLASSIFICATION			
CLAIMED			
H01M	/	10	/ 54
NON-CLAIMED			
	/		/

US ORIGINAL CLASSIFICATION	
CLASS	SUBCLASS

CROSS REFERENCES(S)						
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	14	
/STEPHEN J YANCHUK/ Primary Examiner, Art Unit 1752	23 March 2024	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

Issue Classification 	Application/Control No. 16/343,224	Applicant(s)/Patent Under Reexamination HANISCH, Christian
	Examiner STEPHEN J YANCHUK	Art Unit 1752

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47															
CLAIMS															
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1		10		19										
2	2		11		20										
3	3		12	10	21										
4	4		13	11	22										
5	5		14	12	23										
6	6		15	13	24										
7	7		16	14	25										
8	8	9	17												
	9		18												

NONE	Total Claims Allowed:	
(Assistant Examiner)	(Date)	14
/STEPHEN J YANCHUK/ Primary Examiner, Art Unit 1752	23 March 2024	O.G. Print Claim(s)
(Primary Examiner)	(Date)	1
		O.G. Print Figure
		1

PE2E SEARCH - Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
L1	1	"16343224"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 09:30 AM
L2	3763	(H01M10/54.cpc.) and @ad<"20161020"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 10:01 AM
L3	4198	(H01M10/54.cpc. H01M6/52.cpc.) and @ad<"20161020"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 10:02 AM
L4	25	L3 and (dry drying) same (pressure mpa hpa) same (temp temperature)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 10:03 AM
L5	5	"15569484"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 10:11 AM
L6	158	L3 and (comminut\$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 10:21 AM
L7	1	L6 and condens\$4 same (dry drying)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 10:22 AM
L8	23	L6 and (agitat\$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 10:23 AM
L9	45	Duesenfeld	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 10:23 AM
L10	255	L3 and (convey\$4 integrated adj3 system)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 10:46 AM
L11	0	L10 and (dustfree dust adj free)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 10:47 AM
L12	32	L10 and (dust)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 10:47 AM
L14	6441	(C22B1/005.cpc.	(US-PGPUB; USPAT;	OR	ON	ON	2021/05/22

		C22B7/00,001.cpc.) and @ad<"20161020"	USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)				11:57 AM
L15	65	L14 and (MPA HPA hectopascal megapascal)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/05/22 01:50 PM
L18	4293	(H01M10/54.cpc. H01M6/52.cpc.) and @ad<"20161020"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/11/19 11:09 PM
L19	162	L18 and (comminut\$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/11/19 11:09 PM
L21	25	"2010149611"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/11/19 11:11 PM
L22	4	"5303872".pn.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/11/19 11:12 PM
L23	15	"5303872"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/11/19 11:13 PM
L24	3	"9160043"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/11/19 11:17 PM
L25	3854	(H01M10/54.cpc.) and @ad<"20161020"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/11/20 08:25 AM
L26	14	L25 and (depressur\$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/11/20 08:25 AM
L27	3854	(H01M10/54.cpc.) and @ad<"20161020"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/11/20 10:19 AM
L28	144	L27 and (agitat\$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/11/20 10:19 AM
L29	35	L27 and (agitat\$4) same3 (pressur\$4 depressur\$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/11/20 10:21 AM
L30	11	"11050097"	(US-PGPUB; USPAT; USOCR; FPRS; EPO;	OR	ON	ON	2021/11/20 12:48 PM

L31	3	"16343224"	JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L32	4328	(H01M10/54.cpc.) and @ad<"20161020"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L33	4839	(H01M10/54.cpc. H01M6/52.cpc.) and @ad<"20161020"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L34	31	L3 and (dry drying) same (pressure mpa hpa) same (temp temperature)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L35	7	"15569484"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L36	173	L3 and (comminut\$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L37	3	L6 and condens\$4 same (dry drying)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L38	22	L6 and (agitat\$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L39	80	Duesenfeld	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L40	320	L3 and (convey\$4 integrated adj3 system)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L41	0	L10 and (dustfree dust adj free)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L42	36	L10 and (dust)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L43	7055	(C22B1/005.cpc. C22B7/00,001.cpc.) and @ad<"20161020"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	ON	ON	2024/03/22 04:42 PM

L44	70	L14 and (MPA HPA hectopascal megapascal)	IBM_TDB) (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L45	4839	(H01M10/54.cpc. H01M6/52.cpc.) and @ad<"20161020"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L46	173	L18 and (comminut\$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L47	31	"2010149611"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L48	4	"5303872".pn.	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L49	15	"5303872"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L50	4	"9160043"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L51	4328	(H01M10/54.cpc.) and @ad<"20161020"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L52	14	L25 and (depressur\$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L53	4328	(H01M10/54.cpc.) and @ad<"20161020"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L54	152	L27 and (agitat\$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L55	35	L27 and (agitat\$4) same3 (pressur\$4 depressur\$4)	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM
L56	15	"11050097"	(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/03/22 04:42 PM

L57	805	(H01M10/54.cpc. H01M6/52.cpc. Y02/10/20.cpc. Y02W30/84.cpc.) AND @ad<"20171012"	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/22 04:49 PM
L58	135	L57 AND carbonate WITH (pressur\$4 temperature vapor\$4 vaporiz\$4 remov\$4)	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/22 04:50 PM
L59	52	L58 AND (dimethyl ethyl methylcarbonate)	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/22 04:50 PM
L60	50	L59 AND (temperature pressure)	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/22 04:51 PM
L61	26	L60 AND (fluorine)	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/22 04:55 PM
L62	1688	(H01M10/54.cpc. H01M6/52.cpc. Y02/10/20.cpc. Y02W30/84.cpc. C22B1/005.cpc. C22B7/00,001.cpc.) AND @ad<"20171012"	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/22 05:27 PM
L63	115	L62 AND (comminut\$4 (break\$4 shred\$4) WITH (electrode positive negative cathode anode) WITH (small shards fragment\$4 piec\$4))	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/22 05:29 PM
L64	115	L63 AND @ad<"20171012"	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/22 05:29 PM
L65	69	L63 AND (batter\$4 electrochemical lithium)	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/22 05:30 PM
L66	63	L65 AND (pressur\$4 temperature)	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/22 05:31 PM
L67	15	L66 AND carbonate WITH (pressur\$4 temperature vapor\$4 vaporiz\$4 remov\$4)	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/22 05:31 PM
L68	2	"15569484"	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/22 06:29 PM
L69	409	(C22B1/005.cpc.) AND @ad<"20171012"	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/23 01:23 PM
L70	112	L69 AND (fluor\$4 carbonate)	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/23 01:23 PM
L71	50	L70 AND (pressure same2 (temp temperature))	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/23 01:24 PM
L72	13256	(Y02P10/20.cpc.) AND @ad<"20171012"	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/23 02:01 PM
L73	1596	L72 AND (lithium li)	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/23 02:01 PM

L74	701	L73 AND (comminut\$4 crush\$4 Break\$4 shred\$4)	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/23 02:02 PM
L75	72	L74 AND (carbonate same3 fluori\$4)	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/23 02:02 PM

PE2E SEARCH - Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
N1	1	(electrochemical battery batteries).clm. AND (comminut\$4 crush\$4 Break\$4 shred\$4).clm. AND (carbonate).clm. AND (fluor\$4 WITH salt).clm. AND (pressure).clm. AND (temperature).clm.	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/23 01:36 PM
N2	5	"20040028585"	(US-PGPUB; USPAT)	OR	ON	ON	2024/03/23 01:51 PM

Doc code: IDS

PTO/SB/08a (02-18)

Doc description: Information Disclosure Statement (IDS) Filed

Approved for use through 11/30/2020. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		16343224	
	Filing Date		2019-04-18	
	First Named Inventor		Christian HANISCH	
	Art Unit			
	Examiner Name			
	Attorney Docket Number		03101253US	

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	1	2983768	CA	A1	2016-11-03	Duesenfeld Gmbh		

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/STEPHEN J YANCHUK/

03/22/2024

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	16343224
Filing Date	2019-04-18
First Named Inventor	Christian HANISCH
Art Unit	
Examiner Name	
Attorney Docket Number	03101253US

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Add**EXAMINER SIGNATURE**

Examiner Signature	/STEPHEN J YANCHUK/	Date Considered	03/22/2024
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*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16343224
Filing Date	2019-04-18
First Named Inventor	Christian HANISCH
Art Unit	
Examiner Name	
Attorney Docket Number	03101253US

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☒ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Michael E. Whitham/	Date (YYYY-MM-DD)	2022-12-19
Name/Print	Michael E. Whitham	Registration Number	32635

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

/STEPHEN J YANCHUK/

03/22/2024

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The information provided by you in this form will be subject to the following routine uses:

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3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

/STEPHEN J YANCHUK/

03/22/2024

Doc code: IDS

PTO/SB/08a (02-18)

Doc description: Information Disclosure Statement (IDS) Filed

Approved for use through 11/30/2020. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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Application Number	16343224
Filing Date	2019-04-18
First Named Inventor	Christian HANISCH
Art Unit	
Examiner Name	
Attorney Docket Number	03101253US2

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	1	2001012704	JP	A	2001-01-19	ORION MACHINERY CO LTD		
	2	20040071776	KR	A	2004-08-12	SLOOP STEVEN E		

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/STEPHEN J YANCHUK/

03/22/2024

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)

Application Number	16343224
Filing Date	2019-04-18
First Named Inventor	Christian HANISCH
Art Unit	
Examiner Name	
Attorney Docket Number	03101253US2

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵
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Examiner Signature	/STEPHEN J YANCHUK/	Date Considered	03/22/2024
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¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16343224
Filing Date	2019-04-18
First Named Inventor	Christian HANISCH
Art Unit	
Examiner Name	
Attorney Docket Number	03101253US2

CERTIFICATION STATEMENT

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See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Michael E. Whitham/	Date (YYYY-MM-DD)	2022-10-19
Name/Print	Michael E. Whitham	Registration Number	32635

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/STEPHEN J YANCHUK/

03/22/2024

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1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
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5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

/STEPHEN J YANCHUK/

03/22/2024

Ascend Elements EX1002 Page 182

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re patent application of

Hanisch

Application No. 16/343,224

Filed: April 18, 2019

Confirmation No. 6508

Group Art Unit: 1723

Examiner: YANCHUK, Stephen J.

For: RECYCLING METHOD FOR TREATING USED BATTERIES,
IN PARTICULAR RECHARGEABLE BATTERIES, AND
BATTERY PROCESSING INSTALLATION

Commissioner for Patents
PO Box 1450
Alexandria, Virginia 22313-1450

STATUS INQUIRY

Sir:

An RCE and response was timely filed in the USPTO more than one year ago (filed Feb. 18, 2022). The undersigned hereby inquires about the status of the above identified application.

Respectfully submitted,

/Michael E. Whitham/

Michael E. Whitham
Reg. No. 32,635

WCF IP
11491 Sunset Hills Road, Suite 340
Reston, VA 20190

Tel. (703) 787-9400
Fax. (703) 787-7557

Customer No.: 164319

Electronic Acknowledgement Receipt

EFS ID:	47731457
Application Number:	16343224
International Application Number:	
Confirmation Number:	6508
Title of Invention:	RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION
First Named Inventor/Applicant Name:	Christian HANISCH
Customer Number:	30743
Filer:	Michael E. Whitham
Filer Authorized By:	
Attorney Docket Number:	03101253US
Receipt Date:	23-MAR-2023
Filing Date:	18-APR-2019
Time Stamp:	12:14:29
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Miscellaneous Incoming Letter	2023-03-23_03101253US_status.pdf	15045 08b7305e9994e862a612b6f35db81e7d0d059fe8	no	1

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		16343224
	Filing Date		2019-04-18
	First Named Inventor	Christian HANISCH	
	Art Unit		
	Examiner Name		
	Attorney Docket Number		03101253US

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Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ²ⁱ	Kind Code ⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T ⁵
	1	2983768	CA	A1	2016-11-03	Duesenfeld Gmbh		

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**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	16343224
Filing Date	2019-04-18
First Named Inventor	Christian HANISCH
Art Unit	
Examiner Name	
Attorney Docket Number	03101253US

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(Not for submission under 37 CFR 1.99)

Application Number	16343224
Filing Date	2019-04-18
First Named Inventor	Christian HANISCH
Art Unit	
Examiner Name	
Attorney Docket Number	03101253US

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Signature	/Michael E. Whitham/	Date (YYYY-MM-DD)	2022-12-19
Name/Print	Michael E. Whitham	Registration Number	32635

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APPLICATION #
16/343,224

RECEIPT DATE / TIME
12/19/2022 10:11:19 AM ET

ATTORNEY DOCKET #
03101253US

Title of Invention

RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION

Application Information

APPLICATION TYPE	Utility - U.S. National Stage under 35 USC 371	PATENT #	-
CONFIRMATION #	6508	FILED BY	Sam Cook
PATENT CENTER #	61317539	FILING DATE	04/18/2019
CUSTOMER #	30743	FIRST NAMED INVENTOR	Christian HANISCH
INTL. APPLICATION #	-	INTL. FILING DATE	-
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Michael Whitham

Documents

TOTAL DOCUMENTS: 2

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
CA2983768A1.PDF	26	Foreign Reference	985 KB
2022-12-19_03101253US_IDS5.pdf	4	Information Disclosure Statement (IDS) Form (SB08)	1010 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
CA2983768A1.PDF	A024CC666676DDBD68A9B454DDDEE8DEF3287F207F1C8A4B

3508743E97774129AE059A00F4725936C50E76A137F86BE592B
2B07DB16924FDFC283A22EFAD94A4

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	Filing Date		2019-04-18
	First Named Inventor	Christian HANISCH	
	Art Unit		
	Examiner Name		
	Attorney Docket Number		03101253US2

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	2	20040071776	KR	A	2004-08-12	SLOOP STEVEN E		

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Examiner Name	
Attorney Docket Number	03101253US2

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵
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Examiner Signature		Date Considered	
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Attorney Docket Number	03101253US2

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☒ A certification statement is not submitted herewith.

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Signature	/Michael E. Whitham/	Date (YYYY-MM-DD)	2022-10-19
Name/Print	Michael E. Whitham	Registration Number	32635

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8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
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ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #
16/343,224

RECEIPT DATE / TIME
10/19/2022 05:34:02 PM ET

ATTORNEY DOCKET #
03101253US

Title of Invention

RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION

Application Information

APPLICATION TYPE	Utility - U.S. National Stage under 35 USC 371	PATENT #	-
CONFIRMATION #	6508	FILED BY	Sam Cook
PATENT CENTER #	61084629	FILING DATE	04/18/2019
CUSTOMER #	30743	FIRST NAMED INVENTOR	Christian HANISCH
INTL. APPLICATION #	-	INTL. FILING DATE	-
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Michael Whitham

Documents

TOTAL DOCUMENTS: 5

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
2022-10-19_03101253US2_IDS4.pdf	4	Information Disclosure Statement (IDS) Form (SB08)	1010 KB
JP2001012704A.PDF	9	Foreign Reference	614 KB
Warning: The attached file contains comments or annotations. Comments are not recommended and may cause processing problems with the document.			
JP2001012704A_abstract0.pdf	1	Abstract	138 KB
KR20040071776_abstract0.p	1	Abstract	63 KB

df

KR20040071776A.PDF

14

Foreign Reference

920 KB

Warning: The attached file contains comments or annotations. Comments are not recommended and may cause processing problems with the document.

Digest

DOCUMENT

MESSAGE DIGEST(SHA-512)

2022-10-19_03101253US2_IDS4.pdf	B59525C4E62FBC4F5CA6CB150A8AD27EC979C1DE95F23F65 A67DF3D4C0892D1AC121F6EEA3842521B003D300079FF4C40 7DBE58D8F429FB8A28D604DE87569DE
JP2001012704A.PDF	8D7C668034B6C11E21C300D6E387D02A49A908EA9F1408A8A C68DD18DE76D96274F03B71C6F65C85E9F741A714276D84D0 EA142A93CC6A7132D82AF94B3545FE
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KR20040071776A.PDF	0C805A26511A43C977C89771E6E4057B1B3B39DBE09EBDB5F 9AB17DF25EC3E3EA423B9372D34821DD485DA2FA0A28A99B8 F534792BA79BA74FE10C51890DABCF

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If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application

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If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875				Application or Docket Number 16/343,224		Filing Date 04/18/2019		☐ To be Mailed		
ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO										
APPLICATION AS FILED - PART I										
		(Column 1)	(Column 2)							
FOR		NUMBER FILED	NUMBER EXTRA	RATE (\$)		FEE (\$)				
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))		N/A	N/A	N/A						
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))		N/A	N/A	N/A						
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))		N/A	N/A	N/A						
TOTAL CLAIMS (37 CFR 1.16(i))		minus 20 =	*	x \$100 =						
INDEPENDENT CLAIMS (37 CFR 1.16(h))		minus 3 =	*	x \$460 =						
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))		If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).								
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))										
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL						
APPLICATION AS AMENDED - PART II										
		(Column 1)		(Column 2)	(Column 3)					
AMENDMENT	02/18/2022	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)		ADDITIONAL FEE (\$)		
	Total (37 CFR 1.16(i))	* 14	Minus	** 20	= 0	x \$100 =		0		
	Independent (37 CFR 1.16(h))	* 1	Minus	*** 3	= 0	x \$480 =		0		
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
						TOTAL ADD'L FEE		0		
		(Column 1)		(Column 2)	(Column 3)					
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)		ADDITIONAL FEE (\$)		
	Total (37 CFR 1.16(i))	*	Minus	**	=	x \$0 =				
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x \$0 =				
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
						TOTAL ADD'L FEE				
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.						LIE				
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".						/SHAREILL A COLES/				
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".										
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.										

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**Request
for
Continued Examination (RCE)
Transmittal**

Address to:
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Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Application Number	16/343224
Filing Date	April 18, 2019
First Named Inventor	Hanisch
Art Unit	1723
Examiner Name	Yanchuck
Attorney Docket Number	03101253US

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. See Instruction Sheet for RCEs (not to be submitted to the USPTO) on page 2.

1. **Submission required under 37 CFR 1.114** Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).
- a. ☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.
- i. ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____
- ii. ☐ Other _____
- b. ☒ Enclosed
- i. ☒ Amendment/Reply
- ii. ☐ Affidavit(s)/ Declaration(s)
- iii. ☐ Information Disclosure Statement (IDS)
- iv. ☐ Other _____
2. **Miscellaneous**
- a. ☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of _____ months. (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)
- b. ☐ Other _____
3. **Fees** The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.
- The Director is hereby authorized to charge the following fees, any underpayment of fees, or credit any overpayments, to Deposit Account No. 50-2041.
- a. ☒
- i. ☒ RCE fee required under 37 CFR 1.17(e)
- ii. ☐ Extension of time fee (37 CFR 1.136 and 1.17)
- iii. ☐ Other _____
- b. ☐ Check in the amount of \$ _____ enclosed
- c. ☐ Payment by credit card (Form PTO-2038 enclosed)
- d. ☐ Payment by EFS-Web

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SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

Signature	/Michael E. Whitham/	Date	February 18, 2020
Name (Print/Type)	Michael E. Whitham	Registration No.	32,635

CERTIFICATE OF MAILING OR TRANSMISSION

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re patent application of

Hanisch

Application No. 16/343,224

Filed: April 18, 2019

Confirmation No. 6508

Group Art Unit: 1723

Examiner: YANCHUK, Stephen J.

For: RECYCLING METHOD FOR TREATING USED BATTERIES,
IN PARTICULAR RECHARGEABLE BATTERIES, AND
BATTERY PROCESSING INSTALLATION

Commissioner for Patents
PO Box 1450
Alexandria, Virginia 22313-1450

AMENDMENT UNDER 37 C.F.R. 1.114

Sir:

Applicant submits this concurrently with a Request for Continued Examination (RCE). This is in response to the Final Office Action dated November 23, 2021. Applicant respectfully requests, in view of the following, that the application be reconsidered.

Amendments to the Claims begin on page 2.

Remarks begin on page 5.

Listing of the Claims:

The following is a complete listing of all the claims in the application, with an indication of the status of each:

1. (Currently Amended) A method for treating used lithium batteries ~~comprising at least a cathode, anode, separator, and electrolyte~~, comprising:

receiving, into a comminuting device, used lithium batteries that include a cathode, anode, separator, and electrolyte comprising a fluorine salt and a solvent, the solvent including an organic carbonate;

comminuting the used lithium batteries, by the comminuting device, and obtaining such that comminuted material as a result is obtained; ; and

inactivating the comminuted material and obtaining such that an inactivated comminuted material as a result is obtained, wherein the inactivating includes a drying process, comprising where drying the comminuted material is conducted by removal of organic carbonate from the electrolyte by vaporizing the organic carbonate at a maximum pressure-temperature above a boiling point of the organic carbonate, the pressure being not more than [[of]] 300 hPa, and the a maximum temperature being not more than[[of]] 80° C to vaporize at least a portion and lower than a decomposition temperature of the electrolyte fluorine salt.

2. (Currently Amended) The method according to claim 1, wherein:

the organic solvent comprises dimethyl carbonate, or ethyl methylcarbonate, or both; and the drying process further continues the drying until the vaporizing removes at least 90 percent by weight of the dimethyl carbonate, or ethyl methylcarbonate, or both, from the electrolyte ~~comminuted material is deactivated by the drying, such that an electrochemical reaction is not possible.~~

3. (Currently Amended) The method according to claim 1, further comprising:

capturing and condensing gases created from the vaporizing of vaporized organic carbonate in the electrolyte during the drying process.

4. (Currently Amended) The method according to claim 1, further comprising:

performing the drying within an interior of a drying device;

continuous monitoring, by a controller, of at least one progress parameter that is indicative of a progress of the drying, the at least one progress parameter comprising a pressure in the interior of the drying device or a pressure of a gas flow out of the interior of the drying device ~~concentration of organic carbonates from vaporized electrolyte in an atmosphere of a drying device used during the drying process, and~~

not terminating the drying process until the progress parameter reaches a pre-determined progress parameter threshold ~~value lower explosion limit has been undercut.~~

5. (Currently Amended) The method according to claim 1, wherein the ~~drying process~~ the pressure is not more than ~~conducted at a maximum pressure of 30 hPa for at least 50% of a duration of the drying time, or and/or the a minimum pressure does not exceed 50 hPa during the drying process is at most 50 hPa, or both.~~

6. (Currently Amended) The method according to claim 1, further comprising: wherein feeding the comminuted material, through an airlock, into an interior of a drying device; and

performing the drying within the interior of the drying device ~~one or more of the comminuted material and inactivated comminuted material is moved in a drying device by an agitator, and the agitator is used to supply at least 50% of an evaporation heat required for drying of the comminuted material.~~

7. (Currently Amended) The method according to claim 6, further comprising: wherein vacuum sucking away of ~~gases created from vaporized organic carbonate electrolyte during the drying process are sucked away and/or~~

~~wherein the batteries comprise current collector foils having a coating material and movement using the agitator is conducted such that at least 50% by weight of the coating material of comminuted material is sucked away.~~

8. (Currently Amended) The method according to claim 1 wherein: comminuting the used lithium batteries is performed within a container; comminution and the drying processes is performed within the ~~are conducted in one container only.~~

9. – 16. (Cancelled)

17. (Currently Amended) The method according to claim 3 wherein condensing is performed at an ambient pressure, or condensing is performed at and/or a temperature within a temperature range that extends from above 0° C to and below 50° C, or both.

18.-20. (Canceled)

21. (Currently Amended) The method according to claim 1, wherein comminuting of the used lithium batteries is configured ~~executed~~ such that the comminuted material includes components of comminuted material, and at least 90% by weight of the components of the comminuted material have ~~has~~ a ~~maximum~~ sieve size that is not more than ~~[[of]]~~ 50mm.

22. (New) The method according to claim 1, wherein receiving the used lithium-ion batteries further includes receiving used lithium-ion batteries that further comprise carrier foil and binder that binds active material to the carrier foil, and

the temperature of the vaporizing pressure-temperature being not more than 80° C, lower than a decomposition temperature of the binder, and lower than the decomposition temperature of the fluorine salt

23. (New) The method according to claim 22, further comprising a high temperature drying of the inactivated comminuted material, the high temperature drying being configured to decompose binder.

24. (New) The method according to claim 1, further comprising:

moving by an agitator, over a duration of the drying, a not yet inactivated comminuted material among the comminuted material, or a mixture of inactivated comminuted material and not yet inactivated comminuted material, or both; and

supplying, during the drying, a vaporization heat to the comminuted material, wherein the supplying includes the agitator supplying at least 35% of said vaporization heat.

25. (New) The method according to claim 1, further comprising:

performing the drying within an interior of a drying device; and
agitating, by an agitator, the inactivated comminuted material when removing the inactivated comminuted material from the drying device.

REMARKS

Applicant amends Claims 1-8, 17, and 21 for form. Claims 22 -25 are new. Claim 18 is canceled. Applicant submits that all amendments and new claims are supported by Applicant's original disclosure, and not new matter. Table 1 below identifies example support for amendments to Claims 1, 2, 4, and 6, for new Claims 22-25. Other amendments are for informalities.

Table 1

Claim	Example Support in Original Specification
1	p. 3, lines 13-21; p. 7, lines 2-7; p. 9, lines 6-9; p. 12, lines 16-28; and p. 15, lines 18-20.
2	p. 12, lines 16-28.
4	p. 10, lines 14-25.
6	p. 20, lines 1-4; and p. 23, lines 11-15.
22	p. 7, line 9-18; p. 16, lines 24-26.
23	p. 16, lines 14-18.
24, 25	p. 13, lines 9-22.

Rejections under 35 U.S.C. § 112(b)

The Office Action rejects Claim 4 and Claim 6 as allegedly not meeting requirements of 35 U.S.C. § 112(b) (hereinafter alternatively "Section 112(b)"). Applicant submits in response that Claims 4 and 6, as amended for form, obviate the rejections. The amendments are submitted without disclaimer of subject matter, and do not represent or imply Applicant agreement with any rejection or related position set forth in the Office Action

Regarding Claim 4, the amended base Claim 1 positively recites¹ the electrolyte to include "organic carbonate," and Claim 4, amended for form, recites² "drying in... [a] drying

¹ Addressing Office's assertion at p. 3, last two lines, re "organic carbonates ... in the system."

² Addressing Office Action assertion at p. 3, first full paragraph, second sentence.

device,” and “computer control³” of “monitoring ... a progress parameter that is indicative of a progress of the drying, the process parameter being a pressure,” either “inside the drying device or ... in a gas flow out of the interior.” Applicant identifies support in Table 1 at the beginning of these remarks. Amended Claim 4 also ties the controller monitoring of the “progress parameter” to the Claim 1 drying process by the limitation “not terminating the drying until the progress parameter reaches a pre-determined progress parameter threshold.”

Also regarding Claim 4, Applicant respectfully believes, on Applicant’s best understanding of the Office Action assertion of “any material selection⁴,” that the amended claim obviates the assertion.

Regarding Claim 6, Applicant submits, based on Applicant’s best understanding of the Office’s position set forth by the Office Action at p. 4, lines 6-18, that the positions are addressed and obviated by the Claim 6 amendments, and further submits that amended Claim 6, read in view of amended Claim 1, meets all requirements under Section 112(b).

Applicant, for at least the reasons presented above, respectfully requests reconsideration and withdrawal of the Section 112(b) rejections of Claims 4 and 6.

Rejections under 35 U.S.C. § 103

The Office asserts rejection of Claims 1-7, 17-18, and 21 as allegedly “unpatentable over Ho et al. (PGPUB 2018/0013181),” (hereinafter “Ho”) and Hayashi et al. (PGPUB 2016/0049699),” (hereinafter “Hayashi”). The Office Action rejects Claims 8 and 21 as allegedly unpatentable over Ho and Hayashi, as the Office applies these to Claim 1, in further view of U.S. Patent 5,303,872 (hereinafter “Milewits”).

Applicant respectfully traverses the rejections.

Applicant’s Claim 1 defines a “method for treating used lithium batteries” that comprises a combination of steps including

receiving, into a comminuting device, used lithium batteries that include a cathode, anode, separator, and electrolyte comprising a fluorine salt and a solvent, the solvent including an organic carbonate;

comminuting the used lithium batteries, by the comminuting device, and obtaining comminuted material as a result; and

inactivating the comminuted material and obtaining inactivated

³ Addressing the Office Action position at p. 3, first full paragraph, third sentence.

⁴ Office Action recitation, starting at p. 3, last line, ending at p. 4, first line.

comminuted material as a result.

Claim 1 further defines the “inactivating” as comprising

drying the comminuted material by removal of organic carbonate from the electrolyte by vaporizing the organic carbonate at a pressure-temperature above a boiling point of the organic carbonate,

the pressure being not more than 300 hPa, and

the temperature being not more than 80° C and lower than a decomposition temperature of the fluorine salt,

The Claim 1 method, as described in the specification, provides a novel and non-obvious solutions to particular problems and shortcomings in the prior art techniques for removing certain active components from comminuted, i.e., from pieces of, used lithium-ion batteries.

Applicant’s specification describes as one such problem the generation of hydrogen fluoride. Applicant’s specification notes the problem is significant, as hydrogen fluoride is a highly toxic⁵ and difficult to dispose of substance. The Claim 1 method, as described, solves this problem, and provides further features and benefits.

Applicant respectfully refers to Ho, which the Office Action relies upon as the primary reference in asserting that Ho in view of Hayashi establishes prima face obviousness of Claim 1.

Applicant respectfully submits that searching Ho using each feature of Claim 1 finds just *one* feature to which something in Ho can be argued as comparable. The one feature is “comminuting,” as Ho’s technique includes a “chopping” of lithium-ion batteries.

Applicant submits that nothing taught by Ho as following the chopping appears as being reasonably arguable as a teaching or suggestion toward any Claim 1 feature other than “comminuting” e.g., there is no teaching or suggestion toward “inactivating ... drying vaporizing ... organic carbonate.” What teaches is immersing the battery pieces in a “polar solvent” in which the binder materials are soluble, supplying high frequency agitation the dissolve binder materials, to form a suspension of the anode and cathode materials in the polar solvent, for recovery.

The Office Action recites that Ho

is silent to teach a method step of inactivating pertaining to the electrolyte undergoing a pressure and temperature to be vaporized.

⁵ See specification at p. 2, lines 3-5 and 9-11 (i.e., last two sentences of paragraph bridging pp. 1 and 2, and concluding sentence of p. 2 paragraph beginning with “WO 2010/102377 A1 ...”).

Applicant agrees that Ho is silent. Applicants respectfully adds that Ho is directed to a materially different purpose than Claim 1, namely recovering anode and cathode materials, not electrolyte, and performs its different purpose using a very different mechanism than defined by the Claim 1 limitations, and that Ho operates according to a far different principle of operation than the method defined by Claim 1.

Applicant respectfully submits, viewing the amended Claim 1 positive recitations of the “drying” that Ho not only lacks teaching or suggestion of, but is fundamentally incapable of, and incapable of being modified⁶ to attain:

drying the comminuted material by removal of organic carbonate from the electrolyte by vaporizing the organic carbonate,

In addition, Ho, because its technique functions by immersing battery pieces in liquid, does not perform and is inherently incapable of performing any “reduced pressure” operation.

The Office Action asserts that

Hayashi teaches a method for processing fluorine-containing electrolyte including a gasification step of gasifying a volatile component of an electrolyte solution including a fluorine compound by heating the electrolyte solution under a reduced pressure [Abstract]. It is interpreted that one having ordinary skill in the art would look to modify the method step of Ho with the specifics of Hayashi because of the health risks presented by fluorine.

Applicant respectfully responds first that Applicant cannot identify relevance to Ho and Hayashi of the Office Action’s asserted motivation of “because of the health risks presented by fluorine.” As Applicant submits above, Ho pertains to recovery of anode and cathode materials, by dissolving the binder in a solution, allowing the anode and cathode materials to become a suspension. Ho does not mention recovering electrolyte. Ho does not show anything that, on Applicant’s reading of the reference, would be understood by persons of ordinary skill in the art as creating hydrogen fluoride. The Office Action also appears to have not considered that Hayashi technique purports to eliminate the hydrogen fluoride, namely, by “passing the gasification gas passes through a filling layer of the calcium compound ... [wherein] fluorine in the gas reacts with calcium, [and] calcium fluoride is generated.” Also, Hayashi’s technique immerses the entire

⁶ Applicant respectfully submits that removing the entire apparatus and method that Ho discloses as its inventive concept, and replacing it with Hayashi’s method and apparatus, having a fundamentally principle of operation, appears outside any rationale set forth in the Manual of Patent Examining Procedure for “modifying” in the context of 35 U.S.C. § 103.

battery case, with the safety valve intact, into a fluid. The entire battery is heated by the fluid, whereupon the method uses the battery's safety valve to lower the pressure within the battery case.

Applicant does not identify a logic on which a person of ordinary skill would be motivated "because of the health risks presented by fluorine" to look at Ho and Hayashi and create the combination defined by Claim 1.

Applicant submits second that supposed "modification," by performing a complete replacement of Ho's immersion method and apparatus with a Hayashi's fundamentally different mechanism (and perform additional substantial modifications, if possible, to cure the deficiencies in its technique relative to Claim 1) it would effect a fundamental change in Ho's principle of operation. Under MPEP rules, though,

[i]f the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims prima facie obvious⁷.

Similarly, modification Hayashi to include a chopping, would necessitate removing Hayashi's technique of heating the entire battery case and using the batteries operational safety valve. This would fundamentally change Hayashi's principle of operation; therefore such modification cannot be a rationale for prima facie obviousness.

Applicant submits, thirdly, that the proposed "modification" of Ho would remove its function of obtaining anode and cathode materials from the battery. This would render Ho unsatisfactory for its intended purpose. Under MPEP guidelines

[i]f a proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification⁸.

Applicant submits, fourth, that Hayashi lacks, among other features of Claim 1,

the pressure-temperature being above a boiling point of the organic carbonate ... and lower than a decomposition temperature of the fluorine salt.

Hayashi teaches the **opposite**, namely removal of the organic carbonate and the fluorine salt, together, followed by separation of the two.

⁷ MPEP, Section 2143.01(VI) (citations omitted)

⁸ Id., at 2143.01(V) (citations omitted)

Applicant further submits that Applicant's Claim 1 recites a method for inactivating comminuted materials by removing organic carbonate from the electrolyte, using a particularly defined pressure temperature that, as clearly described in Applicant's specification, solves the related art problem of creation of hydrogen fluoride. .

Hayashi does *not* teach a technique for *avoiding the creation* of hydrogen fluoride. Hayashi teaches a technique that explicitly *creates* hydrogen fluoride. Hayashi creates the hydrogen fluoride by effecting, within a lithium-ion battery case, a pressure-temperature that causes temperature decomposition of the organic solvent *and the fluoride salt* in the electrolyte. Applicant therefore submits that Hayashi cannot be reasonably asserted as teaching or suggestion toward the pressure-temperature conditions defined by Claim 1.

Applicant respectfully submits that, for at least the reasons presented above, the combination of Ho and Hayashi cannot establish prima facie obviousness of Claim 1. Applicant further submits that the Milewits reference does not cure the above-presented deficiencies in the combination of Ho and Hayashi compared to Claim 1.

Applicant therefore submits that Claim 1 is patentable over the art of record.

Applicant respectfully submits that dependent Claims 2-8, 17, and 21-25, are patentable over the art of record based at least on dependency from an allowable claim, in addition to defining further features and combinations neither taught nor suggested by the cited art.

CONCLUSION

In view of the foregoing, Applicant respectfully requests that the application be reconsidered; that Claims 1-8, 17, and 21-25 be allowed; and the application be passed to issue.

Although the present communication may include alterations to the application or claims, or characterizations of claim scope or referenced art, Applicant is not conceding in this application that previously pending claims are not patentable over the cited references. Rather, any alterations or characterizations are being made to facilitate expeditious prosecution of the application. Applicant reserves the right to pursue at a later time any previously pending or other broader or narrower claims that capture any subject matter supported by the present disclosure, including subject matter found to be specifically disclaimed herein or by any prior prosecution. Accordingly, reviewers of this or any parent, child or related prosecution history shall not reasonably infer that Applicant has made any disclaimers or disavowals of any subject matter supported by the present application.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

A provisional petition is hereby made for any extension of time necessary for the continued pendency during the life of this application. Please charge any fees for such provisional petition and any deficiencies in fees and credit any overpayment of fees to Attorney's Deposit Account No. 50-2041.

Respectfully submitted,

/Laurence E. Stein/

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Customer No.: 164319

Electronic Patent Application Fee Transmittal

Application Number:	16343224			
Filing Date:	18-Apr-2019			
Title of Invention:	RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION			
First Named Inventor/Applicant Name:	Christian HANISCH			
Filer:	Michael E. Whitham			
Attorney Docket Number:	03101253US			
Filed as Large Entity				
Filing Fees for U.S. National Stage under 35 USC 371				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
RCE- 1ST REQUEST	1801	1	1360	1360
Total in USD (\$)				1360

Electronic Acknowledgement Receipt

EFS ID:	45031735
Application Number:	16343224
International Application Number:	
Confirmation Number:	6508
Title of Invention:	RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION
First Named Inventor/Applicant Name:	Christian HANISCH
Customer Number:	30743
Filer:	Michael E. Whitham
Filer Authorized By:	
Attorney Docket Number:	03101253US
Receipt Date:	18-FEB-2022
Filing Date:	18-APR-2019
Time Stamp:	11:09:57
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$ 1360
RAM confirmation Number	E20222HB10164269
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File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		03101253us_2_18_22.pdf	588041	yes	12
			1333055076aa63dfcab080ada5c1cad01aac2284		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Request for Continued Examination (RCE)		1	1	
	Amendment Submitted/Entered with Filing of Continued Prosecution Application (CPA)/Request for Continued Examination(RCE)		2	2	
	Claims		3	5	
	Applicant Arguments/Remarks Made in an Amendment		6	12	
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	38271	no	2
			72b54c96e7070c9befa4b0ee2080715bddf3686c		
Warnings:					
Information:					
Total Files Size (in bytes):			626312		

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/343,224	04/18/2019	Christian HANISCH	03101253US	6508
30743	7590	11/23/2021		
W&C IP			EXAMINER	
11491 SUNSET HILLS ROAD			YANCHUK, STEPHEN J	
SUITE 340				
RESTON, VA 20190				
			ART UNIT	PAPER NUMBER
			1723	
			MAIL DATE	DELIVERY MODE
			11/23/2021	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Response to Arguments

Applicant's arguments with respect to claim(s) 1 have been considered but are moot because the new ground of rejection does not rely on any reference applied in the prior rejection of record for any teaching or matter specifically challenged in the argument.

Previous obvious double patenting rejection overcome by terminal disclaimer filed on 08/10/2021 pertaining to application 15/569484, now patent US-11,050,097.

The instant claim recites a maximum pressure and a maximum temperature to operate an inactivation step. The newly added limitation recites a cause-and-effect limitation where by the pressure and temperature of the instant claim result in a vaporize of at least a portion of the electrolyte. A question is raised to the examiner based upon the limitation as to if the vaporize step is an active step that needs to be present or just flows from the limitations already present. Antoine equation is the mathematical expression of the relation between the vapor pressure and the temperature of a pure substance. At any given temperature, for a specific substance, there is a pressure at which the gas of that specific substance is in dynamic equilibrium with its liquid or solid forms. Since the applicant has written the limitation in a cause-and-effect manner and utilized "at least a portion", the examiner questions if the scope of the instant claim is true for all material that is pressurized to 300hPa or lower and 80°C or lower. It is noted that the temperature of the instant claim includes room temperature and even at room temperature, Antoine equation holds that at least a portion of the specific material (electrolyte) would vaporize.

For the purposes of advancing prosecution, the below rejections take into consideration the instant specification pertaining to vaporization conditions and method steps. The information pertaining to the Antoine equation above is to make the record clear that under broadest reasonable interpretation, the limitation presented may not be limiting to the specifics presented in the instant specification.

Claim Rejections - 35 USC § 112

The following is a quotation of 35 U.S.C. 112(b):

(b) **CONCLUSION.**—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 4 is rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor (or for applications subject to pre-AIA 35 U.S.C. 112, the applicant), regards as the invention. The instant claim recites a continuous monitoring, but does not recite a nexus between a monitoring and a lower explosion limit. There is no recitation of a computer control and therefore that will not be read into the claim limitation. For the purposes of examination, the “monitoring” will be interpreted to be done by a human and that human has a strong motivation to not have an explosion. Therefore an overshoot of the time of processing such that explosion is avoided is predictable. Instant claim does not lead to a calculation and margin of error factor added onto the calculation and therefore a human waiting until a device is not explosive naturally flows therefrom.

Additionally, the instant claim is silent to positively recite the requirement of organic carbonates to be present in the system let alone in the vaporized electrolyte; the instant claim is silent to any

material selection. Therefore it holds that vaporized electrolytes could contain a null factor of organic carbonate and read on the claim whereby the motivation is to improve safety. The inherent motivation to improve safety is well known in the science community. The limitation of claim 4 is found indefinite because it is unclear if organic carbonate needs to exist or if the presence of existence indicates a factor to be considered.

Claim 6 is rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor (or for applications subject to pre-AIA 35 U.S.C. 112, the applicant), regards as the invention. The instant claim recites “one or more of the comminuted material and the inactivated comminuted material is moved...” which contradicts claim 1 step “inactivating the comminuted material such that an inactivated comminuted material is obtained”. Step 1 recites that comminuted material is converted to an inactivated material, but claim 6 appears to imply there are comminuted materials which have not be inactivated. This means either claim 1 includes a plurality of comminuted materials whereby only a portion are made inactive (not claimed) or there is an additional structural feature with the same previously defined titles which invokes improper claiming under antecedent basis as claim 6 is referring to a separate and distinct element by a previously defined name which has already been acted upon. Based upon claim 6, it is now indefinite if there is one type of comminuted material or if there is plural, whereby only a portion of the comminuted material is made inactive.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the

claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-7, 17-18, 21 is/are rejected under 35 U.S.C. 103 as being unpatentable over Ho et al (PGPUB 2018/0013181) and further in view of Hayashi et al (PGPUB 2016/0049699).

Claim 1: Ho teaches a method of recycling lithium-ion batteries [abstract]. The battery comprises at least a cathode, anode, and electrolyte [0040-0041, 0100-0101]; these features are inherent to the term “battery” in the art. It is interpreted that the prior art step of “chopping” reads on instant claim method step of “comminuting” [Fig. 1; 0038].

The prior art teaches a method to be capable of extracting usable, recyclable materials from the battery, but is silent to teach a method step of inactivating pertaining to the electrolyte undergoing a pressure and temperature to be vaporized.

Hayashi teaches a method for processing fluorine-containing electrolyte including a gasification step of gasifying a volatile component of an electrolyte solution including a fluorine compound by heating the electrolyte solution under a reduced pressure [Abstract]. It is interpreted that one having ordinary skill in the art would look to modify the method step of Ho with the specifics of Hayashi because of the health risks presented by fluorine; if a battery electrolyte is to be recycled and it contains fluorine, one of ordinary skill in the art would have looked to the prior art for additional handling procedures. The prior art teaches that the temperature selection range for the method of gasification is dependent on the organic solvent material of the electrolyte, for their specific materials 80°C is the lowest temperature explicitly cited as optimal, but this temperature would change with changing materials [0030-0034]; additionally, the prior art reports temperatures at 20°C [0034] and does not “teach away” from such temperatures, but cites that 80°C-150°C is more optimal than lower based upon the organic solvents presented in the prior art. It is also held herein that the prior art and the instant claim overlap at 80°C and therefore the limitation of “a maximum temperature of 80°C” is explicitly met by the optimal temperature range presented by the prior art. The pressure of the reduced pressure

conversion is taught to be 0.1kPA (which equals 1hPa) [0034]. The prior art teaches a method of gasifying at least a portion of the electrolyte material under these conditions [0036-0039]. It would have been obvious to one having ordinary skill in the art at the time of invention/filing to modify the method of recycling batteries when the electrolyte material comprises fluorine of Ho to include a vaporization step under reduced pressure as taught by Hayashi in order to improve the safety of the materials handled [0013].

Claim 2: The comminuting step is interpreted to be a cutting and dismantling step, this militates in favor of a battery elements not being operated as an electrochemical reaction.

Ho is silent to teach the operation of electrolyte material that contains fluorine to have additional safety processing.

Hayashi teaches a gas of a gasified volatile component to be introduced to a wet or dry processing step whereby the fluorine is immobilized as calcium fluoride and an organic solvent oil phase is collected. It is interpreted that calcium fluoride is deactivated and is not a material which meets an electrochemical reaction limitation. It would have been obvious to one having ordinary skill in the art at the time of invention/filing to modify the method of recycling batteries when the electrolyte material comprises fluorine of Ho to include a vaporization step under reduced pressure as taught by Hayashi in order to improve the safety of the materials handled [0013].

Alternatively, we can look for other recycled materials of Ho. The instant claim is not explicit to recite the electrolyte is the comminuted material. Ho teaches the recycling and recovery of component materials [0100-0120]. Since the instant claim is not specific as to the deactivated, comminuted material, the various elements taught by Ho are sufficient to read on the claim as presented. A singular element separated from a device is interpreted to not be possible to undergo an electrochemical reaction as additional structural features would be required for such to occur.

Claim 3: Ho is silent to teach the operation of electrolyte material that contains fluorine to have additional safety processing.

Hayashi teaches a dry processing step that includes a condensation trap in the dry processing of vaporized electrolyte material [0053-0057]. It would have been obvious to one having ordinary skill in the art at the time of invention/filing to modify the method of recycling batteries when the electrolyte material comprises fluorine of Ho to include a vaporization step under reduced pressure as taught by Hayashi in order to improve the safety of the materials handled [0013].

Claim 4: Neither Ho nor Hayashi explode. It is therefore interpreted that the lower explosion limit is undercut in each operation whereby explosions are not present. One having ordinary skill in the art would be highly motivated to allow more than enough time to pass to avoid any explosions or other safety concerns. One having ordinary skill in the art is motivated to have more caution to explosion and would allow for ample time to pass.

Claim 5: Ho is silent to teach the operation of electrolyte material that contains fluorine to have additional safety processing.

Hayashi teaches the dry process to be performed at 5kPa (50hPA) [0056-0057]. It would have been obvious to one having ordinary skill in the art at the time of invention/filing to modify the method of recycling batteries when the electrolyte material comprises fluorine of Ho to include a vaporization step under reduced pressure as taught by Hayashi in order to improve the safety of the materials handled [0013].

Claim 6-7: Ho teaches an agitation step [0130, 0137], but is silent to teach a step of creating gas and removing vaporized electrolyte. The instant claim is recited under “a drying device” and under “comprising” language, although Ho teaches an agitation to take place in a liquid environment, the end product is a dried component whereby Ho teaches a first step of a drying process to be a washing and separation with the agitation. The process takes place in water [0130].

Ho is silent to teach the operation of electrolyte material that contains fluorine to have additional safety processing. Ho is silent to teach a vaporization and removal of vapor.

Hayashi teaches a reaction with water to hydrolyze materials [0036]. The prior art teaches the vaporization and handling of vaporized volatile elements [0036-0039]. The gasification occurs at a temperature and pressure condition [0033-0035]. It would have been obvious to incorporate a temperature and pressure condition has recited in Hayashi to the comminuted material in water in order to vaporize and remove the volatile electrolyte material gas in order to improve safety. It would have been obvious to one having ordinary skill in the art at the time of invention/filing to modify the method of recycling batteries when the electrolyte material comprises fluorine of Ho to include a vaporization step under reduced pressure as taught by Hayashi in order to improve the safety of the materials handled [0013].

The specifics to the source of heat in the system is not material to material being worked upon and therefore the origin of the heat is not interpreted to material alter the material being worked upon. The limitation presented of the agitator applying 50% of the heat is not materially distinguishing to the produce a different product, the prior art would be motivated by the temperature ranges presented in the prior art and apply temperatures as necessary through routine experimentation.

Claim 17: Ho is silent to teach the operation of electrolyte material that contains fluorine to have additional safety processing.

Hayashi teaches the dry process to be performed such that at least a portion of the method step is at a temperature of 10°C [0056-0057]. It would have been obvious to one having ordinary skill in the art at the time of invention/filing to modify the method of recycling batteries when the electrolyte material comprises fluorine of Ho to include a vaporization step under reduced pressure as taught by Hayashi in order to improve the safety of the materials.

Claim 18: Ho teaches a method step of agitation of a water and comminuted material as part of a first step to drying separated recycling materials [0130, 0137].

Ho is silent to teach a temperature and pressure of a water solution such that electrolyte can vaporize and improve the safety of the materials.

Hayashi teaches a temperature and pressure applied to a water and electrolyte whereby hydrolyzation occurs and the inactivated comminuted electrolyte material is removed through vaporization [0037-0039]. It would have been obvious to one having ordinary skill in the art at the time of invention/filing to modify the method of recycling batteries when the electrolyte material comprises fluorine of Ho to include a vaporization step under reduced pressure as taught by Hayashi in order to improve the safety of the materials.

It is interpreted that the evaporation step of Hayashi would result in the removal of the inactivated comminuted electrolyte material from the agitation material of Ho.

Claim 21: Ho teaches electrode materials are dimensioned with a sieve having a mesh width of 2mm-4mm [0033, 0112]. Ho teaches a chopping of the components [0015], but is silent to teach the explicit size of the components. It is interpreted that the size of the chopped segments are obvious to optimize (MPEP 2144.04) whereby the scale of the system is set to have a sieve of material at 2mm-4mm. The discovery of workable ranges to be recyclable is routine and obvious. It is interpreted that one having ordinary skill in the art would be motivated to have components that are small enough to be efficiently recycled, but large enough that are easily handled. The machining considerations will set the boundaries as well as the ease to separate the components.

Claims 8, 21 is/are rejected under 35 U.S.C. 103 as being unpatentable over Ho et al (PGPUB 2018/0013181) and Hayashi et al (PGPUB 2016/0049699) as applies to claim 1 above, and further in view of Milewits et al (USPAT 5,303,872).

Claim 8: Ho teaches a process for recycling battery elements. It is not clear from the disclosure the processes are contained into one container.

Milewits teaches a field transportable battery disposable unit comprising cutting apparatus adapted to receive one or more exhausted batteries [Abstract]. The features required to safely discard a battery are taught to be located in one device [Fig 1; Col 1 Ln 45-Col 2 Ln 43]. It would have been obvious to one having ordinary skill in the art at the time of invention/filing to modify the enclosure of Ho to include a singular transportable case for recycling batteries as taught by Milewits in order to enable a user to safely discard batteries on location, eliminating the need to transport batteries to a central facility for subsequent disposal [Col 1 Ln 38-44].

Claim 21: Ho teaches electrode materials are dimensioned with a sieve having a mesh width of 2mm-4mm [0033, 0112]. Ho teaches a chopping of the components [0015], but is silent to teach the explicit size of the components. It is interpreted that the size of the chopped segments are obvious to optimize (MPEP 2144.04) whereby the scale of the system is set to have a sieve of material at 2mm-4mm. The discovery of workable ranges to be recyclable is routine and obvious.

Milewits teaches a field transportable battery disposable unit comprising cutting apparatus adapted to receive one or more exhausted batteries [Abstract]. The features required to safely discard a battery are taught to be located in one device [Fig 1; Col 1 Ln 45-Col 2 Ln 43]. It would have been obvious to one having ordinary skill in the art at the time of invention/filing to modify the enclosure of Ho to include a singular transportable case for recycling batteries as taught by Milewits in order to enable a user to safely discard batteries on location, eliminating the need to transport batteries to a central facility for subsequent disposal [Col 1 Ln 38-44].

It is interpreted that the size of the components would be obvious to dimension such that they are capable of fitting and being processed by a smaller, portable device such as Milewits. The

dimensions of the material being worked upon do not materially alter the final product characteristics as presented by the prior art.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to STEPHEN J YANCHUK whose telephone number is (571)270-7343. The examiner can normally be reached M-Th 10a-8p.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Milton Cano can be reached on 313-446-4937. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of published or unpublished applications may be obtained from Patent Center. Unpublished application information in Patent Center is available to registered users. To file and manage patent submissions in Patent Center, visit: <https://patentcenter.uspto.gov>. Visit <https://www.uspto.gov/patents/apply/patent-center> for more information about Patent Center and <https://www.uspto.gov/patents/docx> for information about filing in DOCX format. For additional questions, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/STEPHEN J YANCHUK/
Primary Examiner, Art Unit 1723

Notice of References Cited	Application/Control No. 16/343,224		Applicant(s)/Patent Under Reexamination HANISCH, Christian	
	Examiner STEPHEN J YANCHUK		Art Unit 1723	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20180013181-A1	01-2018	Ho; Kam Piu	H01M10/0525	1/1
*	B	US-20160049699-A1	02-2016	Hayashi; Hiroshi	C01F11/22	44/387
*	C	US-5303872-A	04-1994	Milewits; Marvin	B09B3/00	241/100
	D					
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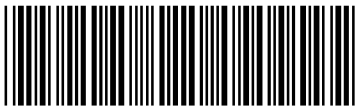
FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
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NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
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*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

<i>Search Notes</i> 	Application/Control No. 16/343,224	Applicant(s)/Patent Under Reexamination HANISCH, Christian
	Examiner STEPHEN J YANCHUK	Art Unit 1723

CPC - Searched*		
Symbol	Date	Examiner
H01M: 10/54, 6/52	05/22/2021	SJY
C22B: 1/005, 7/00,001	05/22/2021	SJY

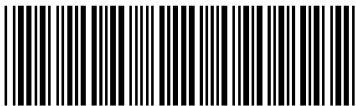
CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
Inventor Search	05/22/2021	SJY
IDS Review	05/22/2021	SJY
App history review: 15/569484	05/22/2021	SJY
East Word Search	05/22/2021	SJY
Updated Search Notes	11/20/2021	SJY
NPL Review: drying comminuted electrolyte	11/20/2021	SJY

/STEPHEN J YANCHUK/ Primary Examiner, Art Unit 1723	
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<i>Search Notes</i> 	Application/Control No. 16/343,224	Applicant(s)/Patent Under Reexamination HANISCH, Christian
	Examiner STEPHEN J YANCHUK	Art Unit 1723

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

/STEPHEN J YANCHUK/ Primary Examiner, Art Unit 1723	
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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	3,854	(H01M10/54.cpc.) and @ad<"20161020"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/11/20 10:19
L2	144	L1 and (agitat\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/11/20 10:19
L3	35	L1 and (agitat\$4) same3 (pressur\$4 depressur\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/11/20 10:21
S1	1	"16343224"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/05/22 09:30
S2	3,763	(H01M10/54.cpc.) and @ad<"20161020"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/05/22 10:01
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S4	25	S3 and (dry drying) same (pressure mpa hpa) same (temp temperature)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/05/22 10:03
S5	5	"15569484"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/05/22 10:11
S6	158	S3 and (comminut\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/05/22 10:21
S7	1	S6 and condens\$4 same (dry drying)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/05/22 10:22
S8	23	S6 and (agitat\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO;	OR	ON	2021/05/22 10:23

			JPO; DERWENT; IBM_TDB			
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S10	255	S3 and (convey\$4 integrated adj3 system)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/05/22 10:46
S11	0	S10 and (dustfree dust adj free)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/05/22 10:47
S12	32	S10 and (dust)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/05/22 10:47
S14	6,441	(C22B1/005.cpc. C22B7/00,001.cpc.) and @ad<"20161020"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/05/22 11:57
S15	65	S14 and (MPA HPA hectopascal megapascal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/05/22 13:50
S18	4,293	(H01M10/54.cpc. H01M6/52.cpc.) and @ad<"20161020"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/11/19 23:09
S19	162	S18 and (comminut\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/11/19 23:09
S21	25	"2010149611"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/11/19 23:11
S22	4	"5303872".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/11/19 23:12
S23	15	"5303872"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/11/19 23:13

S24	3	"9160043"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/11/19 23:17
S25	3,854	(H01M10/54.cpc.) and @ad<"20161020"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/11/20 08:25
S26	14	S25 and (depressur\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/11/20 08:25

EAST Search History (Interference)

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11/20/2021 12:42:11 PM

C:\Users\syanchuk\Documents\EAST\Workspaces\16343224.wsp

Doc code: IDS

PTO/SB/08a (02-18)

Doc description: Information Disclosure Statement (IDS) Filed

Approved for use through 11/30/2020. OMB 0651-0031

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		16343224	
	Filing Date		2019-04-18	
	First Named Inventor		Christian HANISCH	
	Art Unit			
	Examiner Name			
	Attorney Docket Number		03101253US	

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Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20140290438	A1	2014-10-02	CHRISTIAN HANISCH	

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Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ²ⁱ	Kind Code ⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T ⁵
	1	2005011698	JP	A	2005-01-13	KAWASAKI HEAVY IND LTD		×
	2	2008204755	JP	A	2008-09-04	TOYOTA MOTOR CORP		☒
	3	2013004299	JP	A	2013-01-07	MITSUBISHI MATERIALS CORP		☒

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	16343224
Filing Date	2019-04-18
First Named Inventor	Christian HANISCH
Art Unit	
Examiner Name	
Attorney Docket Number	03101253US

4	2015028928	JP	A	2015-02-12	MITSUBISHI MATERIALS CORP	☒
5	H06338352	JP	A	1994-12-06	HITACHI LTD	☒

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NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵
	1		

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Examiner Signature	/STEPHEN J YANCHUK/	Date Considered	11/20/2021
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Application Number	16343224
Filing Date	2019-04-18
First Named Inventor	Christian HANISCH
Art Unit	
Examiner Name	
Attorney Docket Number	03101253US

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☒ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

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See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

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A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Michael E. Whitham/	Date (YYYY-MM-DD)	2021-08-04
Name/Print	Michael E. Whitham	Registration Number	32635

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/STEPHEN J YANCHUK/

11/20/2021

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3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
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11/20/2021

Doc code: IDS

PTO/SB/08a (02-18)

Doc description: Information Disclosure Statement (IDS) Filed

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	Filing Date		2019-04-18	
	First Named Inventor	Christian HANISCH		
	Art Unit			
	Examiner Name			
	Attorney Docket Number		03101253US	

U.S.PATENTS						Remove
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	9780419	B2	2017-10-03	LION ENGINEERING GMBH	

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Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20050241943	A1	2005-11-03	KAWASAKI JUKOGYO; KABUSHIKI KAISHA	
	2	20140290438	A1	2014-10-02	C. HANISCH; W. HASELRIEDER; A. KWADÉ	
	3	20160049699	A1	2016-02-18	MITSUBISHI MATERIALS CORPORATION	

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	1	1438729	CN	A	2003-08-27	UNIV HUANAN NORMAL		×

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number		16343224
Filing Date		2019-04-18
First Named Inventor	Christian HANISCH	
Art Unit		
Examiner Name		
Attorney Docket Number		03101253US

2	102496752	CN	A	2012-06-13	CHINA NAT OFFSHORE OIL CORP		☒
3	103259062	CN	B	2015-09-09	UNIV TSINGHUA GRADUATE SCHOOL		☒
4	103959553	CN	A	2014-07-30	UNIV. BRAUNSCHWEIG TECH	Equivalent to WO2010/102337	☐
5	4424825	DE	A1	1996-01-18	GABLER ING KONTOR LUEBECK		☒
6	10 2011 110 083	DE	A1	2013-02-14	TECH UNI BRAUNSCHWEIG CAROLO WILHELMINA		☐
7	10 2012 024 876	DE	A1	2014-06-26	ELECTROCYCLING GMBH; VOLKSWAGEN AKTIENGESELLSCHAFT		☐
8	2005197149	JP	A	2005-07-21	TOYOTA MOTOR CORP		☒
9	10-0665626	KR	B1	2007-01-09	REMETECH CO., LTD.		☒
10	20060101683	KR		2005-03-21			☒
11	2010/102377	WO	A1	2010-09-16	WAYNE STEVENS		☐
12	2010/149611	WO	A1	2010-12-29	SB LIMOTIVE COMPANY LTD.		☒

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Ascend Elements, EX 1002, Page 241

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	1	DEHNERT ET AL: "Vacuum Distillation", ALLGEMEINE CHEMIE, 14.3, page 14, 1979	
	2	HERAUSGEBER: "Florke/Wolff Kursthemen Chernis - Allgemeine und Phsyikalische Chemie", "(Course Issues Chemisty- General and Physical Chemistry)", 1985	
	3	HIGGELKE: "Infinite Power Solutions stellt papierdunnen Akku vor", "(Infinite Power Solution presents paper-thin Battery)", 2012-06-06	
	4	VDMA-Norm 24351 Trocknungstechnik (VDMA=German Engineering Federation; VDMA Standard 24351 - Drying Technology - Basic terms and definitions), 1999-01	
	5	WOLF ET AL: Allgemeine und Physikalische Chemie, CHEMIE, 1985	

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Examiner Signature	/STEPHEN J YANCHUK/	Date Considered	11/20/2021
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**INFORMATION DISCLOSURE
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Attorney Docket Number	03101253US

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SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Michael E. Whitham/	Date (YYYY-MM-DD)	2021-08-03
Name/Print	Michael E. Whitham	Registration Number	32635

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3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
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6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

11/20/2021

/STEPHEN J YANCHUK/



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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/343,224	04/18/2019	Christian HANISCH	03101253US

CONFIRMATION NO. 6508

POA ACCEPTANCE LETTER



30743
W&C IP
11491 SUNSET HILLS ROAD
SUITE 340
RESTON, VA 20190

Date Mailed: 08/11/2021

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 08/10/2021.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at (571) 272-4000 or (571) 272-4200 or 1-888-786-0101.

/zabraha/

Application Number * 16/343,224 *	Application/Control No. 16/343,224	Applicant(s)/Patent under Reexamination HANISCH, Christian	
	Examiner YANCHUK, STEPHEN J	Art Unit 1723	
Document Code - DISQ		Internal Document - DO NOT MAIL	

TERMINAL DISCLAIMER	☒ APPROVED	☐ DISAPPROVED
Date Filed: <u>10 August 2021</u>	This patent is subject to a Terminal Disclaimer	

Approved/Disapproved by:
/FELICIA D ROBERTS/ Technology Center: <u>OPLC</u> Telephone: <u>(571)272-0550</u> <u>11,050,097</u>

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875				Application or Docket Number 16/343,224		Filing Date 04/18/2019		☐ To be Mailed		
ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO										
APPLICATION AS FILED - PART I										
		(Column 1)		(Column 2)						
FOR		NUMBER FILED		NUMBER EXTRA		RATE (\$)		FEE (\$)		
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))		N/A		N/A		N/A				
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))		N/A		N/A		N/A				
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))		N/A		N/A		N/A				
TOTAL CLAIMS (37 CFR 1.16(i))		minus 20 = *				x \$100 =				
INDEPENDENT CLAIMS (37 CFR 1.16(h))		minus 3 = *				x \$460 =				
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))		If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).								
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))										
* If the difference in column 1 is less than zero, enter "0" in column 2.						TOTAL				
APPLICATION AS AMENDED - PART II										
		(Column 1)		(Column 2)		(Column 3)				
AMENDMENT	08/10/2021	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR		PRESENT EXTRA		RATE (\$)		
								ADDITIONAL FEE (\$)		
	Total (37 CFR 1.16(i))	* 11	Minus	** 20	= 0	x \$100 =		0		
	Independent (37 CFR 1.16(h))	* 1	Minus	*** 3	= 0	x \$480 =		0		
	☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))										
								TOTAL ADD'L FEE		0
		(Column 1)		(Column 2)		(Column 3)				
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR		PRESENT EXTRA		RATE (\$)		
								ADDITIONAL FEE (\$)		
	Total (37 CFR 1.16(i))	*	Minus	**	=	x \$0 =				
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x \$0 =				
	☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))										
								TOTAL ADD'L FEE		
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.								LIE		
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".								/TERESA J JACKSON WOODRUFF/		
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".										
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.										

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re patent application of inventors:

HANISCH

Confirmation No. 6508

Serial No. 16/343,224

Group Art Unit: 1723

Filed: April 18, 2019

Examiner: Yanchuk

For: "RECYCLING METHOD FOR TREATING USED BATTERIES, IN
PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING
INSTALLATION"

Assistant Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT UNDER 37 C.F.R. 1.111

Dear Sir:

In response to the office action mailed May 25, 2021, please amend the above-identified patent application as follows:

Listing of Claims begin on page 2

Remarks begin on page 5

LISTING OF THE CLAIMS

Below is a complete listing of the claims including the status of each:

1. (currently amended) A method for treating used lithium batteries comprising at least a cathode, anode, separator, and electrolyte, comprising:
 - (a) comminuting the batteries such that comminuted material is obtained, and
 - (b) inactivating the comminuted material such that an inactivated comminuted material is obtained,
 - (e) wherein inactivating includes a drying process where drying is conducted at a maximum pressure of 300 hPa and a maximum temperature of 80 °C to vaporize at least a portion of the electrolyte, and
 - (d) ~~wherein the inactivated comminuted material is not filled into a transport container and/or said inactivated comminuted material is immediately further processed after the drying process.~~
2. (currently amended) The method according to claim 1, wherein
 - ~~the batteries are dried at a temperature which is below a decomposition temperature of a binder used in the batteries, and~~
 - the comminuted material is deactivated by the drying, such that an electrochemical reaction is not possible.
3. (currently amended) The method according to claim 1, further comprising condensing gases created from vaporized electrolyte during the drying process.
4. (currently amended) The method according to claim 1, further comprising:
 - continuous monitoring of a concentration of organic carbonates from vaporized electrolyte in an atmosphere of a drying device used during the drying process, and
 - not terminating the drying process until a lower explosion limit has been undercut.

5. (previously presented) The method according to claim 1, wherein
the drying process is conducted at a maximum pressure of 30 hPa for at least 50%
of the drying time, and/or
a minimum pressure during the drying process is at most 50 hPa.
6. (previously presented) The method according to claim 1 wherein
one or more of the comminuted material and the inactivated comminuted material
is moved in a drying device by an agitator, and
the agitator is used to supply at least 50% of an evaporation heat required for drying
of the comminuted material.
7. (currently amended) The method according to claim 6 wherein
gases created from vaporized electrolyte during the drying process are sucked away
and/or
wherein the batteries comprise current collector foils having a coating material and
movement using the agitator is conducted such that at least 50% by weight of ~~[[a]]~~the
coating material of the comminuted material is sucked away.
8. (previously presented) The method according to claim 1 wherein the comminution and
drying processes are conducted in one container only.
- 9-16. (canceled)
17. (previously presented) The method according to claim 3 wherein condensing is
performed at an ambient pressure and/or a temperature above 0°C and below 50°C.
18. (previously presented) The method according to claim 6 where movement by the
agitator is performed when removing the inactivated comminuted material from drying
device.
- 19-20. (canceled)

21. (New) The method according to claim 1, wherein comminuting of the batteries is executed such that at least 90% by weight of components of the comminuted material has a maximum sieve size of 50mm.

REMARKS

Claims 1-4 and 7 are amended, claim 21 is added, and claims 9-16 and 19-20 are canceled without prejudice as being drawn to a nonelected invention. The application now includes claims 1-8, 17-18, and 21. The applicant reserves the right to pursue claims in non-amended form or other claims supported by the patent specification in one or more continuation applications.

Double Patenting

Claims 1-8 and 17-18 were rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-22 of USSN 15/569,484, now U.S. Patent 11,050,097. A terminal disclaimer regarding the '097 patent is submitted herewith. This rejection is thus overcome.

Claim Rejections – 35 USC § 112

Claims 2-4, 7, and 17 was rejected as being indefinite. This rejection is traversed.

To accelerate prosecution to grant, claim 2 is amended to remove the reference to the decomposition temperature of a binder.

Claim 1 is amended to clarify that the used lithium batteries comprise at least a cathode, anode, separator, and electrolyte (see page 6, first and second paragraphs). Claim 3 is amended to clarify that the gases are created from vaporized electrolyte during the drying process (see page 5, last paragraph and page 6).

Claim 4 is amended to clarify that the organic carbonates are from vaporized electrolyte (see page 12, fourth paragraph).

Claim 7 is amended to clarify that the gases are created from vaporized electrolyte (see page 5, last paragraph and page 6). Claim 7 is further to clarify that the batteries comprise current collector foils having a coating material and that this coating material is sucked away (see page 13, second paragraph).

Reconsideration and withdrawal of this rejection is thus respectfully requested.

Claim Rejections – 35 USC § 102/103

Claims 1-8 and 17-18 were rejected as being anticipated by or, in the alternative,

as unpatentable over Kaplan et al. (US 2016/0045841). This rejection is traversed.

As discussed above, independent claim 1 has been amended to require a method of treating used lithium batteries which comprise at least a cathode, anode, separator, and electrolyte. The method includes steps of comminuting the batteries such that comminuted material is obtained and inactivating the comminuted material such that an inactivated comminuted material is obtained, wherein inactivating includes a drying process where drying is conducted at a maximum pressure of 300 hPa and a maximum temperature of 80 °C to vaporize at least a portion of the electrolyte.

Kaplan describes methods of processing and recycling a variety of materials. Lithium batteries are mentioned (paragraph [0013]), however, Kaplan does not describe steps of comminuting the batteries and then drying the comminuted material to vaporize electrolyte. Instead, Kaplan indicates that “Lithium batteries must be cryogenically frozen” to keep them in an inert state since “lithium is explosive at room temperatures” (paragraph [0326]). Thus, the batteries are not heated to a temperature which would allow vaporization of the electrolyte as required by the present invention.

The Examiner points to the drying steps set forth in paragraphs [0679]-[0700]. However, as recognized by the Examiner, this portion of Kaplan relates to ion exchange systems, e.g. including resins or zeolites (see heading at [0650] and disclosure at [0666]). One of ordinary skill in the art would recognize that this section of Kaplan would not apply to lithium batteries as required by the present invention.

Therefore, Kaplan does not teach or suggest all the limitations of the claimed invention and thus does not make the claimed invention obvious. Reconsideration and withdrawal of this rejection is thus respectfully requested.

Claims 1-2, 4, 6, 8, and 18 were rejected as being unpatentable over Muska et al. (US 2018/0366740). This rejection is traversed.

Muska describes a process for recycling alkaline and carbon zinc batteries to recover manganese and zinc (abstract and paragraph [0006]). Several other battery types including lithium batteries are listed as potentially being processed and/or separated according to the disclosed methods (paragraph [0059]). It is later specified that the lithium batteries are separated from the feedstock prior to processing (paragraphs [0060]

and [0066]). Indeed, Muska indicates that lithium cells are separated because they “have been found to cause problems to the extent they are comminuted or subjected to certain hydrometallurgical processes” (paragraph [0060]). Thus, one of ordinary skill in the art would recognize that Muska does not teach comminuting lithium batteries and subsequently drying the comminuted material to vaporize electrolyte as required by the present invention. Indeed, Muska is completely silent regarding vaporization of any kind.

Therefore, Muska does not teach or suggest all the limitations of the claimed invention and thus does not make the claimed invention obvious. Reconsideration and withdrawal of this rejection is thus respectfully requested.

New Claim

Claim 21 depends from claim 1 and requires that comminuting of the batteries is executed such that at least 90% by weight of components of the comminuted material has a maximum sieve size of 50mm (see page 8, second paragraph). Claim 21 is not obvious over the prior art for at least the same reasons as discussed above.

Concluding Remarks

In view of the above, the claims are in immediate condition for allowance. Reconsideration and allowance at an early date is requested.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at 703-787-9400 (fax: 703-787-7557; email: whitney@wcc-ip.com) to discuss any other changes deemed necessary in a telephonic or personal interview.

If an extension of time is required for this response to be considered as being timely filed, a conditional petition is hereby made for such extension of time. Please charge any deficiencies in fees and credit any overpayment of fees to Attorney's Deposit Account No. 50-2041.

Respectfully submitted,

/Whitney C. Fields/

Whitney C. Fields
Reg. No. 71,290

W&C IP
11491 Sunset Hills Road; Suite 340
Reston, VA 20190
703-787-9400 (Telephone)
703-787-7557 (Facsimile)
Customer No. 30743

POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date
16/343,224	April 18, 2019

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

☒ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above:

OR

30743

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:

☒ The address associated with the above-mentioned Customer Number

OR

☐ The address associated with Customer Number:

OR

☐ Firm or Individual Name

Address

City

State

Zip

Country

Telephone

Email

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

DUESENFELD GMBH

☐ Inventor or Joint Inventor (title not required below)

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)

☒ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature

Date (Optional)

05.08.2021

Name

Frank Kleinschmidt

Title

CFO DUESENFELD GMBH

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

☐ Total of forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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**TERMINAL DISCLAIMER TO OBVIATE A DOUBLE PATENTING
REJECTION OVER A "PRIOR" PATENT**Docket Number (Optional)
03101253US

In re Application of: HANISCH

Application No.: 16/343,224

Filed: April 18, 2019

For: RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY
PROCESSING INSTALLATION

The applicant, DUESENFELD GMBH, owner of 100 percent interest in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of **prior patent** No. 11,050,097 as the term of said **prior patent** is presently shortened by any terminal disclaimer. The applicant hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the **prior patent** are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the applicant does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term of the **prior patent**, "as the term of said **prior patent** is presently shortened by any terminal disclaimer," in the event that said **prior patent** later:

- expires for failure to pay a maintenance fee;
- is held unenforceable;
- is found invalid by a court of competent jurisdiction;
- is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321;
- has all claims canceled by a reexamination certificate;
- is reissued; or
- is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer.

Check either box 1 or 2 below, if appropriate.

1. ☐ The undersigned is the applicant. If the applicant is an assignee, the undersigned is authorized to act on behalf of the assignee.

I hereby acknowledge that any willful false statements made are punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

2. ☒ The undersigned is an attorney or agent of record. Reg. No. 71,290

/Whitney C. Fields/

Signature

August 10, 2021

Date

Whitney C. Fields

Typed or printed name

Attorney of Record

Title

703-787-9400

Telephone Number

- ☒ Terminal disclaimer fee under 37 CFR 1.20(d) included.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

This collection of information is required by 37 CFR 1.321. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Electronic Patent Application Fee Transmittal

Application Number:	16343224			
Filing Date:	18-Apr-2019			
Title of Invention:	RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION			
First Named Inventor/Applicant Name:	Christian HANISCH			
Filer:	Whitney Cara Fields			
Attorney Docket Number:	03101253US			
Filed as Large Entity				
Filing Fees for U.S. National Stage under 35 USC 371				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
STATUTORY OR TERMINAL DISCLAIMER	1814	1	170	170
Total in USD (\$)				170

Electronic Acknowledgement Receipt

EFS ID:	43467046
Application Number:	16343224
International Application Number:	
Confirmation Number:	6508
Title of Invention:	RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION
First Named Inventor/Applicant Name:	Christian HANISCH
Customer Number:	30743
Filer:	Whitney Cara Fields
Filer Authorized By:	
Attorney Docket Number:	03101253US
Receipt Date:	10-AUG-2021
Filing Date:	18-APR-2019
Time Stamp:	09:59:29
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$ 170
RAM confirmation Number	E202180059502096
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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		03101253USres8_10_21.pdf	1591321	yes	10
			2f005c4df635e503277be72c3e0c7f4e8eea4a42		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Amendment/Req. Reconsideration-After Non-Final Reject		1	1	
	Claims		2	4	
	Applicant Arguments/Remarks Made in an Amendment		5	8	
	Power of Attorney		9	9	
	Terminal Disclaimer Filed		10	10	
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	37917	no	2
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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		16343224
	Filing Date		2019-04-18
	First Named Inventor	Christian HANISCH	
	Art Unit		
	Examiner Name		
	Attorney Docket Number		03101253US

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	1	20140290438	A1	2014-10-02	CHRISTIAN HANISCH	

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	1	2005011698	JP	A	2005-01-13	KAWASAKI HEAVY IND LTD		×
	2	2008204755	JP	A	2008-09-04	TOYOTA MOTOR CORP		☒
	3	2013004299	JP	A	2013-01-07	MITSUBISHI MATERIALS CORP		☒

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		16343224	
	Filing Date		2019-04-18	
	First Named Inventor	Christian HANISCH		
	Art Unit			
	Examiner Name			
	Attorney Docket Number	03101253US		

4	2015028928	JP	A	2015-02-12	MITSUBISHI MATERIALS CORP	☒
5	H06338352	JP	A	1994-12-06	HITACHI LTD	☒

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NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵
	1		

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Examiner Signature		Date Considered	
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*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	16343224
Filing Date	2019-04-18
First Named Inventor	Christian HANISCH
Art Unit	
Examiner Name	
Attorney Docket Number	03101253US

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☒ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Michael E. Whitham/	Date (YYYY-MM-DD)	2021-08-04
Name/Print	Michael E. Whitham	Registration Number	32635

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt

EFS ID:	43424259
Application Number:	16343224
International Application Number:	
Confirmation Number:	6508
Title of Invention:	RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION
First Named Inventor/Applicant Name:	Christian HANISCH
Customer Number:	30743
Filer:	Michael E. Whitham/Kyle Comiskey
Filer Authorized By:	Michael E. Whitham
Attorney Docket Number:	03101253US
Receipt Date:	04-AUG-2021
Filing Date:	18-APR-2019
Time Stamp:	13:36:05
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	03101253US_IDS3.pdf	1034506	no	4
			66b1342fe6ed26627fbf5fd54234a3dfdd2bd66a		

Warnings:

Information:					
2	Foreign Reference	JP2005011698A.PDF	369621	no	9
			e560ed44a40cdee333b46afe3b71478dfa2c0584		
Warnings:					
Information:					
3	Foreign Reference	JP2005011698A-eng.pdf	98162	no	2
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Warnings:					
Information:					
4	Foreign Reference	JP2008204755A.PDF	1047902	no	22
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Warnings:					
Information:					
5	Foreign Reference	JP2008204755A-eng.pdf	100876	no	2
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Warnings:					
Information:					
6	Foreign Reference	JP2013004299A.PDF	376321	no	10
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7	Foreign Reference	JP2013004299A-eng.pdf	87258	no	1
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Warnings:					
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8	Foreign Reference	JP2015028928A.PDF	383721	no	10
			c71db94763a59d2b10c02d04c2eae04b8ce05386		
Warnings:					
Information:					

9	Foreign Reference	JP2015028928A-eng.pdf	110319	no	2
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10	Foreign Reference	JPH06338352A.PDF	1670301	no	22
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Information:					
11	Foreign Reference	JPH06338352A-eng.pdf	77929	no	1
			2ad355a70f09c4dc464ce018556ba686688fd797		
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Information:					
Total Files Size (in bytes):			5356916		
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>					

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		16343224
	Filing Date		2019-04-18
	First Named Inventor	Christian HANISCH	
	Art Unit		
	Examiner Name		
	Attorney Docket Number		03101253US

U.S.PATENTS						Remove
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	9780419	B2	2017-10-03	LION ENGINEERING GMBH	

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Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20050241943	A1	2005-11-03	KAWASAKI JUKOGYO; KABUSHIKI KAISHA	
	2	20140290438	A1	2014-10-02	C. HANISCH; W. HASELRIEDER; A. KWADÉ	
	3	20160049699	A1	2016-02-18	MITSUBISHI MATERIALS CORPORATION	

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	1	1438729	CN	A	2003-08-27	UNIV HUANAN NORMAL		×

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number		16343224
Filing Date		2019-04-18
First Named Inventor	Christian HANISCH	
Art Unit		
Examiner Name		
Attorney Docket Number	03101253US	

2	102496752	CN	A	2012-06-13	CHINA NAT OFFSHORE OIL CORP		☒
3	103259062	CN	B	2015-09-09	UNIV TSINGHUA GRADUATE SCHOOL		☒
4	103959553	CN	A	2014-07-30	UNIV. BRAUNSCHWEIG TECH	Equivalent to WO2010/102337	☐
5	4424825	DE	A1	1996-01-18	GABLER ING KONTOR LUEBECK		☒
6	10 2011 110 083	DE	A1	2013-02-14	TECH UNI BRAUNSCHWEIG CAROLO WILHELMINA		☐
7	10 2012 024 876	DE	A1	2014-06-26	ELECTROCYCLING GMBH; VOLKSWAGEN AKTIENGESELLSCHAFT		☐
8	2005197149	JP	A	2005-07-21	TOYOTA MOTOR CORP		☒
9	10-0665626	KR	B1	2007-01-09	REMETECH CO., LTD.		☒
10	20060101683	KR		2005-03-21			☒
11	2010/102377	WO	A1	2010-09-16	WAYNE STEVENS		☐
12	2010/149611	WO	A1	2010-12-29	SB LIMOTIVE COMPANY LTD.		☒

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number		16343224
Filing Date		2019-04-18
First Named Inventor	Christian HANISCH	
Art Unit		
Examiner Name		
Attorney Docket Number	03101253US	

If you wish to add additional Foreign Patent Document citation information please click the Add button

NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵
	1	DEHNERT ET AL: "Vacuum Distillation", ALLGEMEINE CHEMIE, 14.3, page 14, 1979	
	2	HERAUSGEBER: "Florke/Wolff Kursthemen Chernis - Allgemeine und Phsyikalische Chemie", "(Course Issues Chemisty- General and Physical Chemistry)", 1985	
	3	HIGGELKE: "Infinite Power Solutions stellt papierdunnen Akku vor", "(Infinite Power Solution presents paper-thin Battery)", 2012-06-06	
	4	VDMA-Norm 24351 Trocknungstechnik (VDMA=German Engineering Federation; VDMA Standard 24351 - Drying Technology - Basic terms and definitions), 1999-01	
	5	WOLF ET AL: Allgemeine und Physikalische Chemie, CHEMIE, 1985	

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EXAMINER SIGNATURE

Examiner Signature		Date Considered	
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*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

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(Not for submission under 37 CFR 1.99)

Application Number	16343224
Filing Date	2019-04-18
First Named Inventor	Christian HANISCH
Art Unit	
Examiner Name	
Attorney Docket Number	03101253US

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

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OR

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See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Michael E. Whitham/	Date (YYYY-MM-DD)	2021-08-03
Name/Print	Michael E. Whitham	Registration Number	32635

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1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
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6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
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9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal

Application Number:	16343224			
Filing Date:	18-Apr-2019			
Title of Invention:	RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION			
First Named Inventor/Applicant Name:	Christian HANISCH			
Filer:	Michael E. Whitham/Kyle Comiskey			
Attorney Docket Number:	03101253US			
Filed as Large Entity				
Filing Fees for U.S. National Stage under 35 USC 371				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	1806	1	260	260
Total in USD (\$)				260

Electronic Acknowledgement Receipt

EFS ID:	43414669
Application Number:	16343224
International Application Number:	
Confirmation Number:	6508
Title of Invention:	RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION
First Named Inventor/Applicant Name:	Christian HANISCH
Customer Number:	30743
Filer:	Michael E. Whitham/Kyle Comiskey
Filer Authorized By:	Michael E. Whitham
Attorney Docket Number:	03101253US
Receipt Date:	03-AUG-2021
Filing Date:	18-APR-2019
Time Stamp:	14:38:07
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$260
RAM confirmation Number	E202183E38222065
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	03101253US_IDS2.pdf	1035710	no	5
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Information:					
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Warnings:					
Information:					
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Warnings:					
Information:					
5	Foreign Reference	CN103259062B.PDF	519377	no	7
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Warnings:					
Information:					

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Warnings:					
Information:					
8	Foreign Reference	DE4424825A1.PDF	408033	no	6
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Warnings:					
Information:					
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Warnings:					
Information:					
10	Foreign Reference	DE102011110083A1.pdf	1652744	no	10
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Information:					
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Warnings:					
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13	Foreign Reference	KR100665626B1.PDF	211841	no	5
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Warnings:					
Information:					

14	Foreign Reference	KR100665626B1-eng.PDF	1406243	no	6
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Warnings:					
Information:					
15	Foreign Reference	WO2010102377A1.pdf	908180	no	21
			600a11f658014655747042b000043fbd2895e98c		
Warnings:					
Information:					
16	Foreign Reference	WO2010149611A1.pdf	974421	no	23
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Warnings:					
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17	Foreign Reference	WO2010149611A1-eng.pdf	74452	no	1
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Warnings:					
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18	Foreign Reference	CN1438729A-eng.pdf	401480	no	13
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Information:					
19	Non Patent Literature	Herausgeber-1985.pdf	1072411	no	6
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Warnings:					
Information:					
20	Non Patent Literature	Higgelke-2012.pdf	793541	no	10
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Warnings:					
Information:					

21	Non Patent Literature	VDMA-Norm-1999.pdf	2828930	no	58
			c88d2c56090bb5b0646c458b04d83213b7ddbe8a		
Warnings:					
Information:					
22	Foreign Reference	KR20060101683.pdf	576814	no	7
			b900b95acdd801b2920a12cf6161ca46283c5418		
Warnings:					
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23	Non Patent Literature	Dehnert-1979.pdf	11033618	no	4
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Warnings:					
Information:					
25	Non Patent Literature	Higgelke-2012-eng.pdf	194430	no	2
			ae02460e0673fdc1e96708bdcfe9257cec1e373dd		
Warnings:					
Information:					
26	Non Patent Literature	Wolf-1985.pdf	12892500	no	4
			56e28804ba360c05d82410082eab029c2686395e		
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27	Fee Worksheet (SB06)	fee-info.pdf	38474	no	2
			ddacaa4d5afae8d20cbdc7b3ab1c62af5fdaeecd7		
Warnings:					
Information:					
Total Files Size (in bytes):			45076152		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/343,224	04/18/2019	Christian HANISCH	03101253US	6508
30743	7590	05/25/2021		
W&C IP			EXAMINER	
11491 SUNSET HILLS ROAD			YANCHUK, STEPHEN J	
SUITE 340				
RESTON, VA 20190				
			ART UNIT	PAPER NUMBER
			1723	
			MAIL DATE	DELIVERY MODE
			05/25/2021	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

16/343,224

Applicant(s)

HANISCH, Christian

Examiner

STEPHEN J YANCHUK

Art Unit

1723

AIA (FITF) Status

Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on 2/16/2021.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on ____.

2a) ☐ This action is **FINAL**.

2b) ☒ This action is non-final.

3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.

4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☒ Claim(s) 1-20 is/are pending in the application.

5a) Of the above claim(s) 9-16 and 19-20 is/are withdrawn from consideration.

6) ☐ Claim(s) ____ is/are allowed.

7) ☒ Claim(s) 1-8 and 17-18 is/are rejected.

8) ☐ Claim(s) ____ is/are objected to.

9) ☐ Claim(s) ____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10) ☐ The specification is objected to by the Examiner.

11) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a) ☒ All b) ☐ Some** c) ☐ None of the:

1. ☐ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. ____.

3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

3) ☐ Interview Summary (PTO-413)

Paper No(s)/Mail Date ____.

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)

4) ☐ Other: ____.

Paper No(s)/Mail Date ____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Election/Restrictions

Applicant's election of Group 1 claims 1-8, 17-18 in the reply filed on 02/16/2021 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.01(a)).

Claims 9-16, 19-20 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected groups, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 02/16/2021.

Note to applicant

The clause "the inactivated comminuted material is not filled into a transport container": This limitation is interpreted that at no point after the drying and pressure step is the resulting material ever transported or moved. As soon as an comminuted material is moved, even if additional processing steps allowed under "comprising language", the scope of the instant limitation would be in breach. In essence, loading the material into a vessel whereby that vessel is moved would be outside the scope of this limitations.

However, the second clause "inactivated comminuted material is immediately further processed after the drying process": The scope of "processed" is undefined and therefore can be any process step. Packing or relocating is a process step. In essence, packing inactivated material into a vessel for transport reads on the broadest reasonable interpretation of the claims. Since the two clauses are

written in “or”, the instant claims as presented fail to overcome the background section disclosed prior art.

The instant claims are rejected below in a manner to advance prosecution and therefore the rejections below are addressed to the invention of the instant specification in light of the claimed scope. This communication is to clearly showcase how the claims presented do NOT provide a scope which is patentable at this time.

Additionally, what is the full breadth of “comminute”. Examiner takes the position that the broadest reasonable interpretation of comminuting a battery is to separate the battery into its various parts. The instant claim provides no guidance to the material being worked upon and therefore the casing of a lithium battery is capable of falling within the material. The level of patentability is that a new or different material is produced by the end of the method steps. Heating and pressuring well known materials of the casing would not produce a new product and the product thereof would be electrochemically inert as required of claim 2. Although this interpretation is not addressed below, it should be apparent that clarification of the material selection is vital to the specific invention.

Claim 1 includes the title of “inactivated comminuted material”, there is no scope limiting attribute to this title alone whereby the claim limitations need to limit the scope of the material by active method steps, not title alone. If there are additional features to cause a material to be inactivated from a specific operation, such methods should be positively claimed as relying on title alone is improper.

In claim 2, applicant states a drying state makes an electrochemical reaction not possible. Examiner contends that the separation of electrochemical material from a circuit already meets this function and therefore the recitation of such in claim 2 is not further limiting to the scope of the invention. Additionally claim 2 recites “a binder” but only in reference to the selection of a temperature

selection for the drying material; the instant claim does NOT positively claim there is a binder in the comminuting material and such binder may have already been separated from the material.

These statements are herein produced to help applicant improve their amendment to the claim language to produce limitations which are in line with their invention and to help make the claims commensurate in scope with the coverage in which they hope to obtain. Identification of limitations which fail to further narrow the scope are key to compact prosecution as applicant is now on notice of limitations which should be looked into.

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on nonstatutory double patenting provided the reference application or patent either is shown to be commonly owned with the examined application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement. See MPEP § 717.02 for applications subject to examination under the first inventor to file

provisions of the AIA as explained in MPEP § 2159. See MPEP § 2146 *et seq.* for applications not subject to examination under the first inventor to file provisions of the AIA. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO Internet website contains terminal disclaimer forms which may be used. Please visit www.uspto.gov/patent/patents-forms. The filing date of the application in which the form is filed determines what form (e.g., PTO/SB/25, PTO/SB/26, PTO/AIA/25, or PTO/AIA/26) should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp.

Claims 1-8, 17-18 are rejected on the ground of nonstatutory double patenting as being unpatentable over claim 1-22 of U.S. Patent No. [Not yet published] of serial number 15/569484. Although the claims at issue are not identical, they are not patentably distinct from each other because the temperature requirement of the instant claim 1 is not recited in the claims of '484. Discovery of a workable temperature for operation of the prior filed patent would be obvious and routine and therefore not materially distinct.

Claim Rejections - 35 USC § 112

The following is a quotation of 35 U.S.C. 112(b):

(b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 2 is rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor (or for applications subject to pre-AIA 35 U.S.C. 112, the applicant), regards as the invention. Applicant claims a temperature drying temperature to be dependent on a binder material selection of the battery. The binder is not previously required in the comminuting material and not positively recited to be herein included. There is no material selection to the binder material and therefore it is indefinite if this recitation further limits the already established 80°C. It is predictable that common binder materials have decomposition temperatures at 120°C, whereby the instant claim may be in violation of 112 4th if that is true because claim 2 would in effect be saying “the batteries are dried at a temperature which is below 120°C”. Additionally we don’t know the material selection of the binder that may be used or if it is binder of the electrolyte or active materials. The binder herein only operates as a reference to limit the temperature and need not exist elements being processed by the instant claim.

Claim 3, 17 is rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor (or for applications subject to pre-AIA 35 U.S.C. 112, the applicant), regards as the invention. The material selection of the instant method is not defined and limited to such that a gas is actively produced and therefore a condensation of such gas need not exist.

Claim 4 is rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor (or for applications subject to pre-AIA 35 U.S.C. 112, the applicant), regards as the invention. There is no positive recitation of a material that is capable of producing a concentration of organic carbonates in the atmosphere as the definition of the comminuting material is not defined. Applicant’s scope may be incorporated to solve a specific problem for a specific material, but without

such recitation of scope to the specific material, the specific solution is moot. There is no nexus between the monitoring and the termination step of claim 4 whereby under Alice and 101 interpretations, the monitoring of a system does not have distinguishing weight to the process being performed as such is nothing more than the abstract idea of itself. It is indefinite how the monitoring of a system is novel and distinct from the prior art that need not have the sensor because there is no issue of explosion.

Claim 7 is rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor (or for applications subject to pre-AIA 35 U.S.C. 112, the applicant), regards as the invention. The instant claim does not recite material selection for comminuted material and therefore it is indefinite how all materials of a battery that can be comminuted produce gases. Applicant states definitively that gases are created, but not all of the scope of the instant claim produce gases. Claims are hereby interpreted in that if a comminuted material produces 0 gases then 0 gases are sucked away whereby the total amount produced is sucked away, null function truism.

Claim 7 is rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor (or for applications subject to pre-AIA 35 U.S.C. 112, the applicant), regards as the invention. What is this coating material that is sucked away? Where did this material come from? Is the material coated back in the battery stage, during the drying, or actively coated and then stripped? Is the "sucked away" the same for the gas and the coating material? How does a sucking process remove a coating material? This claim is unexamined in its current form.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a)(2) the claimed invention was described in a patent issued under section 151, or in an application for patent published or deemed published under section 122(b), in which the patent or application, as the case may be, names another inventor and was effectively filed before the effective filing date of the claimed invention.

Claim Rejections - 35 USC § 103

In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries for establishing a background for determining obviousness under 35 U.S.C. 103 are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claim(s) 1-8, 17-18 is/are rejected under 35 U.S.C. 102(a)(2) as anticipated by or, in the alternative, under 35 U.S.C. 103 as obvious over Kaplan et al (PGPUB 2016/0045841).

Claim 1: Kaplan teaches a process for recycling useful materials [Abstract]. Applicant is encouraged to positively claim their specific materials to overcome and clarify the scope to overcome

above 112 rejections; applicant should investigate the entirety of this disclosure for how Kaplan recycles the specific materials recited herein. Instant claim is silent to teach any specific material that is being recycled, prior art is incorporated for all materials it recycles [0003-0007] which specifically includes spent (used) batteries [0004]. The materials for recycling are taught to be pulverized into fine particles (comminuting) [0200, 0690]. The ion exchange membrane is taught to undergo a process of 50-60°C and 120-200hPa to reduce moisture content to a degree of less than 10% of the mass of mixture [0679, 0690-0691]. The material is then incorporated into an additional process step the heating and pressure step [0680-0689, 0692-0700].

In order to advance prosecution, it is interpreted the instant specification invention pertains to an ion exchange material. Kaplan is relied upon for the entire process of ion exchange materials [0650-0700] which encompasses the invention of the instant specification; there is no novelty or criticality of invention on the record of the instant invention over the disclosure of the prior art. Although the specific case study of ion exchange membrane is being investigated, the specific material selection is not actually limiting within the instant claim presented. Instant claim is incorporated as a 102/103 because of the clause “immediately” whereby the prior art teaches a continuous process but the time of such is obviated to be met by the prior art.

Claim 2: Kaplan teaches the drying temperature to be 50-60°C which is interpreted to be under the material property of at least one common binder for use in a battery cell. Examiner takes official notice that at least one common binder for use in batteries comprises a decomposition temperature over 60°C. Kaplan teaches a material which is not actively utilized in an electrochemical reaction following drying [0650-0700].

Claim 3: Kaplan teaches condensation of drawn-off vapors [0682, 0693].

Claim 4: Kaplan teaches a recycling and sorting on materials which do not have a problem of explosion. Therefore the limitation of “not terminating the drying process” is inherently true. The

monitoring of a system does not materially change the method operation as taking measurements that are not actively implemented into action are nothing more than the system gaining the abstract idea of “self”. Applicant has failed to link the monitoring of an attribute to an active step. Additionally, applicant has failed to establish the system comprises organic carbonates to monitor. Muska teaches a control system [Fig 4-77] which is interpreted to read on a continuous monitoring step; but the instant claim requires nothing materially more than such.

Claim 5: Kaplan teaches a process of 120-200hPa to reduce moisture content to a degree of less than 10% of the mass of mixture [0679, 0690-0691]; this is above the minimum pressure of 50hPa claimed.

Claim 6: Kaplan teaches a step of mixing which produces an agitation to the material whereby the limitation of “agitator” is met [0683, 0692]. The process is taught to be a continuous step [0692].

Claim 7: Kaplan teaches gases and movement to be performed by a mixer (applicant’s agitator) and having vapors drawn off and condensed [0692-0693]. The limitations pertaining to coating is unexaminable as it is unclear where this material is coming from.

Claim 8: Kaplan teaches a continuous process performed in one device container [0650-0700].

Claim 17: Kaplan teaches vapors to be removed and condensed and passed to a waste water treatment device [0693]. The specific selection of temperature and pressure for such operation is obvious to find workable ranges whereby the specifics of the claimed pressure and temperature do not produce a new or different end result from that of the prior art.

Claim 18: Kaplan teaches a continuous mixing device which moves the material from a drying stage to a later stage of processing [0691-0696].

Claim 1-2, 4, 6, 8, 18 is/are rejected under 35 U.S.C. 103 as being unpatentable over Muska et al (PGPUB 2018/0366740).

Claim 1: Muska teaches a process for recycling batteries [Abstract]. A used battery is sorted [0070] and then comminuted [0070]. The materials are segregated from each other [0071-0072]. The comminuted material is taught to be dried by heat [0077]. The comminution material undergoes a vacuum [0078, 0083].

Muska is silent to teach the specific workable ranges of the above vacuum. Muska teaches the vacuum is incorporated to help facilitate moving material through the system [0078], but also to have an increased vacuum to remove dust from comminution [0083]. It is hereby interpreted that one having ordinary skill in the art would arrive at maximum pressure of 300hPa in order to achieve the above dust removal of the comminution.

Muska is silent to teach the specific temperature of the drying step to be less than 80°C. The relative temperature of most processing is ambient temperature [0049] whereby it is predictable that the selection of a drying temperature is one in which the material properties of the comminution is not chemically changed and thereby obviating the claimed range.

Claim 2: Muska teaches a drying step [0078] which is interpreted to be less than the previously required 80°C. It is known that selection of binder materials for common use in the various layers of a battery exceed 80°C decomposition temperature and therefore this scope fails to further limit the instant scope. Additionally, Muska teaches an active step of separating and sorting the materials whereby there is no assembly which would allow for the material to electrochemically activate to create a charge; an electrochemical reaction is not possible at the stages of sorting and recycling the material of the prior art.

Claim 4: Muska teaches a recycling and sorting on materials which do not have a problem of explosion. Therefore the limitation of “not terminating the drying process” is inherently true. The monitoring of a system does not materially change the method operation as taking measurements that are not actively implemented into action are nothing more than the system gaining the abstract idea of

“self”. Applicant has failed to link the monitoring of an attribute to an active step. Additionally, applicant has failed to establish the system comprises organic carbonates to monitor. Muska teaches a control system [0009] which is interpreted to read on a continuous monitoring step; but the instant claim requires nothing materially more than such.

Claim 6: Muska teaches an agitator [0046, 0064] and is taught to move the dryer as a whole whereby it is interpreted that 100% of the heat during drying is applied to the comminuted material while engaged with an agitator and that the material is moved.

Claim 8: Muska teaches a single operation mechanism (200) which recycles the material of a battery; whatever mechanism houses the operation parts of the machine 200 is interpreted to be container which operates to keep outside elements such as rain and snow off of the machine. The scope of the instant claim fails to define bounds of “container” to be specific.

Claim 18: Muska teaches an agitator that moves and dries the inactivated comminuted material [0046, 0064].

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

DE 10-2011-110083 [0021-0022, 0034-0039; Fig 1]: Applicant should take into consideration the specifics of this reference. Rejection made in the Written Opinion appears to be applicable for the claims as presented. Amendment should be a non-obvious scope over the above references as well as the references from the international patent offices to have faster prosecution.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to STEPHEN J YANCHUK whose telephone number is (571)270-7343. The examiner can normally be reached on M-Th 10a-8p.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Milton Cano can be reached on 313-446-4937. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <https://ppair-my.uspto.gov/pair/PrivatePair>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/STEPHEN J YANCHUK/
Primary Examiner, Art Unit 1723

<i>Notice of References Cited</i>	Application/Control No. 16/343,224		Applicant(s)/Patent Under Reexamination HANISCH, Christian	
	Examiner STEPHEN J YANCHUK		Art Unit 1723	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20180366740-A1	12-2018	Muska; David	C22B47/00	1/1
*	B	US-20160045841-A1	02-2016	KAPLAN; Allen	B01D3/06	429/49
	C					
	D					
	E					
	F					
	G					
	H					
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	J					
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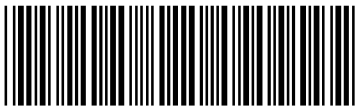
FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

<i>Search Notes</i> 	Application/Control No. 16/343,224	Applicant(s)/Patent Under Reexamination HANISCH, Christian
	Examiner STEPHEN J YANCHUK	Art Unit 1723

CPC - Searched*		
Symbol	Date	Examiner
H01M: 10/54, 6/52	05/22/2021	SJY
C22B: 1/005, 7/00,001	05/22/2021	SJY

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
Inventor Search	05/22/2021	SJY
IDS Review	05/22/2021	SJY
App history review: 15/569484	05/22/2021	SJY
East Word Search	05/22/2021	SJY

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

/STEPHEN J YANCHUK/ Primary Examiner, Art Unit 1723	
--	--

Bibliographic Data

Application No: 16/343,224

Foreign Priority claimed: ☒ Yes ☐ No

35 USC 119 (a-d) conditions met: ☒ Yes ☐ No ☐ Met After Allowance

Verified and Acknowledged: /STEPHEN J YANCHUK/

Examiner's Signature

Initials

Title:

RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
04/18/2019	429	1723	03101253US
RULE			

APPLICANTS

DUESENFELD GMBH, Wendeburg, GERMANY

INVENTORS

Christian HANISCH, Braunschweig, GERMANY

CONTINUING DATA

This application is a 371 of PCT/EP2017/076113 10/12/2017

FOREIGN APPLICATIONS

GERMANY DE10 2016 120 046.8 10/20/2016

IF REQUIRED, FOREIGN LICENSE GRANTED**

05/09/2019

STATE OR COUNTRY

GERMANY

ADDRESS

W&C IP
11491 SUNSET HILLS ROAD
SUITE 340
RESTON, VA 20190
UNITED STATES

FILING FEE RECEIVED

\$1,720

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	1	"16343224"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/05/22 09:30
L2	3,763	(H01M10/54.cpc.) and @ad<"20161020"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/05/22 10:01
L3	4,198	(H01M10/54.cpc. H01M6/52.cpc.) and @ad<"20161020"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/05/22 10:02
L4	25	3 and (dry drying) same (pressure mpa hpa) same (temp temperature)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/05/22 10:03
L5	5	"15569484"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/05/22 10:11
L6	158	3 and (comminut\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/05/22 10:21
L7	1	6 and condens\$4 same (dry drying)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/05/22 10:22
L8	23	6 and (agitat\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/05/22 10:23
L9	45	Duesenfeld	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/05/22 10:23
L10	255	3 and (convey\$4 integrated adj3 system)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/05/22 10:46
L11	0	10 and (dustfree dust adj free)	US-PGPUB; USPAT; USOCR; FPRS; EPO;	OR	ON	2021/05/22 10:47

			JPO; DERWENT; IBM_TDB			
L12	32	10 and (dust)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/05/22 10:47
L14	6,441	(C22B1/005.cpc. C22B7/00,001.cpc.) and @ad<"20161020"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/05/22 11:57
L15	65	14 and (MPA HPA hectopascal megapascal)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2021/05/22 13:50

EAST Search History (Interference)

<This search history is empty>

5/22/2021 2:54:52 PM

C:\Users\syanchuk\Documents\EAST\Workspaces\16343224.wsp

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re patent application of

Hanisch

Confirmation No. 6508

Serial No. 16/343,224

Group Art Unit 1723

Filed April 18, 2021

Examiner Yanchuck

For RECYCLING METHOD FOR TREATING USED BATTERIES, IN
PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY
PROCESSING INSTALLATION

Commissioner for Patents
PO Box 1450
Alexandria, Virginia 22313-1450

RESPONSE TO RESTRICTION REQUIREMENT

Sir:

In response to the restriction requirement mailed January 21, 2021, the applicant elects the Group 1 invention which includes claims 1-8 (identified in the office action) and claims 17 and 18 which depend on claims in Group 1.

Please proceed to examination.

If any extensions of time are required to gain entry and consideration of this response, a provisional petition therefore is hereby made and the Commissioner is authorized to charge attorney's deposit account 50-2041 (W&C IP) for the extension fees and for any other fees required to gain entry and consideration of this response.

Respectfully submitted,



Michael E. Whitham
Reg. No. 32,635

W&C IP
11491 Sunset Hills Road, Suite 340
Reston, VA 20190

Tel. (703) 787-9400
Fax. (703) 787-7557

Customer No.: 30743

Electronic Acknowledgement Receipt

EFS ID:	41928731
Application Number:	16343224
International Application Number:	
Confirmation Number:	6508
Title of Invention:	RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION
First Named Inventor/Applicant Name:	Christian HANISCH
Customer Number:	30743
Filer:	Michael E. Whitham
Filer Authorized By:	
Attorney Docket Number:	03101253US
Receipt Date:	16-FEB-2021
Filing Date:	18-APR-2019
Time Stamp:	11:30:30
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no
------------------------	----

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Response to Election / Restriction Filed	03101253us_2_16_21.pdf	28969	no	1
			8b6484bdfddbc93e617cd9f116f9cd863505867		

Warnings:

Information:	
Total Files Size (in bytes):	28969
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>	



UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/343,224	04/18/2019	Christian HANISCH	03101253US	6508
30743	7590	01/21/2021		
W&C IP			EXAMINER	
11491 SUNSET HILLS ROAD			YANCHUK, STEPHEN J	
SUITE 340				
RESTON, VA 20190				
			ART UNIT	PAPER NUMBER
			1723	
			MAIL DATE	DELIVERY MODE
			01/21/2021	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

16/343,224

Applicant(s)

HANISCH, Christian

Examiner

STEPHEN J YANCHUK

Art Unit

1723

AIA (FITF) Status

Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on 05/12/2020.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on ____.

2a) ☐ This action is **FINAL**.

2b) ☐ This action is non-final.

3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.

4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☒ Claim(s) 1-20 is/are pending in the application.

5a) Of the above claim(s) ____ is/are withdrawn from consideration.

6) ☐ Claim(s) ____ is/are allowed.

7) ☐ Claim(s) ____ is/are rejected.

8) ☐ Claim(s) ____ is/are objected to.

9) ☒ Claim(s) 1-20 are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10) ☐ The specification is objected to by the Examiner.

11) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a) ☒ All b) ☐ Some** c) ☐ None of the:

1. ☐ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. ____.

3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

3) ☐ Interview Summary (PTO-413)

Paper No(s)/Mail Date ____.

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)

4) ☐ Other: ____.

Paper No(s)/Mail Date ____.

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

DETAILED ACTION

Election/Restriction

REQUIREMENT FOR UNITY OF INVENTION

As provided in 37 CFR 1.475(a), a national stage application shall relate to one invention only or to a group of inventions so linked as to form a single general inventive concept ("requirement of unity of invention"). Where a group of inventions is claimed in a national stage application, the requirement of unity of invention shall be fulfilled only when there is a technical relationship among those inventions involving one or more of the same or corresponding special technical features. The expression "special technical features" shall mean those technical features that define a contribution which each of the claimed inventions, considered as a whole, makes over the prior art.

The determination whether a group of inventions is so linked as to form a single general inventive concept shall be made without regard to whether the inventions are claimed in separate claims or as alternatives within a single claim. See 37 CFR 1.475(e).

When Claims Are Directed to Multiple Categories of Inventions:

As provided in 37 CFR 1.475 (b), a national stage application containing claims to different categories of invention will be considered to have unity of invention if the claims are drawn only to one of the following combinations of categories:

- (1) A product and a process specially adapted for the manufacture of said product; or
- (2) A product and a process of use of said product; or
- (3) A product, a process specially adapted for the manufacture of the said product, and a use of the said product; or

(4) A process and an apparatus or means specifically designed for carrying out the said process;
or

(5) A product, a process specially adapted for the manufacture of the said product, and an
apparatus or means specifically designed for carrying out the said process.

Otherwise, unity of invention might not be present. See 37 CFR 1.475 (c).

Restriction is required under 35 U.S.C. 121 and 372.

This application contains the following inventions or groups of inventions which are not so
linked as to form a single general inventive concept under PCT Rule 13.1.

In accordance with 37 CFR 1.499, applicant is required, in reply to this action, to elect a single
invention to which the claims must be restricted.

Group I, claim(s) 1-8, drawn to a method of rejuvenating a battery cell.

Group II, claim(s) 9-16, 19, drawn to an apparatus for rejuvenating a battery cell.

Group III claim 30, drawn to a method of rejuvenating a battery cell

The groups of inventions listed above do not relate to a single general inventive concept under
PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical
features for the following reasons:

Groups I, II, III lack unity of invention because even though the inventions of these groups
require the technical feature of a battery rejuvenation which comprises drying and heat and pressure,
this technical feature is not a special technical feature as it does not make a contribution over the prior
art in view of DE 10-2011/110083. The prior art [0021-0022, 0034-0039] discloses the handling of used
batteries substantially aligned with the overlapping scope of the different groups addressed herein.

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the
inventorship must be corrected in compliance with 37 CFR 1.48(a) if one or more of the currently
named inventors is no longer an inventor of at least one claim remaining in the application. A request to

correct inventorship under 37 CFR 1.48(a) must be accompanied by an application data sheet in accordance with 37 CFR 1.76 that identifies each inventor by his or her legal name and by the processing fee required under 37 CFR 1.17(i).

The examiner has required restriction between product or apparatus claims and process claims. Where applicant elects claims directed to the product/apparatus, and all product/apparatus claims are subsequently found allowable, withdrawn process claims that include all the limitations of the allowable product/apparatus claims should be considered for rejoinder. All claims directed to a nonelected process invention must include all the limitations of an allowable product/apparatus claim for that process invention to be rejoined.

In the event of rejoinder, the requirement for restriction between the product/apparatus claims and the rejoined process claims will be withdrawn, and the rejoined process claims will be fully examined for patentability in accordance with 37 CFR 1.104. Thus, to be allowable, the rejoined claims must meet all criteria for patentability including the requirements of 35 U.S.C. 101, 102, 103 and 112. Until all claims to the elected product/apparatus are found allowable, an otherwise proper restriction requirement between product/apparatus claims and process claims may be maintained. Withdrawn process claims that are not commensurate in scope with an allowable product/apparatus claim will not be rejoined. See MPEP § 821.04. Additionally, in order for rejoinder to occur, applicant is advised that the process claims should be amended during prosecution to require the limitations of the product/apparatus claims. **Failure to do so may result in no rejoinder.** Further, note that the prohibition against double patenting rejections of 35 U.S.C. 121 does not apply where the restriction requirement is withdrawn by the examiner before the patent issues. See MPEP § 804.01.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to STEPHEN J YANCHUK whose telephone number is (571)270-7343. The examiner can normally be reached on M-Th 10a-8p.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Milton Cano can be reached on 313-446-4937. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <https://ppair-my.uspto.gov/pair/PrivatePair>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/STEPHEN J YANCHUK/
Primary Examiner, Art Unit 1723

PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1
 Stylesheet Version v1.2

EPAS ID: PAT6101558

SUBMISSION TYPE:	NEW ASSIGNMENT	
NATURE OF CONVEYANCE:	ASSIGNMENT	
CONVEYING PARTY DATA		
	Name	Execution Date
	CHRISTIAN HANISCH	07/01/2019
RECEIVING PARTY DATA		
Name:	DUESENFELD GMBH	
Street Address:	ROTHBERGSTRASSE 8	
City:	WENDEBURG	
State/Country:	GERMANY	
Postal Code:	38176	
PROPERTY NUMBERS Total: 1		
Property Type	Number	
Application Number:	16343224	
CORRESPONDENCE DATA		
Fax Number:	(703)787-7557	
<i>Correspondence will be sent to the e-mail address first; if that is unsuccessful, it will be sent using a fax number, if provided; if that is unsuccessful, it will be sent via US Mail.</i>		
Phone:	7037879400	
Email:	walter@wcc-ip.com	
Correspondent Name:	WHITHAM & COOK, P.C.	
Address Line 1:	11491 SUNSET HILLS ROAD	
Address Line 2:	SUITE 340	
Address Line 4:	RESTON, VIRGINIA 20190	
ATTORNEY DOCKET NUMBER:	03101253US	
NAME OF SUBMITTER:	WALTER W. RICHARDSON	
SIGNATURE:	/Walter W. Richardson/	
DATE SIGNED:	05/12/2020	
	This document serves as an Oath/Declaration (37 CFR 1.63).	
Total Attachments: 2		
source=03101253AA_decassgn#page1.tif		
source=03101253AA_decassgn#page2.tif		

**DECLARATION (37 C.F.R. 1.63) FOR UTILITY OR DESIGN PATENT APPLICATION
USING AN APPLICATION DATA SHEET (37 C.F.R. 1.76) AND ASSIGNMENT**

Title of Invention: **RECYCLING METHOD FOR TREATING USED BATTERIES, IN
PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING
INSTALLATION**

As a below named inventor, I hereby declare that:

This declaration and assignment document is directed to:

☐ the attached application;

☒ United States application number 16/343,224 filed on April 18, 2019;

☒ PCT international application number PCT/EP2017/076113 filed on October 12, 2017;

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I have reviewed and understand the contents of the application, including the claims.

I am aware of the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in 37 CFR Section 1.56.

Whereas, the undersigned inventor(s) has/have made certain inventions, improvements, and discoveries (herein referred to as the "Invention") disclosed in the above-identified patent application;

Whereas, **DUESENFELD GMBH**, having a place of business at Rothbergstrasse 8, 38176 Wendeburg, GERMANY (herein referred to as "ASSIGNEE"), desires to acquire, and each undersigned inventor desires to grant to ASSIGNEE, the entire worldwide right, title, and interest in and to the Invention and in and to any and all patent applications and patents directed thereto;

Now, therefore, for good and valuable consideration, the receipt and sufficiency thereof being hereby acknowledged, each undersigned inventor ("ASSIGNOR") hereby sells or has sold, assigns or has assigned, and otherwise transfers or has transferred to the ASSIGNEE, its successors, legal representatives, and assigns, the entire worldwide right, title, and interest in and to the Invention, the above-identified United States patent application, and any and all other patent applications and patents for the Invention which may be applied for or granted therefor in the United States and in all foreign countries and jurisdictions, including all divisions, continuations, reissues, reexaminations, renewals, extensions, counterparts, substitutes, and extensions thereof, and all rights of priority resulting from the filing of such applications and granting of such patents. In addition, each undersigned inventor hereby authorizes and requests the Director of the United States Patent and Trademark Office to issue any United States Patent, and foreign patent authorities to issue any foreign patent, granted for the Invention, to ASSIGNEE, its successors, legal representatives, and assigns, the entire worldwide right, title, and interest in and to the same to be held and enjoyed by ASSIGNEE, its successors, legal representatives, and assigns to the full end of the terms for which any and all such patents may be granted, as fully and entirely as would have been held and enjoyed by the undersigned had this Assignment not been made; and each undersigned inventor agrees to execute any and all documents and instruments and perform all

lawful acts reasonably related to recording this Assignment or perfecting title to the Invention and all related patents and applications, in ASSIGNEE, its successors, legal representatives, and assigns, whenever requested by ASSIGNEE, its successors, legal representatives, or assigns.

Each undersigned inventor acknowledges their prior and ongoing obligations to sell, assign, and transfer the rights under this Assignment to ASSIGNEE and is unaware of any reason why they may not have the full and unencumbered right to sell, assign, and transfer the rights hereby sold, assigned, and transferred, and has not executed, and will not execute, any document or instrument in conflict herewith. Each undersigned inventor also hereby grants ASSIGNEE, its successors, legal representatives, and assigns, the right to insert in this Assignment any further identification (including, but not limited to, patent Application Number) which may be necessary or desirable for recordation of this Assignment.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

I hereby authorize and request any attorney of WHITHAM & COOK, P.C., Customer No. 30743, to insert or correct any information concerning the identity of ASSIGNOR, ASSIGNEE, or the above-mentioned application (including the serial no. and the filing date).

(1) Legal Name of Inventor: **Christian HANISCH**

Signature: _____

Date: _____

0.07.2013



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/343,224	04/18/2019	Christian HANISCH	03101253US

CONFIRMATION NO. 6508

PUBLICATION NOTICE



OC000000110599837

30743
W&C IP
11491 SUNSET HILLS ROAD
SUITE 340
RESTON, VA 20190

Title:RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION

Publication No.US-2019-0260101-A1

Publication Date:08/22/2019

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently <http://www.uspto.gov/patft/>.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Public Records Division. The Public Records Division can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Public Records Division, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently <https://portal.uspto.gov/pair/PublicPair>. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

MULTIPLE DEPENDENT CLAIM FEE CALCULATION SHEET Substitute for Form PTO-1360 (For use with Form PTO/SB/06)							Application Number 16343224		Filing Date	
							Applicant(s) Christian HANISCH			
							* May be used for additional claims or amendments			
CLAIMS	AS FILED		AFTER FIRST AMENDMENT		AFTER SECOND AMENDMENT			*	*	*
	Indep	Depend	Indep	Depend	Indep	Depend				
1	1		1							
2		1		1						
3		(1)		1						
4		(1)		1						
5		(1)		1						
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8		(1)		1						
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10		1		1						
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Total Indep	2		3		0					
Total Depend	14	↙	17	↙	0	↙				
Total Claims	16		20		0					

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 16/343,224				
APPLICATION AS FILED - PART I										
(Column 1)		(Column 2)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY				
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)			
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	300			
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A			N/A	520			
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	760			
TOTAL CLAIMS (37 CFR 1.16(j))	20	minus 20 = *			OR	x 100 =	0.00			
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3	minus 3 = *				x 460 =	0.00			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00			
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL		TOTAL	1580			
APPLICATION AS AMENDED - PART II										
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY		
AMENDMENT A		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x	=	OR	x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=	OR	x	=
	Application Size Fee (37 CFR 1.16(s))							OR		
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	
AMENDMENT B		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x	=	OR	x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=	OR	x	=
	Application Size Fee (37 CFR 1.16(s))							OR		
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.										



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

U.S. APPLICATION NO.	FIRST NAMED INVENTOR	ATTY. DOCKET NO.
16/343,224	Christian HANISCH	03101253US

30743
W&C IP
11491 SUNSET HILLS ROAD
SUITE 340
RESTON, VA 20190

INTERNATIONAL APPLICATION NO.	
PCT/EP2017/076113	
I.A. FILING DATE	PRIORITY DATE
10/12/2017	10/20/2016

CONFIRMATION NO. 6508
371 ACCEPTANCE LETTER



Date Mailed: 05/10/2019

NOTICE OF ACCEPTANCE OF APPLICATION UNDER 35 U.S.C 371 AND 37 CFR 1.495

The applicant is hereby advised that the United States Patent and Trademark Office, in its capacity as a Designated / Elected Office (37 CFR 1.495), has ACCEPTED the above identified international application for national patentability examination in the United States Patent and Trademark Office.

The United States Application Number assigned to the application is shown above. A Filing Receipt will be issued for the present application in due course. **THE DATE APPEARING ON THE FILING RECEIPT AS THE "FILING DATE or 371(c) DATE" IS THE DATE ON WHICH THE LAST OF THE 35 U.S.C. 371 (c)(1) and (c)(2) REQUIREMENTS HAS BEEN RECEIVED IN THE OFFICE. THIS DATE IS SHOWN BELOW.** The filing date of the above identified application is the international filing date of the international application (Article 11(3) and 35 U.S.C. 363)

04/18/2019
DATE OF RECEIPT OF 35 U.S.C.
371(c)(1) and (c)(2) REQUIREMENTS

The following items have been received:

- Copy of the International Application filed on 04/18/2019
- English Translation of the IA filed on 04/18/2019
- Copy of the International Search Report filed on 04/18/2019
- Preliminary Amendments filed on 04/18/2019
- Information Disclosure Statements filed on 04/18/2019
- Request for Immediate Examination filed on 04/18/2019
- U.S. Basic National Fees filed on 04/18/2019
- Authorize Access to Search Results filed on 04/18/2019
- Priority Documents filed on 04/18/2019
- Authorization to Permit Access filed on 04/18/2019
- Application Data Sheet (37 CFR 1.76) filed on 04/18/2019

Applicant is notified that the above-identified application contains the deficiencies noted below. No period for reply is set forth in this notice for correction of these deficiencies. However, if a deficiency relates to the inventor's oath or declaration, the applicant must file an oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each actual inventor no later than the expiration of the time period set in the "Notice of Allowability" to avoid abandonment. See 37 CFR 1.495(c).

- Properly executed inventor's oath or declaration for the following inventor(s) has not been submitted:
Christian HANISCH

Applicant is reminded that any communications to the United States Patent and Trademark Office must be mailed to the address given in the heading and include the U.S. application no. shown above (37 CFR 1.5)

VONDA M WALLACE

Telephone: (571) 272-3734



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
16/343,224	04/18/2019		1720	03101253US	20	3

CONFIRMATION NO. 6508

FILING RECEIPT



0000000108086562

30743
W&C IP
11491 SUNSET HILLS ROAD
SUITE 340
RESTON, VA 20190

Date Mailed: 05/10/2019

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please submit a written request for a corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections provided that the request is grantable.

Inventor(s)

Christian HANISCH, Braunschweig, GERMANY;

Applicant(s)

DUESENFELD GMBH, Wendeburg, GERMANY;

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a 371 of PCT/EP2017/076113 10/12/2017

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.)

GERMANY 10 2016 120 046.8 10/20/2016

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 05/09/2019

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/343,224**

Projected Publication Date: 08/22/2019

Non-Publication Request: No

Early Publication Request: No

Title

RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION

Preliminary Class

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER
Title 35, United States Code, Section 184
Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

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The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit <http://www.SelectUSA.gov> or call +1-202-482-6800.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		16343224
	Filing Date		2019-04-18
	First Named Inventor	Christian HANISCH	
	Art Unit		
	Examiner Name		
	Attorney Docket Number		03101253US

U.S. PATENTS						Remove
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear
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If you wish to add additional U.S. Patent citation information please click the Add button.

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U.S. PATENT APPLICATION PUBLICATIONS						Remove
Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear
	1	20050241943	A1	2005-11-03	Kakuta et al.	

If you wish to add additional U.S. Published Application citation information please click the Add button.

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FOREIGN PATENT DOCUMENTS								Remove
Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ²	Kind Code ⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear	T ⁵
	1	10 2011 110 083	DE	A1	2013-02-14	Technische Universitaet Braunschweig Carolo . . .		×
	2	2010/102377	WO	A1	2010-09-16	Wayne C. Stevens		□
	3	10 2012 024 876	DE	A1	2014-06-26	Electrocycling GmbH; Volkswagen Aktiengesellschaft		☒

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number		16343224
Filing Date		2019-04-18
First Named Inventor	Christian HANISCH	
Art Unit		
Examiner Name		
Attorney Docket Number	03101253US	

4	2016/174156	WO	A1	2016-04-28	Lion Engineering GmbH	☐
5	2016/164752	WO	A1	2016-10-13	Energizer Brands, LLC	☐
6	101394015	CN	A	2009-03-25	Shenzhen Bak Battery Co Ltd	☒
7	10 2015 207 843	DE	A1	2016-11-03	Lion Engineering GMBH	☒
8	60 2005 001 937	DE	T2	2008-05-29	Recuply S.A.	☐

If you wish to add additional Foreign Patent Document citation information please click the Add button

NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵
	1		

If you wish to add additional non-patent literature document citation information please click the Add button

EXAMINER SIGNATURE

Examiner Signature		Date Considered	
--------------------	--	-----------------	--

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	16343224
Filing Date	2019-04-18
First Named Inventor	Christian HANISCH
Art Unit	
Examiner Name	
Attorney Docket Number	03101253US

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Michael E. Whitham/	Date (YYYY-MM-DD)	2019-04-17
Name/Print	Michael E. Whitham	Registration Number	32635

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. **DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt

EFS ID:	35778439
Application Number:	16343224
International Application Number:	
Confirmation Number:	6508
Title of Invention:	RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION
First Named Inventor/Applicant Name:	Christian HANISCH
Customer Number:	30743
Filer:	Michael E. Whitham/Walter Richardson
Filer Authorized By:	Michael E. Whitham
Attorney Docket Number:	03101253US
Receipt Date:	19-APR-2019
Filing Date:	
Time Stamp:	14:26:35
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	03101253US_IDS.pdf	1035123	no	4
			0dce7bdc00cb1d01ec48f3ef4838c940279ae66		

Warnings:

Information:					
2	Foreign Reference	ForRef1.pdf	478088	no	9
			c87520f3e7cab1a02ffa93c27eb9bd86a2672e1c		
Warnings:					
Information:					
3	Foreign Reference	ForRef2.pdf	2371712	no	21
			2d9a8c3f1ba46d05c9fc669b1a125477740a9dbd		
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4	Foreign Reference	ForRef3.pdf	641717	no	14
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5	Foreign Reference	ForRef4.pdf	3287741	no	31
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6	Foreign Reference	ForRef5.pdf	3474791	no	33
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7	Foreign Reference	ForRef6.pdf	482895	no	15
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8	Foreign Reference	ForRef7.pdf	667082	no	13
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Information:					

9	Foreign Reference	ForRef8.pdf	674322 170fd006b409671029583b9160a991ea4dd22e17	no	17
Warnings:					
Information:					
Total Files Size (in bytes):			13113471		
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>					

PCT-ANTRAG

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0	Vom Anmeldeamt auszufüllen	
0-1	Internationales Aktenzeichen	PCT/EP2017/076113
0-2	Internationales Anmeldedatum	12 OCT 2017 (12.10.2017)
0-3	Name des Anmeldeamts und "PCT International Application"	RO/EP
0-4	Formular PCT/RO/101 PCT-Antrag	
0-4-1	Erstellt mit	PCT Online Filing Version 3.5.000.251e MT/FOP 20141031/0.20.5.20
0-5	Antragsersuchen Der Unterzeichnete beantragt, daß die vorliegende internationale Anmeldung nach dem Vertrag über die internationale Zusammenarbeit auf dem Gebiet des Patentwesens behandelt wird	
0-6	(Vom Anmelder gewähltes) Anmeldeamt	Europäisches Patentamt (EPA) (RO/EP)
0-7	Aktenzeichen des Anmelders oder Anwalts	6110-004 PCT-1
I	Bezeichnung der Erfindung	Recycling-Verfahren zum Behandeln gebrauchter Batterien, insbesondere wieder aufladbarer Batterien und Batterie-Verarbeitungsanlage
II	Anmelder	
II-1	Diese Person ist	Nur Anmelder
II-2	Anmelder für	Alle Bestimmungsstaaten
II-4	Name	DUESENFELD GmbH
II-5	Anschrift	Friedlandweg 5 38114 Braunschweig Deutschland
II-6	Staatsangehörigkeit (Staat)	DE
II-7	Sitz/Wohnsitz (Staat)	DE
III-1	Anmelder und/oder Erfinder	
III-1-1	Diese Person ist	Erfinder nur
III-1-3	Erfinder für	Alle Bestimmungsstaaten
III-1-4	Name (FAMILIENNAME, Vorname)	HANISCH, Christian
III-1-5	Anschrift	Sophienstraße 14 38118 Braunschweig Deutschland

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IV-1	Anwalt oder gemeinsamer Vertreter oder besondere Zustellanschrift Die unten bezeichnete Person ist/wird hiermit bestellt, um für den (die) Anmelder vor den zuständigen internationalen Behörden zu handeln, und zwar in folgender Eigenschaft:	Anwalt
IV-1-1	Name	Gramm, Lins & Partner Patent- und Rechtsanwälte PartGmbB
IV-1-2	Anschrift	Theodor-Heuss-Straße 1 38122 Braunschweig Deutschland
IV-1-3	Telefonnr.	+49 531 28140 0
IV-1-4	Telefaxnr.	+49 531 28140 28
IV-1-5	E-Mail	braunschweig@grammpatent.de
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VI-1	Priorität einer früheren nationalen Anmeldung beansprucht	
VI-1-1	Anmeldedatum	20. Oktober 2016 (20.10.2016)
VI-1-2	Nummer	10 2016 120 046.8
VI-1-3	Staat oder Mitglied der WTO	DE
VI-2	Einbeziehung durch Verweis : Ist ein in Artikel 11 Absatz 1 Ziffer iii Buchstabe d oder e genannter Bestandteil der internationalen Anmeldung oder ein in Regel 20.5 Absatz a genannter Teil der Beschreibung, der Ansprüche oder der Zeichnungen nicht anderswo in der internationalen Anmeldung, aber vollständig in einer früheren Anmeldung enthalten, deren Priorität, zu dem Datum, an dem ein oder mehrere in Artikel 11 Absatz 1 Ziffer iii genannte Bestandteile zuerst beim Anmeldeamt eingegangen sind, beansprucht wird, so wird dieser Bestandteil oder Teil, vorbehaltlich der Bestätigung nach Regel 20.6, für die Zwecke der Regel 20.6 in diese internationale Anmeldung einbezogen.	
VII-1	Gewählte Internationale Recherchenbehörde	Europäisches Patentamt (EPA) (ISA/EP)

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VIII	Erklärungen	Anzahl der Erklärungen	
VIII-1	Erklärung hinsichtlich der Identität des Erfinders	—	
VIII-2	Erklärung hinsichtlich der Berechtigung des Anmelders, zum Zeitpunkt des internationalen Anmeldedatums, ein Patent zu beantragen und zu erhalten	1	
VIII-3	Erklärung hinsichtlich der Berechtigung des Anmelders, zum Zeitpunkt des internationalen Anmeldedatums, die Priorität einer früheren Anmeldung zu beanspruchen	1	
VIII-4	Erfindererklärung (nur im Hinblick auf die Bestimmung der Vereinigten Staaten von Amerika)	—	
VIII-5	Erklärung hinsichtlich unschädlicher Offenbarungen oder Ausnahmen von der Neuheitsschädlichkeit	—	

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VIII-2-1	Erklärung: Berechtigung, ein Patent zu beantragen und zu erhalten Erklärung hinsichtlich der Berechtigung des Anmelders, zum Zeitpunkt des internationalen Anmeldedatums, ein Patent zu beantragen und zu erhalten (Regeln 4.17 Ziffer ii und 51bis.1 Absatz a Ziffer ii), für den Fall, daß eine Erklärung nach Regel 4.17 Ziffer iv nicht einschlägig ist: Name (FAMILIENNAME, Vorname)	In bezug auf diese internationale Anmeldung DUESENFELD GmbH ist kraft des nachfolgend Aufgeführten berechtigt, ein Patent zu beantragen und zu erhalten:
VIII-2-1(i ii)		auf Grund einer Vereinbarung zwischen DUESENFELD GmbH und HANISCH, Christian, datiert 05. Oktober 2017 (05.10.2017)

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VIII-3-1	Erklärung: Berechtigung, Priorität zu beanspruchen Erklärung hinsichtlich der Berechtigung des Anmelders, zum Zeitpunkt des internationalen Anmeldedatums, eine Priorität zu beanspruchen, in Fällen, in denen der Anmelder nicht der Anmelder der früheren Anmeldung, deren Priorität beansprucht wird, ist oder in Fällen, in denen sich der Name des Anmelders seit dem Einreichen der früheren Anmeldung geändert hat (Regeln 4.17 Ziffer iii und 51bis.1 Absatz a Ziffer iii): Name	In bezug auf diese internationale Anmeldung DUESENFELD GmbH ist kraft des nachfolgend Aufgeführten berechtigt, die Priorität der früheren Anmeldung Nr. 10 2016 120 046.8 zu beanspruchen:
VIII-3-1(i ii)		auf Grund einer Vereinbarung zwischen HANISCH, Christian und DUESENFELD GmbH, datiert 05. Oktober 2017 (05.10.2017)

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IX	Kontrollliste	Anzahl der Blätter	Elektronische Datei(en) beigelegt
IX-1	Antrag (inklusive Erklärungsblätter)	7	✓
IX-2	Beschreibung	30	✓
IX-3	Ansprüche	4	✓
IX-4	Zusammenfassung	1	✓
IX-5	Zeichnung(en)	4	✓
IX-7	INSGESAMT	46	
	Beigelegte Unterlagen	Unterlage(n) in Papierform beigelegt	Elektronische Datei(en) beigelegt
IX-8	Blatt für die Gebührenberechnung	—	✓
IX-20	Nr. der Abb. der Zeichn., die mit der Zusammenf. veröffentlicht werden soll	1	
IX-21	Sprache der int. Anmeldung	Deutsch	
X-1	Unterschrift des Anmelders, des Anwalts oder des Gemeinsamen Vertreters	(PKCS7 digitale Unterschrift)	
X-1-1	Name	Gramm, Lins & Partner Patent- und Rechtsanwälte PartGmbH	
X-1-2	Name der unterzeichnenden Person	Jan Plöger 30018	
X-1-3	Eigenschaft (sofern sich dies nicht eindeutig aus dem Antrag ergibt)	(Vertreter)	

VOM ANMELDEAMT AUSZUFÜLLEN

10-1	Datum des tatsächlichen Eingangs dieser internationalen Anmeldung	12 OCT 2017 (12.10.2017)
10-2	Zeichnung(en):	
10-2-1	Eingegangen	✓
10-2-2	Nicht eingegangen	
10-3	Geändertes Eingangsdatum aufgrund nachträglich, jedoch fristgerecht eingeg. Unterlage(n) oder Zeichnung(en) zur Vervollständigung dieser int. Anmeldung	
10-4	Datum des fristgerechten Eingangs der Berichtigung nach PCT Artikel 11(2)	
10-5	Internationale Recherchenbehörde	ISA/EP
10-6	Übermittlung des Recherchenexemplars bis zur Zahlung der Recherchegebühr aufgeschoben	

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VOM INTERNATIONALEN BÜRO AUSZUFÜLLEN

11-1	Datum des Eingangs des Aktenexemplars beim Internationalen Büro	
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Informationen zur Recherchenstrategie

Pilotphase (vgl. ABI. EPA 2015, A86)

Die Art der auf diesem Blatt enthaltenen Informationen kann sich während des Pilotprojekts zur Verbesserung des Nutzens dieses neuen Dienstes ändern.

Anmeldenummer

PCT/EP2017/076113

ERFINDUNGSBEZEICHNUNG: RECYCLING-VERFAHREN ZUM BEHANDELN GEBRAUCHTER BATTERIEN, INSBESONDERE WIEDER AUFLADBARER BATTERIEN UND BATTERIE-VERARBEITUNGSANLAGE

ANMELDER: DUESENFELD GMBH

IPC-KLASSIFIKATION: H01M6/52, C22B7/00, C22B15/00, C22B21/00, H01M10/54

PRÜFER: Wiedemann, Eric

KONSULTIERTE DATENBANKEN: EPODOC, WPI, INSPEC

KLASSIFIKATIONSSYMBOL, DIE DEN RECHERCHENUMFANG DEFINIEREN:

IPC:

CPC: H01M6/52, C22B7/00, C22B15/00, C22B21/00, H01M10/54

FI/F-TERMS:

SCHLAGWÖRTER ODER SONSTIGE ELEMENTE, IN DENEN DIE ERFINDUNG VORKOMMT:

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

(19) Weltorganisation für geistiges Eigentum
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(30) Angaben zur Priorität:
10 2016 120 046.8
20. Oktober 2016 (20.10.2016) DE

(71) Anmelder: DUESENFELD GMBH [DE/DE]; Friedland-
weg 5, 38114 Braunschweig (DE).

(72) Erfinder: HANISCH, Christian; Sophienstraße 14, 38118
Braunschweig (DE).

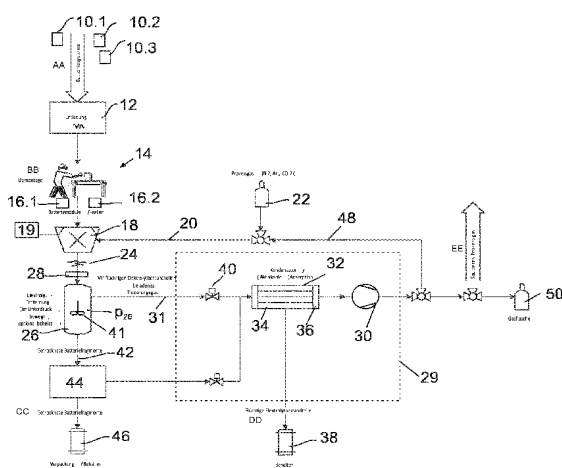
(74) Anwalt: GRAMM, LINS & PARTNER PATENT- UND
RECHTSANWÄLTE PARTGMBB; Theodor-Heuss-
Straße 1, 38122 Braunschweig (DE).

(81) Bestimmungsstaaten (soweit nicht anders angegeben, für
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AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,
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(84) Bestimmungsstaaten (soweit nicht anders angegeben, für
jede verfügbare regionale Schutzrechtsart): ARIPO (BW,
GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST,
SZ, TZ, UG, ZM, ZW), eurasisches (AM, AZ, BY, KG, KZ,
RU, TJ, TM), europäisches (AL, AT, BE, BG, CH, CY, CZ,
DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT,
LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI,

(54) Title: RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES,
AND BATTERY PROCESSING INSTALLATION

(54) Bezeichnung: RECYCLING-VERFAHREN ZUM BEHANDELN GEBRAUCHTER BATTERIEN, INSBESONDERE WIEDER
AUFLADBARER BATTERIEN UND BATTERIE-VERARBEITUNGSANLAGE



AA Battery systems
BB Disassembly
CC Dried battery fragments
DD Volatile electrolyte constituents
EE Clean process gas
12 Discharging
16.1 Battery modules/cells
22 Process gas (N₂, Ar, CO₂)
26 Electrolyte removal, moved under negative pressure, optionally heated
31 Drying gas containing volatile electrolyte constituents
34 Condenser // (activated carbon) adsorption
38 Container
42 Dried battery fragments
46 Packaging/container
50 Gas bottle

(57) Abstract: The invention relates to a method for treating used lithium batteries (10), having the following steps: comminuting the batteries (10) so that comminuted material (24) is obtained, and deactivating the comminuted material (24) by drying so that a deactivated comminuted material (42) is obtained. According to the invention, drying takes place at a pressure of at most 300 hPa and at most 80°C, and, after drying, the deactivated comminuted material (42) is not transferred to a transport container and/or further processed.

(57) Zusammenfassung: Die Erfindung betrifft ein Verfahren zum Behandeln gebrauchter Lithium- Batterien (10) mit den Schritten: Zerkleinern der Batterien (10), sodass Zerkleinerungsgut (24) erhalten wird, und Inaktivieren des Zerkleinerungsguts (24) durch Trocknen, sodass ein inaktiviertes Zerkleinerungsgut (42) erhalten wird. Erfindungsgemäß ist vorgesehen, dass das Trocknen bei einem Druck von höchstens 300 hPa und höchstens 80 °C erfolgt und das inaktivierte Zerkleinerungsgut (42) nach dem Trocknen nicht in einen Transportbehälter abgefüllt und/oder direkt weiterverarbeitet wird.

Fig. 1

WO 2018/073101 A1

SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Erklärungen gemäß Regel 4.17:

- *hinsichtlich der Berechtigung des Anmelders, ein Patent zu beantragen und zu erhalten (Regel 4.17 Ziffer ii)*
- *hinsichtlich der Berechtigung des Anmelders, die Priorität einer früheren Anmeldung zu beanspruchen (Regel 4.17 Ziffer iii)*

Veröffentlicht:

- *mit internationalem Recherchenbericht (Artikel 21 Absatz 3)*

Recycling-Verfahren zum Behandeln gebrauchter Batterien, insbesondere wieder aufladbarer Batterien und Batterie-Verarbeitungsanlage

Die Erfindung betrifft ein Verfahren zum Behandeln gebrauchter Batterien, insbesondere gebrauchter Lithium-Batterien, beispielsweise Lithium-Ionen-Batterien, mit den Schritten (a) Zerkleinern der Batterien, sodass Zerkleinerungsgut erhalten wird, und (b) Inaktivieren des Zerkleinerungsguts, sodass ein inaktiviertes Zerkleinerungsgut erhalten wird.

Gemäß einem zweiten Aspekt betrifft die Erfindung eine Batterie-Verarbeitungsanlage zum Behandeln gebrauchter Batterien, insbesondere zum Behandeln gebrauchter Lithium-Batterien, mit (a) einer Zerkleinerungseinheit zum Zerkleinern der Batterien, sodass Zerkleinerungsgut erhalten wird, und (b) einer Inaktivierungsvorrichtung zum Inaktivieren des Zerkleinerungsguts.

Aus der US 2005/0241943 A1 ist ein Verfahren zum Aufarbeiten gebrauchter Batterien bekannt, bei dem die Batterien vor einem Zerkleinerungsschritt erwärmt werden, sodass Kunststoffbestandteile der Batterien zerstört werden. Nachteilig an einem derartigen Vorgehen ist, dass die verbleibenden Komponenten der Batterien mit Abbauprodukten des Kunststoffs verunreinigt sein können.

Aus der DE 10 2012 024 876 A1 ist ein System zum Überführen transportkritischer Elektrolytzellen zunächst unter Inertgas zerkleinert und danach mit einem Desaktivierungspulver bestäubt werden, um eine Selbstentzündung des elektrochemisch aktiven Materials zu verhindern. Nachteilig daran ist, dass das entstehende Material dennoch ein vergleichsweise hohes Gefährdungspotential besitzt und dass das Bestäubungspulver selbst ein Expositionsrisiko darstellt und dass die Bildung einer entzündlichen und explosiven Atmosphäre in dem Transportbehälter nicht ausgeschlossen werden kann.

Aus der DE 10 2011 110 083 A1 ist ein Verfahren zum Wiedergewinnen von Ak-

tivmaterial aus einer galvanischen Zelle bekannt, bei dem die galvanischen Zellen zunächst mechanisch zerkleinert, dann vorgetrocknet und nachfolgend gesichtet werden. Schließlich wird der Binder in einem Ofen zersetzt. Eine derartige Vorrichtung eignet sich sehr gut zum effizienten Recyceln größerer Mengen von galvanischen Elementen. Für den Teillast-Betrieb ist diese Anlage jedoch vergleichsweise komplex aufgebaut. Es hat sich zudem gezeigt, dass sich hochtoxische fluororganische Verbindungen und Fluorwasserstoff bilden können, die nur mit großem Aufwand entsorgbar sind.

In der WO 2010/102377 A1 ist ein Verfahren beschrieben, bei dem die zu rezyklierenden Batterien, beispielsweise Lithium-Batterien, in einem Drehrohr ofen erhitzt und die entstehenden Gase abgesaugt werden. Nachteilig an diesem Verfahren ist, dass der Elektrolyt so nur schlecht wiederverwertet werden kann und große Mengen Fluorwasserstoff sowie fluororganische Verbindungen entstehen.

In der nachveröffentlichten Druckschrift WO 2016/174156 A1 ist ein Verfahren beschrieben, bei dem gebrauchte Batterien zunächst dezentral deaktiviert und in einen Transportbehälter abgefüllt werden. Nach Transport des zerkleinerten Materials zu einer zentralen Verarbeitungsstelle werden die deaktivierten Zellfragmente weiterverarbeitet.

Der Erfindung liegt die Aufgabe zugrunde, Nachteile im Stand der Technik zu vermindern.

Die Erfindung löst das Problem durch ein gattungsgemäßes Verfahren, bei dem das Trocknen bei einem Druck von höchstens 300 hPa, vorzugsweise zumindest zeitweise unter 50 hPa, und höchstens 80 °C erfolgt. Insbesondere erfolgt das Inaktivieren zumindest auch durch Trocknen des Zerkleinerungsguts. Gemäß einem zweiten Aspekt löst die Erfindung das Problem durch eine gattungsgemäße Batterie-Verarbeitungsanlage, bei der eine Vakuumanlage mit der Trockenvorrichtung zum Erzeugen eines Vakuums in der Trockenvorrichtung von zumindest 300 hPa verbunden ist und die Trockenvorrichtung zum Trocknen bei

einer Temperatur von höchstens 80 °C ausgebildet ist.

Vorteilhaft an der Erfindung ist, dass durch das Trocknen dem Zerkleinerungsgut so viel Elektrolyt entzogen werden kann, dass eine elektrochemische Reaktion
5 nicht mehr oder nur noch zu vernachlässigbar kleinem Ausmaß möglich ist. Zudem bildet sich keine entzündliche oder explosive Gasphase über den Batteriefragmenten, da diesen insbesondere die leichtsiedenden organischen Karbonate des Elektrolyten entzogen wurden. Das Zerkleinerungsgut ist daher weitgehend inert und kann, insbesondere dann, wenn es unter Vakuum verpackt wird, sicher
10 transportiert oder weiterverarbeitet werden.

Ein weiterer Vorteil ist es, dass zum Inaktivieren des Zerkleinerungsmaterials kein zusätzliches Material hinzugegeben werden muss. Das verringert den Aufwand beim Aufarbeiten der Batterien, verringert das Gewicht des inaktivierten
15 Zerkleinerungsguts und erhöht die Reinheit in den folgenden Trenn- und Recyclingschritten. Insbesondere in potentiell folgenden hydrometallurgischen Aufarbeitungsschritten ist eine hohe Produktreinheit ohne Eintrag von Fremdionen vorteilhaft.

Vorteilhaft ist zudem, dass die Bildung von Fluorophosphaten, Fluorwasserstoff, Kohlenstoffmonoxid, polyfluorierten Dibenzodioxinen und Dibenzofuranen, Stickoxiden, Carbonylfluorid und/oder Cyanwasserstoff in relevanter Menge ausgeschlossen werden kann. Fluorophosphate sind oft starke Nervengifte, deren Bildung sicher verhindert werden muss. Zudem ist sichergestellt, dass es
20 aufgrund des geringen Elektrolytgehalts nicht zu einer durch eine elektrochemische Reaktion ausgelöste, selbstverstärkend fortschreitende Wärmeentwicklung kommen kann. Es hat sich herausgestellt, dass sich Fluorwasserstoff und Fluorophosphate bereits bei vergleichsweise niedrigen Temperaturen von über 80°C in signifikanter Menge bilden können.

Vorteilhaft ist zudem, dass das Entfernen des Elektrolyten mit geringem Energieaufwand möglich ist. Zudem kann der Elektrolyt weitgehend wiederverwertet werden.

Das gemäß einer bevorzugten Ausführungsform vorgesehene Kondensieren des verdampften Elektrolyten führt zudem zu einer emissionsarmen Wiederverwertung von Lithium-Batterien.

5

Mit der erfindungsgemäßen Batterie-Verarbeitungsanlage sind stofflichen Recyclingquoten von über 80% erreichbar, was mit bisherigen Anlagen nicht erreichbar ist.

- 10 Im Rahmen der vorliegenden Beschreibung wird unter dem Trocknen insbesondere das Entfernen zumindest eines Lösungsmittels des Leitsalzes verstanden. Insbesondere wird das Trocknen so durchgeführt, dass Kohlensäuredimethylester und/oder Kohlensäureethylmethylester zu zumindest 90 Gewichtsprozent entfernt wird.

15

Unter einer Lithium-Batterie wird insbesondere ein Akkumulator verstanden, bei dem die elektrochemische Reaktion Lithium und/oder Lithium-Ionen und/oder eine Lithium-Verbindung involviert.

- 20 Unter einer Batterie-Verarbeitungsanlage wird insbesondere auch eine Akku-Verarbeitungsanlage zum Verarbeiten von Akkumulatoren verstanden.

Unter dem Transportbehälter wird insbesondere auch eine oder eine Transportverpackung verstanden. Vorzugsweise wird die Transportverpackung durch Vakuumverschweißung verschlossen. Gut geeignet als Transportverpackung ist insbesondere Aluminium-Verbundfolie.

25

Unter der Zerkleinerungseinheit wird insbesondere eine Vorrichtung verstanden, die beim Betrieb die Batterien zerkleinert. Beispielsweise ist die Zerkleinerungseinheit (i) eine Druckzerkleinerungseinheit, bei der die Batterien zwischen zwei Werkzeugflächen zerdrückt werden, (ii) eine Schlagzerkleinerungseinheit, bei der die Batterien auf einer Werkzeugfläche aufliegen und durch Schlag mit einem zweiten beweglichen Werkzeug zertrümmert werden, (iii) eine Scherzerklei-

30

nerungseinheit, bei der die Batterien durch zwei sich gegensätzlich bewegend
Werkzeugflächen zerkleinert werden, (iv) eine Schneidzerkleinerungseinheit, bei
der die Batterien mittels zwei Schneiden in zwei Teile geschnitten werden
und/oder (v) eine Prallzerkleinerung, bei der die Batterien gegen eine Wand ge-
worfen werden, gegen ein bewegtes Werkzeug prallen oder zwei Partikel ge-
einander stoßen. Selbstverständlich kann die Zerkleinerungseinheit auch
durch zwei oder mehr der genannten Zerkleinerungsmechanismen wirken.

Die Zerkleinerungseinheit ist gemäß einer bevorzugten Ausführungsform Teil ei-
ner Zerkleinerungsvorrichtung, die einen Behälter aufweist, in der die Zerkleine-
rungseinheit angeordnet ist.

Die angegebenen Temperaturen und Drücke beziehen sich stets auf die Tempe-
ratur der Atmosphäre in der jeweiligen Vorrichtung. So ist unter dem Merkmal,
dass das Trocknen bei einem Druck von höchstens 300 hPa und höchstens
80 °C erfolgt, insbesondere zu verstehen, dass die Temperatur in der Atmosphä-
re des Trockners höchstens 80°C beträgt. Dass die Temperatur lokal höher sein
kann, ist irrelevant.

Günstig ist, wenn das Trocknen nach dem Zerkleinern der Batterien erfolgt. Zwar
ist es möglich und stellt eine Ausführungsform der Erfindung dar, dass die Batte-
rien im unzerkleinerten Zustand einem Vakuum ausgesetzt werden, sodass zu-
mindest Teile des Elektrolyten verdampfen, wobei das entstehende Gas entwe-
der durch ein Sicherheitsventil im Akkumulator entweicht oder die Batterie durch
die Druckdifferenz zwischen der äußeren Umgebung und dem Innendruck zer-
stört wird, sodass verdampfender Elektrolyt austreten kann. Da der Elektrolyt
zumeist zwischen eng gewickelten oder gestapelten und verpressten Schichten
aus Elektroden und Separator und in deren Poren vorliegt und mit anderen Be-
standteilen der Batterien verbunden vorliegt, kann dieses Vorgehen jedoch zeit-
intensiv sein. Es ist daher oft günstiger und stellt eine bevorzugte Ausführungs-
form der Erfindung dar, dass die Batterien mechanisch zerkleinert werden, bei-
spielsweise durch Schneiden, Scheren, Pralleinwirkung, Zertrennen und/oder
Quetschen. So steht für den Stoffübergang in die Gasphase eine größere Grenz-
fläche zur Verfügung.

Vorzugsweise erfolgt das Trocknen während zumindest 50% der Trockenzeit bei einem Druck von höchstens 30 hPa. Alternativ oder zusätzlich beträgt ein Minimaldruck beim Trocknen höchstens 50 hPa. So wird ein sehr hoher Anteil des Elektrolyten entfernt. Unter dem Minimaldruck ist insbesondere der kleinste Atmosphärendruck in der Trockenvorrichtung zu verstehen, der für zumindest eine Minute herrscht.

Es ist gemäß einer bevorzugten Ausführungsform zudem möglich, dass das Trocknen simultan mit dem Zerkleinern erfolgt. In anderen Worten wird an eine Zerkleinerungsvorrichtung, in der die Batterien zerkleinert werden, ein Vakuum mit einem Druck von höchstens 300 hPa angelegt. Vorteilhaft hieran ist, dass die beim Zerkleinern eingebrachte mechanische Energie das Verdampfen des Elektrolyten unterstützt. Es ist daher entbehrlich, zusätzliche Heizenergie zum Verdampfen des Elektrolyten in das Zerkleinerungsgut einzubringen (obwohl dies möglich und von der Erfindung umfasst ist). Außerdem ist es entbehrlich, das Zerkleinerungsgut beim Zerkleinern zu kühlen (obwohl dies möglich und von der Erfindung umfasst ist). Die Zerkleinerungseinheit bewirkt zudem ein Umwälzen des Zerkleinerungsguts, was das Trocknen beschleunigt.

Günstig ist es, wenn das Trocknen unter Rühren und/oder Umwälzen des Zerkleinerungsguts erfolgt. So werden die galvanischen Elemente aus Anode, Separator und Kathode voneinander getrennt. Eine Behinderung der Verdampfung durch zusammenklebende Folien wird verhindert. Es wird mechanische Energie zur Trennung von Stromsammelrfolie und Beschichtung eingebracht und die resultierende Reibungswärme führt dem System die Verdampfungswärme zu.

Vor dem Zerkleinern werden die gebrauchten Batterien vorzugsweise demon- tiert. Das heißt, dass größere Batteriesysteme in ihre kleineren Unterbausteine, die Module oder Stacks, demontiert werden oder sogar die Zellen, die das elektrochemisch wirksame Material enthalten, von der Ansteuerelektronik getrennt werden. Die Ansteuerelektronik umfasst beispielsweise Halbleiterbauelemente und/oder Sensoren und dient der Ladesteuerung der Batterien.

Das Trocknen erfolgt unter Vakuum. Gemäß seiner breitesten Form löst die Erfindung das Problem durch ein gattungsgemäßes Verfahren, bei dem das Vakuum so groß gewählt ist, dass der Dampfdruck von Kohlensäuredimethylester bei 80°C, insbesondere bei 70°C, unterschritten wird. Besonders günstig ist es jedoch, wenn das Trocknen unter einem Druck von höchstens 300 hPa, insbesondere höchstens 100 hPa erfolgt. Bei so niedrigen Drücken verdampfen wesentliche Bestandteile der meisten Elektrolyten, insbesondere Kohlensäuredimethylester und Kohlensäureethylmethylester, bereits bei Temperaturen von weniger als 80°C. Niedrige Temperaturen haben den Vorteil, dass die Bildung von Fluorwasserstoff und fluororganischen Verbindungen behindert wird. Beides stellt eine potentielle Gefährdung für die Batterie-Verarbeitungsanlage sowie die Umgebung dar. Es ist daher günstig, deren Entstehen zu verhindern.

Vorzugsweise erfolgt das Trocknen bei einer Temperatur, die unterhalb einer Zersetzungstemperatur liegt. Unter der Zersetzungstemperatur wird insbesondere die kleinste Temperatur verstanden, für die gilt, dass nach dem Halten des Zerkleinerungsguts auf dieser Temperatur für eine Stunde zumindest 80 Masseprozent des Binders der Lithium-Batterien sich in gasförmige Bestandteile zersetzt haben. Die Zersetzungstemperatur kann damit gemessen werden, indem die Temperatur des Zerkleinerungsguts sukzessive erhöht wird und erfasst wird, wann es zu einem Masseverlust, insbesondere durch Gasentwicklung aufgrund einer Zersetzung des Binders, kommt und das angegebene Kriterium erfüllt ist. Gegebenenfalls muss der Versuch mit jeweils einer neuen Probe an Zerkleinerungsgut bei jeweils erhöhter Temperatur mehrfach durchgeführt werden.

Gemäß einer bevorzugten Ausführungsform umfasst das Verfahren das Kondensieren der beim Trocknen der entstandenen Gase. Das erfolgt vorzugsweise bei Umgebungsdruck, wobei eine Abweichung von ± 50 hPa möglich ist. Günstig ist es, wenn die Temperatur beim Kondensieren zumindest 0°C beträgt. Das vermindert die aufzuwendende Kühlleistung und verhindert Eisbildung. Vorzugsweise beträgt die Kühlleistung zumindest 4 Kilowatt und höchstens 40 Kilowatt bezogen auf eine Tonne pro Stunde verarbeiteter Batterien. Alternativ ist die Tem-

peratur beim Kondensieren kleiner als 0°C , sodass der Atmosphäre Wasser durch Bildung von Eis entzogen wird. Es ist möglich, dass der Kondensator zwei oder mehr Zonen unterschiedlicher Temperatur hat. Vorzugsweise ist die Temperatur in einer der beiden Zonen dann so hoch, dass es zu keiner Eisbildung kommt, und in einer anderen Zone so niedrig, dass Wasser als Eis abgeschieden wird.

Günstig ist es, wenn die Temperatur beim Kondensieren höchstens 50°C , vorzugsweise höchstens 30°C , insbesondere höchstens 20°C , beträgt. Auf diese Weise werden die organischen Karbonate der Batterien fast vollständig zurückgewonnen. Es entstehen zudem kaum Abgase und der Energieaufwand für das Kondensieren ist klein.

Das Zerkleinern der Batterien wird vorzugsweise so durchgeführt, dass zumindest 90 Gew.-% der Bestandteile des Zerkleinerungsguts ein Siebmaß von höchstens 50 mm, insbesondere höchstens 30 mm, vorzugsweise höchstens 20 mm, haben. Hierunter ist zu verstehen, dass 90 Gew.-% der Bestandteile durch ein Sieb fallen, das eine Maschenweite von 50 mm (bzw. die jeweils andere angegebene Weite) hat. Durch eine solche Zerkleinerung werden Mikrokurzschlüsse vermieden und so die Sicherheit des Transports, der Lagerung und der weiteren Verarbeitung erhöht.

Günstig ist es, wenn das Trocknen unter einer Atmosphäre erfolgt, in der der Wasser-Partialdruck kleiner ist als 50 Pa, insbesondere kleiner als 10 Pa. Ein geringer Wasser-Partialdruck führt zu einer geringen Reaktionsrate von Lithium-Verbindungen zu Lithium-Hydroxid und damit zu nur geringer Wasserstoff-Entwicklung. Das verhindert die Bildung von zündfähigen Wasserstoff-Sauerstoff-Gemischen und trägt zur Anlagensicherheit bei.

Günstig ist es zudem, wenn der Sauerstoff-Partialdruck beim Trocknen höchstens 30 Millibar, insbesondere höchstens 10 Millibar beträgt. Die Reaktion von Sauerstoff mit oxidierbaren Bestandteilen der Batterien wird so weitgehend unterdrückt. Es ist möglich, den niedrigen Sauerstoff-Partialdruck durch einen ge-

ringen Druck beim Trocknen zu erreichen. Alternativ oder zusätzlich kann das Trocknen in einer Inertgas-Atmosphäre erfolgen.

5 Gemäß einer bevorzugten Ausführungsform umfasst das Verfahren die Schritte eines kontinuierlichen Erfassens einer Wasserdampfkonzentration beim Zerkleinern und/oder beim Trocknen und eines Verringerns der Wasserdampfkonzentration, wenn ein vorgegebener Schwellenwert überschritten wird. Unter der Wasserdampfkonzentration wird insbesondere ein Anteil an Wasserdampf bezogen auf die Gesamtheit der Bestandteile der Atmosphäre verstanden. Insbesondere wird unter der Wasserdampfkonzentration auch ein Wasserdampf-Partialdruck verstanden. Das Verringern der Wasserdampfkonzentration kann beispielsweise ein Vermindern des Drucks und/oder ein Zuführen von Inertgas umfassen. Der Schwellenwert für die Wasserdampfkonzentration ist vorzugsweise so gewählt, dass unterhalb des Schwellenwerts eine Bildung nennenswerter
10 Mengen von Fluorwasserstoff durch Zersetzung des Leitsalzes, bspw, LiPF_6 , sowie eine Reduktion des Wassers mit metallischem Lithium in nennenswertem Ausmaß unmöglich ist. Diese Kriterien sind bei einem Taupunkt von -40°C erfüllt. Es ist möglich, nicht aber notwendig, dass die Wasserdampfkonzentration direkt gemessen wird, beispielsweise per Spektroskopie, insbesondere Infrarot-
15 Spektroskopie. Es ist beispielsweise auch möglich, dass die Summe der Konzentrationen an Inertgas, Sauerstoff und organischen Verbindungen ermittelt und angenommen wird, dass der Rest aus Wasserdampf besteht.

25 Gemäß einer bevorzugten Ausführungsform umfasst das Verfahren die Schritte eines kontinuierlichen Erfassens einer Sauerstoffkonzentration beim Zerkleinern und/oder beim Trocknen und eines Verringerns der Sauerstoffkonzentration, wenn ein vorgegebener Schwellenwert überschritten wird. Unter der Sauerstoffkonzentration wird insbesondere ein Anteil an Sauerstoff bezogen auf die Gesamtheit der Bestandteile der Atmosphäre verstanden. Insbesondere wird unter
30 der Sauerstoffkonzentration auch ein Sauerstoff-Partialdruck verstanden. Das Verringern der Sauerstoffkonzentration kann beispielsweise ein Vermindern des Drucks und/oder ein Zuführen von Inertgas umfassen. Der Schwellenwert für die Sauerstoffkonzentration ist vorzugsweise so gewählt, dass unterhalb des

- Schwellenwerts eine Explosion unmöglich ist. Es ist möglich, nicht aber notwendig, dass die Sauerstoffkonzentration direkt gemessen wird, beispielsweise per Nernst-Sonde, Lamda-Sonde, mit paramagnetischen Sensoren oder mit einer Widerstandssonde. Es ist beispielsweise auch möglich, dass die Konzentrationen des Sauerstoffs durch die Messung von in Luft mit Sauerstoff vergesellschafteten Gasen, wie bspw. Kohlenstoffdioxid, zu bestimmen, indem angenommen wird, dass Sauerstoff im gleichen Mischungsverhältnis zum gemessenen Gas wie in der Luft vorliegt,
- 5
- 10 Insbesondere umfasst das Verfahren die Schritte (i) beim Trocknen kontinuierliches Überwachen einer Konzentration an organischen Karbonaten in der Atmosphäre der Trockenvorrichtung und (ii) Beenden des Trocknens erst dann, wenn eine untere Explosionsgrenze unterschritten ist. Die untere Explosionsgrenze ist die Konzentration an organischen Bestandteilen, für die gilt, dass nach Füllen
- 15 des Zerkleinerungsguts in einen Behälter in Luft bei 23°C unter 1013 hPa und 80%-Luftfeuchte eine Zündung zu keiner Explosion führt, wohl aber eine höhere Konzentration. Ist diese untere Explosionsgrenze noch nicht unterschritten, wird das Trocknen fortgesetzt.
- 20 Die Konzentration an Inertgas wird vorzugsweise auf zumindest 90 Gew.-%, insbesondere zumindest 95 Gew.-%, vorzugsweise zumindest 97 Gew.-% eingestellt. Die Messung der Konzentration erfolgt beispielsweise spektroskopisch.
- Alternativ oder zusätzlich wird ein Fortschrittsparameter erfasst, der den Fortschritt des Trocknens beschreibt, und das Trocknen wird beendet, wenn der
- 25 Fortschrittsparameter einen vorgegebenen Fortschrittsparameter-Schwellenwert erreicht. Der Fortschrittsparameter ist zu Beginn des Trocknens klein und wächst mit Fortschreiten des Trocknens. Äquivalent dazu ist der Fall, dass der Fortschrittsparameter zu Beginn des Trocknens groß ist und mit Fortschreiten des
- 30 Trocknens abnimmt.

Beispielsweise ist der Fortschrittsparameter die Konzentration an gasförmigem Elektrolyten im abgesaugten Gas. Es ist möglich, nicht aber notwendig, dass da-

zu die Konzentration an gasförmigem Elektrolyten, insbesondere organischen Karbonaten, direkt gemessen wird, beispielsweise per Spektroskopie, insbesondere Infrarot-Spektroskopie. Es ist alternativ oder zusätzlich möglich, dass der Fortschrittsparameter der Kondensat-Strom (gemessen beispielsweise in Volumen, Masse, Gewicht oder Stoffmenge pro Zeiteinheit) an kondensierten Gasbestandteilen in einem etwaig vorhandenen Kondensator ist. Wiederum alternativ ist der Fortschrittsparameter der Druck im Trocknungsbehälter oder der Gasstrom aus dem Trocknungsbehälter. Bei konstanter Pumpleistung hängt der Druck in guter Näherung nur von dem Trocknungsfortschritt und der Temperatur des Zerkleinerungsguts ab. Ist der Elektrolyt weitgehend verdampft, sinkt der Druck. Zudem sinkt der Gasstrom.

Gemäß einer bevorzugten Ausführungsform wird das Zerkleinerungsgut nach dem Trocknen direkt weiterverarbeitet. Insbesondere wird das Zerkleinerungsgut nach dem Trocknen nicht in einen Transportbehälter abgefüllt.. Insbesondere wird das Zerkleinerungsgut nach dem Trocknen mittels einem kontinuierlich oder diskontinuierlich förderndem Förderer zur weiteren Verarbeitung, beispielsweise einer Trennvorrichtung, transportiert. Insbesondere ist der Förderer staubdicht mit dem Trockner verbunden. Beispiele für kontinuierlich fördernde Förderer sind staubdichte Rohrkettenförderer, vorzugsweise mit zwei regelbaren Auslass-Schiebern, Förderbänder, Fördertröge, Förderschnecken, Becherförderer oder semi-kontinuierliche Förderer.

Bevorzugt ist ein Verfahren, bei dem das Trocknen des Zerkleinerungsguts erst beendet wird, wenn sich nach Beenden des Trocknens kein entzündliches oder explosives Gasgemisch über dem abgefüllten Zerkleinerungsgut mehr bilden kann und/oder wenn das Zerkleinerungsgut so trocken ist, dass sich im Transportbehälter oder während der Weiterverarbeitung ein entzündliches oder explosives Gasgemisch ergeben kann. Unter dem Merkmal, dass das Trocknen beendet wird, wenn sich nach Beenden des Trocknens kein entzündliches oder explosives Gasgemisch über dem abgefüllten Zerkleinerungsgut bilden kann, wird insbesondere verstanden, dass sich in einem Transportbehälter in Form eines 50-Literbehälter, der zur Hälfte (bezogen auf sein Volumen) mit dem Zerkleiner-

5 rungsgut gefüllt ist, innerhalb von einer Woche bei 50°C und 1013 hPa kein zündfähiges Gasgemisch bildet. Ob das Kriterium erfüllt ist, wird in Vorversuchen ermittelt. Bildet sich ein zündfähiges Gasgemisch, muss das Trocknen länger und/oder bei niedrigerem Druck durchgeführt werden. Die Vorversuche werden so lange wiederholt, bis eine Trocknungsdauer und/oder ein Trocknungsdruck ermittelt ist, bei der das Merkmal bei einem Testsatz von drei Transportbehälter für alle drei Transportbehälter erfüllt ist.

10 Vorzugsweise wird das Zerkleinerungsgut so lange getrocknet, bis ein Elektrolytgehalt im Zerkleinerungsgut so klein ist, dass eine elektrochemische Reaktion unmöglich ist. In anderen Worten ist der Elektrolytgehalt kleiner als ein Schwellenwert, wobei der Schwellenwert so gewählt ist, dass die Zellspannung bei Unterschreiten dieses Schwellenwerts auf höchstens ein Viertel abgesunken ist. Dieser Schwellenwert wird beispielsweise dadurch bestimmt, dass die Zellen-
15 spannung einer Batterie in Abhängigkeit vom Elektrolytgehalt bestimmt wird. Kurz vor dem Erreichen des Schwellenwerts bricht die Zellspannung zusammen, das heißt, dass sie um zumindest 75% absinkt. Ist der Schwellenwert unterschritten, enthält die Batterie so wenig Elektrolyt, dass in guter Näherung keine elektrochemische Reaktion mehr möglich ist.

20 Vorzugsweise wird das Zerkleinerungsgut so lange getrocknet, dass eine Menge von 50 kg an Zerkleinerungsmaterial, das kompaktiert in einem 50 Liter-Fass enthalten ist, keine oder eine nur so geringe Wärmeentwicklung zeigt, dass ein thermisches Durchgehen, also eine thermisch induzierte Kettenreaktion, für zumindest zwei Monate ausgeschlossen ist und dass eine etwaige Gasentwicklung
25 zudem so gering ausgebildet ist, dass nach zwei Wochen kein Überdruck entsteht, wenn zu Beginn ein Unterdruck von 500 hPa herrscht.

Günstig ist es, wenn das Zerkleinerungsgut so lange getrocknet wird, bis der
30 Elektrolytgehalt an organischen Komponenten, die bei 50°C flüchtig sind, höchstens 3 Gew.-%, höchstens insbesondere 2 Gew.-%, besonders bevorzugt höchstens 1,5 Gew.-%, beträgt.

Vorzugsweise wird das Trocknen so lange durchgeführt, dass der akkumulierte Gehalt an organischen Karbonaten aus dem Elektrolyten, die bei 80°C flüchtig sind, in der Atmosphäre über dem Zerkleinerungsgut 3 Vol.-% unterschreitet.

- 5 Insbesondere wird das Trocknen so lange durchgeführt, bis der Gehalt an Kohlendisäuredimethylester 4 Vol.-%, insbesondere 3 Vol.-%, unterschreitet und/oder der Gehalt an Cyclohexylbenzol 1 Vol.-%, insbesondere 0,5 Vol.-%, unterschreitet.
- 10 Vorzugsweise erfolgt das Trocknen unmittelbar nach dem Zerkleinern. Hierunter wird insbesondere verstanden, dass zwischen dem Beginn des Zerkleinerns der Batterien und dem Zeitpunkt, zu dem zumindest ein Teil des dadurch entstandenen Zerkleinerungsguts anfängt zu Trocknen, höchstens fünf Minuten beträgt, insbesondere höchstens eine Minute. Durch die schnelle Trocknung nach dem
- 15 Zerkleinern wird die Masse an Material klein gehalten, die potentiell elektrochemisch reagieren könnte, zudem wird die elektrochemische Reaktionszeit potentieller exothermer Reaktionen klein gehalten. Das senkt das Risiko für die Anlage und die Umgebung.
- 20 Gemäß einer bevorzugten Ausführungsform wird das Zerkleinerungsgut in der Trockenvorrichtung, insbesondere beim Entnehmen aus der Trockenvorrichtung, mittels eines Rührwerks bewegt. Bei dem Rührwerk kann es sich um die Zerkleinerungseinheit handeln, das ist aber nicht notwendig. Das Rührwerk dient insbesondere zum Verhindern von Verstopfungen und/oder zum Eintrag von Wärme-
- 25 energie in das Zerkleinerungsgut und/oder der Trennung der geschichteten Folien, so dass die Elektrolytverdampfung nicht sterisch behindert wird. Zudem bewirkt der mechanische Energieeintrag eine zumindest teilweise Ablösung der Beschichtung von den Stromsammelfolien. Dadurch entsteht weitere freie Oberfläche der Beschichtungsfragmente, welche die Trocknung begünstigt und die
- 30 folgende Trennung von Beschichtung und Folien erleichtert. Vorzugsweise hat das Rührwerk eine Leistung von zumindest 1 kW pro Kubikmeter Trocknervolumen. Günstig ist es, wenn das Rührwerk zumindest ein Rührblatt aufweist, das so angeordnet ist, dass es das Zerkleinerungsgut nach oben bewegt.

Vorzugsweise wird mittels des Rührwerks mehr als 35%, insbesondere zumindest 50%, einer zum Trocknen des Zerkleinerungsguts notwendigen Verdampfungswärme zugeführt. In anderen Worten ist im Idealfall eine zusätzliche
5 Heizung zum Beheizen des Zerkleinerungsguts entbehrlich. Ist eine solche Heizung vorhanden, ist ihre Leistung vorzugsweise kleiner als die Leistung des Rührwerks. Das Einbringen von Energie in das Zerkleinerungsgut per Rührwerk hat den Vorteil, dass es zu einem Trennen beispielsweise von Beschichtung und Trägerfolie und anderen Komponenten der Batterie kommt.

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Das Rührwerk hat vorzugsweise eine Leistung von zumindest 1 Kilowatt pro Kubikmeter an Volumen der Trockenvorrichtung.

Vorzugsweise besitzt die Trockenvorrichtung eine Heizung, die welche die Wärme aus der Wärmeabfuhr der zumindest einen Vakuumpumpe und/oder des
15 Kondensators bezieht. Durch das Kondensieren des Elektrolyten im Kondensator entsteht Kondensationswärme. Im Kondensator kann daher eine Temperatur von zumindest 60°C herrschen. Die Wärme wird beispielsweise mittels eines Wärmeübertragungsfluids, insbesondere eines Gases oder einer Flüssigkeit,
20 übertragen. Beispielsweise wird das Wärmeübertragungsfluids zum Heizen einer Außenwand der Trockenvorrichtung verwendet.

Ein unabhängiger Gegenstand der vorliegenden Erfindung ist ein Verfahren zum Behandeln gebrauchter Lithium-Batterien mit den Schritten (a) Zerkleinern
25 der Batterien, sodass Zerkleinerungsgut erhalten wird, und (b) Trocknen des Zerkleinerungsguts, sodass Elektrolyt der Batterie verdampft, wobei (c) die zum Verdampfungswärme zu zumindest 50% mittels mechanischer Energie in das Zerkleinerungsgut eingebracht wird. Insbesondere wird die mechanische Energie mittels einer Zerkleinerungseinheit und/oder eines Rührwerks in das Zerkleinerungsgut eingebracht. Besonders günstig ist es, wenn das das Trocknen bei einem Druck von höchstens 300 hPa und höchstens 80 °C erfolgt, das ist aber
30 nicht notwendig. Die in der Beschreibung genannten bevorzugten Ausführungsformen beziehen sich auch auf diesen Aspekt der Erfindung.

Vorzugsweise wird das Zerkleinern und das Trocknen in nur einem Behälter, insbesondere der Zerkleinerungsvorrichtung, durchgeführt. In anderen Worten finden das Zerkleinern und das Trocknen im Unterdruck gleichzeitig in einem Behälter statt. Vorteilhaft hieran ist, dass die mechanische Energie, die zum Zerkleinern zugeführt wird und in Wärmeenergie umgewandelt wird, beim Verdampfen des Elektrolyten aufgenommen und so abgeführt wird. So wird einerseits eine übermäßige Erwärmung des Zerkleinerungsguts verhindert, andererseits ist eine Heizung zum Trocknen entbehrlich.

Besonders günstig ist es, wenn das Vakuum von einem Absolutdruck von höchstens 300 hPa mittels einer Strahlpumpe erzeugt wird. Strahlpumpen sind, insbesondere bei geeigneter Wahl des Strahlmediums, weitgehend unempfindlich gegen aggressive abzupumpende Gase. Günstig ist es, wenn das Strahlmedium, das eine Flüssigkeit ist, einen pH-Wert von zumindest 8, insbesondere von zumindest 9, beispielsweise zumindest 12, hat. In diesem Fall können sich unerwünschte Bestandteile des Gases, das abgepumpt wird, zersetzen oder zu weniger schädlichen Substanzen reagieren. So kann beispielsweise Kohlensäuredimethylester und/oder Kohlensäureethylmethylester durch eine Verseifungsreaktion abgebaut werden. Etwaig im Strahlmedium enthaltener Fluorwasserstoff kann im basischen Milieu in einer Säure-Base-Reaktion zu einem ungefährlichen Salz umgesetzt werden.

Vorzugsweise enthält das Strahlmedium eine Fluor fällende Substanz. Beispielsweise kann das Strahlmedium Natriumkarbonat, Kaliumkarbonat oder Calciumkarbonat enthalten. Die bei der Reaktion mit einer Fluorverbindung, insbesondere Fluorwasserstoff, entstehenden Salze werden vorzugsweise abgetrennt, insbesondere abgefiltert oder aussedimentiert. Auf diese Weise wird zumindest weitgehend verhindert, dass Fluorwasserstoff oder andere giftige fluorhaltige Verbindungen in die Umgebung abgegeben werden können.

Vorzugsweise erfolgt das Trocknen bei einer Temperatur von höchstens 80°C. In diesem Fall entsteht kaum Fluorwasserstoff. Das erhöht die Lebensdauer der

Batterie-Verarbeitungsanlage und verringert die Umweltgefährdung.

Gemäß einer bevorzugten Ausführungsform umfasst das Verfahren die Schritte des Kondensierens von Bestandteilen des Elektrolyten durch Abkühlen und/oder Druckerhöhen, sodass ein Elektrolytkondensat entsteht. Beispielsweise wird das Kondensieren an einer Stelle durchgeführt, die bezüglich des Gasflusses zwischen dem Trockner und der Vakuumpumpe liegt. Vom Trockner kommende Gase müssen daher in diesem Fall zunächst einen Kondensator passieren, bevor sie zur Vakuumpumpe gelangen können. Das führt dazu, dass gasförmiger Elektrolyt, der in dem Gas vorliegt, das beim Trocknen entsteht, zumindest zu einem überwiegenden Teil im Kondensator abgeschieden wird, bevor das verbleibende Gas zur Pumpe gelangt. So kann Elektrolyt zurückgewonnen werden. Zudem verringert sich der Gasstrom durch die Vakuumpumpe, was deren Lebensdauer verlängert und deren Energieverbrauch reduziert.

15

Gemäß einer bevorzugten Ausführungsform umfasst das Verfahren alternativ den Schritt der Gasreinigung durch Adsorption der flüchtigen organischen Bestandteile an einem Aktivkohlefilter vor oder nach der Verdichtereinheit.

20 Vorzugsweise umfasst das erfindungsgemäße Verfahren alternativ oder zusätzlich den Schritt eines Reinigens des Gases, das beim Trocknen entsteht, bevor dieses die Vakuumpumpe erreicht. Das kann beispielsweise auch dadurch erfolgen, dass das Gas einen Aktivkohlefilter und/oder einen Filter passiert, in dem mit Fluorwasserstoff reagierende Substanzen enthalten sind, beispielsweise ein

25 Calciumsalz wie Calciumkarbonat oder ein Kaliumsalz wie Kaliumkarbonat.

Vorzugsweise wird das Hochtemperatur-Trocknen, bei dem sich der Binder zersetzt, so durchgeführt, dass die entstehenden Zersetzungsgase sich nicht mit den Gasen mischen, die beim Niedrigtemperatur-Trocknen entstehen. Es ist

30 möglich, dass das Hochtemperatur-Trocknen und das Niedertemperatur-Trocknen bei unterschiedlichen Drücken erfolgt. Beispielsweise kann das Hochtemperatur-Trocknen bei Normaldruck erfolgen.

Unter dem Aktivmaterial wird der Stoff verstanden, der beim Betrieb der Batterien elektrochemisch reagiert. Unter dem Träger für das Aktivmaterial wird insbesondere eine Trägerfolie verstanden, auf der das Aktivmaterial in Form von Partikeln aufgebracht ist. Beispielsweise handelt es sich bei der Trägerfolie um eine Folie aus Aluminium oder eine Aluminiumlegierung. Der Binder ist der Stoff, der das Aktivmaterial mit dem Träger verbindet, beispielsweise enthält der Binder Polyvinylidenfluorid.

Günstig ist es, wenn beim Zerkleinern der Batterien flüssiger Stickstoff zugegeben wird. Das kühlt die Zerkleinerungsmaschine und das Zerkleinerungsgut und verdrängt zudem Sauerstoff und Wasserdampf aus der Atmosphäre.

Günstig ist es, wenn das Zerkleinern bei dem Taupunkt - 40 °C und/oder einem Sauerstoff-Partialdruck von höchstens 40 hPa, insbesondere höchstens 15 hPa erfolgt.

Gemäß einer bevorzugten Ausführungsform umfasst das Verfahren die Schritte eines Abtrennens von Hartteilen und/oder eines Separierens von Aktivmaterial vom Träger, insbesondere durch eine zweite Zerkleinerungsstufe und/oder Luftstrahlsieben, sodass eine Aktivmaterialfraktion und eine Trägerfraktion entstehen, und eines getrennten Verpackens von Aktivmaterialfraktion und Trägerfraktion in jeweilige Transportbehältnisse. Günstig ist es, wenn diese Transportbehältnisse luftdicht ausgebildet sind. Durch das Trennen von Aktivmaterialfraktion und Trägerfraktion ist ein Transport in der Regel ohne Genehmigungen möglich. Ein weiterer Vorteil ist, dass derartig getrennte Fraktionen nur eine geringe Gefährdung darstellen.

Das Entnehmen des Zerkleinerungsguts aus dem Transportbehälter erfolgt vorzugsweise unter Vakuum und/oder unter Schutzgas.

Es ist möglich, nicht aber notwendig, dass das Zerkleinerungsgut unter Vakuum in den Transportbehälter abgefüllt wird. Günstig ist es, wenn der Transportbehälter ein Vakuumbehälter ist, insbesondere ein evakuierter Vakuum-

behälter, sodass im Transportbehälter nach dem Verschließen ein Unterdruck oder Vakuum herrscht. Alternativ kann der Transportbehälter mit einem Inertgas gefüllt werden.

- 5 Gemäß einer bevorzugten Ausführungsform wird das Verfahren so durchgeführt, dass ein Druck von 100 hPa für zumindest eine Minute unterschritten wird.

10 In einer bevorzugten Batterie-Verarbeitungsanlage sind die Trennungseinheit und die Trockenvorrichtung in einem gemeinsamen Standard-Container angeordnet. Das hat den Vorteil, dass die Batterie-Verarbeitungsanlage besonders einfach transportiert werden kann.

15 Die Trockenvorrichtung ist eingerichtet zum Trocknen des Zerkleinerungsguts für eine so lange Zeit, bis ein Elektrolytgehalt so klein ist, dass eine elektrochemische Reaktion unmöglich ist. Wird die Trockenvorrichtung im Chargenbetrieb betrieben, was eine mögliche Ausführungsform darstellt, so wird das Trocknen beispielsweise für eine vorgegebene Zeitspanne durchgeführt. Alternativ oder zusätzlich wird der Gehalt an organischen Substanzen, beispielsweise an organischen Carbonaten, in der Atmosphäre in der Trockenvorrichtung kontinuierlich gemessen und das Trocknen beendet, wenn eine vorgegebene Schwellen-Konzentration unterschritten wird.

25 Gemäß einer bevorzugten Ausführungsform umfasst die Batterie-Verarbeitungsanlage, insbesondere die Vakuumanlage, einen Kondensator, der eingerichtet ist zum Kondensieren von organischen Bestandteilen der Atmosphäre im Trockner, insbesondere von organischen Carbonaten, beispielsweise von Dimethylcarbonat, Ethylmethylcarbonat und/oder Ethylencarbonat. Der Kondensator kann auch als Kondensiervorrichtung oder als Verflüssiger bezeichnet werden. Vorzugsweise ist der Kondensator in Materialflussrichtung hinter einer Vakuumpumpe angeordnet, mittels der der Trockner evakuiert wird. Günstig ist es, wenn
30 der Kondensator gekühlt ist, vorzugsweise auf eine Temperatur von höchstens 90°C, vorzugsweise höchstens 80°C, insbesondere höchstens 70°C. Um den Kühlaufwand klein zu halten wird der Kondensator, sofern er gekühlt wird, auf

eine Temperatur von zumindest -10°C , insbesondere zumindest 10°C , gekühlt.

Günstig ist es, wenn die Trockenvorrichtung ein Rührwerk aufweist, beispielsweise einen Ankerrührer oder einen Stabrührer, dessen Rührstäbe quer zu einer
5 Rührwelle angebracht sein können. Alternativ oder zusätzlich ist das Rührwerk ein externes Rührwerk, das den Trockner als Ganzes bewegt.

Die Batterie-Verarbeitungsanlage besitzt eine Vakuumanlage, die mit der Trockenvorrichtung zum Erzeugen eines Vakuums in der Trockenvorrichtung verbunden ist. Besonders günstig ist es, wenn auch die Vakuumanlage im Standard-Container angeordnet ist. Bei dem Standard-Container handelt es sich vorzugsweise um einen Container nach ISO-Norm 668, vorzugsweise um einen 40-Fuß-Container oder einen 20-Fuß-Container.

15 Beispielweise umfasst die Vakuumanlage eine Strahlpumpe, bei der ein Strahlmedium zum Erzeugen des Unterdrucks verwendet wird.

Günstig ist es, wenn die Zerkleinerungseinheit in der Trockenvorrichtung angeordnet ist. Es existiert in anderen Worten in diesem Fall ein Behälter, in dem die
20 Batterien sowohl zerkleinert werden und in dem das Zerkleinerungsgut getrocknet wird. Beide Prozesse laufen simultan und unter Vakuum ab. In diesem Fall ist ein Rührwerk entbehrlich.

Vorzugsweise umfasst die Batterie-Verarbeitungsanlage eine Hartmetallabtrennvorrichtung und/oder eine Leichtfraktionabtrennvorrichtung, eine Separiervorrichtung, insbesondere eine Klassiervorrichtung, zum Separieren von Aktivmaterial vom Träger, insbesondere durch eine zweite Zerkleinerungsstufe und/oder Luftstrahlsieben, sodass eine Aktivmaterialfraktion und eine Trägerfraktion entsteht, und vorzugsweise eine zweite Abfüllvorrichtung zum getrennten Abfüllen von Aktivmaterialfraktion und Trägerfraktion. Günstig ist es, wenn diese Abfüllvorrichtung zum Abfüllen unter Unterdruck und/oder unter Inertgas mindestens jedoch
30 staubdicht ausgebildet ist.

Unter einer Hartmetallabtrennvorrichtung wird insbesondere eine Vorrichtung zur Abtrennung von Fragmenten peripherer Bestandteile des Betriebssystems, der Batteriezellhülle und der Strom-Kontakte verstanden. Beispielsweise umfasst die Hartmetallabtrennvorrichtung eine Magnetseparationsvorrichtung und/oder einen
5 Sieb, insbesondere einen Querstromsieb und/oder einen Zickzack-Sieb. Unter der Separiervorrichtung wird insbesondere eine Vorrichtung zum zur Abtrennen der Separatorfolie verstanden.

Die Leichtfraktionabtrennvorrichtung umfasst vorzugsweise einen Zickzack-
10 Sieb und/oder einen Lufttrenner, wobei es günstig ist, wenn die Luft im Kreislauf geführt wird. Das reduziert die Staubexposition der Umwelt mit gesundheitsschädlichem Staub.

Vorzugsweise sind die zweite Abfüllvorrichtung und die Separiervorrichtungen in
15 einem gemeinsamen Standard-Container angeordnet, beispielsweise im oben beschriebenen ersten Standard-Container, oder einem zweiten Standard-Container. Günstig ist es, wenn der Container staubdicht gekapselt ist.

Vorzugsweise umfasst die Batterie-Verarbeitungsanlage eine Schleuse zwischen
20 der Zerkleinerungseinheit und der Inaktivierungsvorrichtung, insbesondere der Trocknungsvorrichtung. Beispielsweise handelt es sich um eine Zellenradschleuse oder einen Flachschieber. Durch die Schleuse wird der Gaseintrag in die Inaktivierungsvorrichtung, insbesondere die Trocknungsvorrichtung, vermindert. Die Schleuse ist vorzugsweise als Dosierschleuse ausgebildet. So kann die In-
25 aktivierungseinheit während des Betriebes der Zerkleinerungseinheit evakuiert werden.

Wenn das Zerkleinern und das Trocknen in unterschiedlichen Behältern durchgeführt werden, besitzt die Batterie-Verarbeitungsanlage vorzugsweise eine
30 staubdichte, insbesondere eine gasdichte, Fördervorrichtung, die die Zerkleinerungsvorrichtung und die Trockenvorrichtung miteinander verbindet. Als staubdicht wird eine Fördervorrichtung insbesondere dann betrachtet, wenn höchstens 5 Gew.-% aller Partikel mit einem Durchmesser von zumindest 0,1 Mikro-

meter die Fördervorrichtung in die Umgebung verlassen.

Um die Trockenzeit zwischen Beginn und Ende des Trocknens zu verringern, ist es günstig, wenn die Trockenvorrichtung eine Heizung umfasst. Es kann sich bei
5 der Heizung um eine konduktive oder eine konvektive Heizung handeln, welche vorzugsweise die Kompressionswärme der Pumpen und die Kondensationswärme in den Trockner einbringt.

Es hat sich herausgestellt, dass die Qualität des zurückgewonnenen Elektrolyten
10 besonders hoch ist, wenn die Trockenvorrichtung zumindest eine trockenlaufende Vakuumpumpe, vorzugsweise ausschließlich trockenlaufende Vakuumpumpen, aufweist.

Die Pumpleistung der Vakuumanlage beträgt bei 300 hPa zumindest das Fünf-
15 zigfache des Volumens des Innenraums der Trockenvorrichtung pro Stunde. Auf diese Weise kann die Trockenzeit klein gehalten werden.

Die Trockenzeit lässt sich zudem vermindern, wenn – wie gemäß einer bevorzugten Ausführungsform vorgesehen – die Trockenvorrichtung zumindest zwei
20 Vakuumpumpen aufweist, die sich in ihrem Volumenstrom bei 400 hPa und ihrem maximal erreichbaren Minimaldruck unterscheiden. So hat eine der beiden Vakuumpumpen vorzugsweise eine hohe Volumenstromleistung (gemessen in Litern pro Sekunde bei 400 hPa), aber einen geringeren Minimaldruck. Der maximal erreichbare Minimaldruck ist der kleinste Druck, der mit der Pumpe er-
25 reichbar ist. Es ist dann möglich, die Pumpen in ihren optimalen Arbeitsbereichen einzusetzen. Die in Materialflussrichtung ersten Pumpen gewährleisten einen hohen Volumenstrom bei niedrigen Drücken, während nachgelagerte Pumpen kleinere Volumenströme gegen Umgebungsdruck verdichten.

Beispielsweise besitzt die Vakuumanlage zumindest eine trocken laufende Wälzkolbenpumpe und/oder zumindest eine trocken laufende Schraubenvakuumpumpe.
30

Die Zerkleinerungseinheit besitzt vorzugsweise ein Bodensieb zum Begrenzen der maximalen Größe des Zerkleinerungsguts. Das erleichtert die Weiterverarbeitung des Zerkleinerungsguts und vermindert die Gefahr einer Nachträglichen Erhitzung und Selbstentzündung des Zerkleinerungsgutes durch Kurzschlüsse von Batteriefragmenten. Vorzugsweise hat das Bodensieb eine Maschenweite von höchstens 35 mm.

Zum Zuführen von Inertgas zur Trockenvorrichtung besitzt diese vorzugsweise ein Zulassventil, das mit einer Inertgas-Versorgungsvorrichtung zum Zuführen von Inertgas in einen Innenraum der Trockenvorrichtung verbunden ist. Insbesondere wird verflüssigtes, also bei 22°C und 1013 hPa gasförmigem, Inertgas mit einer Temperatur von höchstens -30°C zugeführt. Zum gleichen Zweck besitzt die Zerkleinerungsvorrichtung alternativ oder zusätzlich ein Zuführventil, das mit einer Inertgas-Versorgungsvorrichtung zum Zuführen von Inertgas in einen Innenraum der Zerkleinerungsvorrichtung verbunden ist. Die Inertgas-Versorgungsvorrichtung ist vorzugsweise zum Bereitstellen von verflüssigtem Inertgas.

Zum Messen einer Sauerstoffkonzentration, insbesondere zum Ermitteln, ob eine Explosionsgrenze überschritten ist, besitzt die Zerkleinerungseinheit eine Sauerstoff-Erfassungsvorrichtung zum Erfassen einer Sauerstoffkonzentration in der Zerkleinerungseinheit.

Die Batterie-Verarbeitungsanlage kann eine Verbrennungsvorrichtung zur thermischen oder katalytischen Verbrennung von gasförmigen Bestandteilen des Elektrolyten besitzen. Diese ist vorzugsweise in Materialflussrichtung hinter dem Kondensator und/oder vor einer Abgasöffnung angeordnet. So werden keine Bestandteile des Elektrolyten durch die Abgasöffnung in die Umgebung entlassen.

Vorzugsweise besitzt die Batterie-Verarbeitungsanlage eine Partikel-Entfernvorrichtung zum Entfernen von Partikeln aus dem aus der Trockenvorrichtung abgezogenen Gasstrom. Die Partikel-Entfernvorrichtung kann zum Beispiel einen Zyklon und/oder einen Filter und/oder Aktivkohle umfassen.

Im Folgenden wird die Erfindung anhand der beigefügten Zeichnungen näher erläutert. Dabei zeigt

- 5 Figur 1 ein Ablaufdiagramm eines erfindungsgemäßen Verfahrens,
- Figur 2 einen Querschnitt durch eine erfindungsgemäße Batterie-
Verarbeitungsanlage und
- 10 Figur 3 einen Querschnitt durch weitere, optionale Bestandteile einer erfindungsgemäßen Batterie-Verarbeitungsanlage.
- Figur 4 zeigt ein Ablaufdiagramm eines erfindungsgemäßen Verfahrens
gemäß einer zweiten Ausführungsform.

15

Figur 1 zeigt das Ablaufdiagramm eines erfindungsgemäßen Verfahrens. Zunächst werden Batterien 10.1, 10.2, ..., insbesondere Batteriesysteme bestehend aus mehreren Batteriemodulen oder Batteriestacks, welche wiederum aus mehreren Batteriezellen bestehen, in einer Entladeeinheit 12 entladen. Danach
20 folgt an einer Demontagestation 14 die Demontage der Batterien 10, wenn diese erforderlich ist, weil die Batteriesysteme ansonsten aus geometrischen oder gravimetrischen Gründen nicht in die Zerkleinerungseinheit befördert werden können. Dazu werden die Batteriesysteme geöffnet und soweit demontiert, dass die
25 Module/Stacks einzeln entfernt werden können. Gegebenenfalls können auch die Zellen von der Ansteuerelektronik getrennt werden. Die entstehenden Untereinheiten (Module/Stacks) und/oder Zellen 16.1, 16.2, ... werden einer Zerkleinerungseinheit 18 zugeführt, die beispielsweise eine Rotorschere mit einem Rotor und einen Zerkleinerer mit Statoren oder mehreren Rotoren, oder eine Schneidmühle mit einem Rotor und mehreren Rotoren umfasst.

30

Die Zerkleinerungseinheit 18 zerkleinert die Batterien 10 unter Schutzgas 20, das beispielsweise einer Schutzgasflasche entnommen wird. Alternativ oder zusätzlich kann flüssiger Stickstoff aus einer Flüssigstickstoffquelle 19 zugeführt werden. Bei dem Schutzgas kann es sich beispielsweise um Stickstoff, ein Edel-

gas, Kohlendioxid, Lachgas oder ein sonstiges, vorzugweise nicht giftiges Gas handeln.

Beim Zerkleinern entsteht Zerkleinerungsgut 24, das einer Inaktivierungsvorrichtung in Form einer Trockenvorrichtung 26 zugeführt wird. Zwischen der Zerkleinerungseinheit 18 und der Trockenvorrichtung 26 ist eine Schleuse 28 angeordnet, die soweit gasdicht ist, dass die Druckvorrichtung 26 in guter Näherung von der Zerkleinerungseinheit 18 gasdicht getrennt ist.

Die Trockenvorrichtung 26 ist mit einer Vakuumanlage 29 verbunden, die eine Vakuumpumpe 30 aufweist und ein Vakuum erzeugt. In der Trockenvorrichtung 26 herrscht ein Druck p_{26} von $p_{26} \approx 100$ hPa, zeitweise unter 50 hPa. Es sei darauf hingewiesen, dass im Rahmen der vorliegenden Beschreibung unter einer Vakuumpumpe insbesondere ganz allgemein eine Vorrichtung verstanden wird, die ein Vakuum erzeugt. Es ist dabei möglich und bevorzugt, nicht aber notwendig, dass die Vakuumpumpe gleichzeitig als Verdichter wirkt, so dass von ihr Gas unter einem Druck abgegeben wird, der größer ist als der Umgebungsdruck.

In dem in Figur 1 gezeigten Fall handelt es sich bei der Vakuumpumpe um einen Verdichter, der Gas 31, das in der Trockenvorrichtung 26 vorliegt, ansaugt und verdichtet. Alternativ oder zusätzlich kann die Vakuumanlage 29 eine Strahlpumpe aufweisen, bei der ein Strahlmedium in Form einer Flüssigkeit mit hoher Geschwindigkeit durch Venturi-Düse geleitet wird. Das Strahlmedium ist alkalisch und hat einen pH-Wert von zumindest pH 13 und ist beispielsweise eine 10%ige Kaliumhydroxidlösung.

Die Vakuumanlage 29 umfasst eine Gasreinigungsvorrichtung 32, die zwischen der Trockenvorrichtung 26 und der Vakuumpumpe 30 angeordnet ist und die im vorliegenden Fall einen Kondensator 34 und/oder einen Aktivkohlefilter 36 umfasst. Der Kondensator wird bei einer Temperatur von -10 °C betrieben, so dass Kohlendäuredimethylester und Kohlendäureethylmethylester kondensieren und in einen Kondensatbehälter 38 abgegeben werden können. Zudem wird etwaig vorhandenes Wasser ausgefroren. Ein Steuerventil 40 ist ausgebildet zum Öff-

nen, wenn der Druck p_{26} zu groß wird und zum Zufahren, wenn Pumpenkreislauf und Trocknungsbehälter entkoppelt werden sollen.

Vorzugsweise ist das Trocknungsgut während der Trocknung bewegt. Dies kann
5 beispielsweise durch Rühren mit einem Rührwerk 41, wie einem Ankerrührer oder einem Stabrührer mit senkrecht zur Rührwelle angebrachten Stäben passieren. Alternativ durch einen bewegten Trocknungsbehälter.

Durch das Trocknen des Zerkleinerungsguts entsteht inaktiviertes Zerkleinerungsgut 42, das einer Abfüllvorrichtung 44 zugeführt wird. Dort wird das inaktivierte Zerkleinerungsgut 42 unter Vakuum und/oder unter Schutzgas in einen
10 Transportbehälter 46 abgefüllt. Der Transportbehälter 46 ist vorzugsweise gasdicht. Es ist möglich, nicht aber notwendig, dass der Transportbehälter 46 vor dem Abtransport mit Inertgas aufgefüllt wird, so dass er unter Normaldruck steht.

15 Alternativ ist es auch möglich, dass der Transportbehälter unter Vakuum verschlossen und transportiert wird. Es ist möglich, dass alternativ zum Transportbehälter eine vakuumverschweißte Folie, beispielsweise eine Aluminiumverbundfolie, gewählt wird.

20 Über eine Spülleitung 48 wird der Zerkleinerungseinheit 18 Schutzgas 20 von der Vakuumpumpe 30 zugeführt. Arbeitet die Vakuumpumpe 30 wie im vorliegenden Fall, der eine bevorzugte Ausführungsform darstellt, zudem als Kompressor, kann das Schutzgas auf eine Druckgasflasche 50 gezogen werden. Alternativ oder zusätzlich kann das Schutzgas 20, gegebenenfalls nach zusätzlicher
25 Reinigung, in die Umgebung abgegeben werden.

Figur 2 zeigt schematisch einen Querschnitt durch eine erfindungsgemäße Batterie-Verarbeitungsanlage 52 (vgl. Figur 1), die einen Standard-Container 54 aufweist, in dem die Zerkleinerungseinheit 18, die Trockenvorrichtung 26 und die
30 Abfüllvorrichtung 44 angeordnet sind. Hinter der Zerkleinerungseinheit 18 ist ein erster gasdichter Förderer 56 angeordnet, der beispielsweise eine Förderschnecken oder einen Rohrkettenförderer umfasst. Der erste Förderer 56 fördert das Zerkleinerungsgut 24 zur Trockenvorrichtung 26, die mit der in Figur 2 nicht

sichtbaren Vakuum-Erzeugungsvorrichtung verbunden ist. In Materialstromrichtung hinter der Trockenvorrichtung 26 ist ein zweiter Förderer 58 angeordnet, der vorzugsweise ebenfalls gasdicht ausgebildet ist und eine Förderschnecke oder einen Rohrkettentransporter enthalten kann. Der zweite Förderer fördert das inaktivierte Zerkleinerungsgut 42 zur Abfüllvorrichtung 44.

Figur 3 zeigt optionale, in der vorliegenden Ausführungsform vorhandene Einheiten der erfindungsgemäßen Batterie-Verarbeitungsanlage 52 (vgl. Figur 1), die einen Aufschlusszerkleinerer 60 sowie einen Sieb 62 umfasst. Der Aufschlusszerkleinerer 60 enthält eine Transportbehälter-Entleervorrichtung 64, mittels der aus dem Transportbehälter 46 inaktiviertes Zerkleinerungsgut 42 entnommen werden kann. Der Aufschlusszerkleinerer 60 erzeugt Aufschlussmaterial 66, das dem Sieb 62 zugeführt wird. Es kann sich bei dem Sieb beispielsweise um einen Zickzack-Sieb handeln.

Vorzugsweise umfasst die Batterie-Verarbeitungsanlage 52 einen Zerkleinerer, der vorzugsweise im Materialfluss vor der Klassiervorrichtung 74 steht und ein schnell laufendes Zerkleinerungswerkzeug enthält, wobei eine Rotorumfangsgeschwindigkeit größer ist als 1 m/s, vorzugsweise größer als 10 m/s. Dieser Zerkleinerer zerkleinert das Zerkleinerungsmaterial und beansprucht es mechanisch so, dass sich die elektrochemisch aktive Beschichtung mindestens teilweise vom Träger löst. Das Vorhandensein eines solchen Zerkleinerers ist ein allgemeines bevorzugtes Merkmal einer erfindungsgemäßen Batterie-Verarbeitungsanlage.

Im Sieb entstehen eine Leichtfraktion mit Separatorfolie und feinem Beschichtungsmaterial und eine Schwergutfraktion mit Trägerfolien (Aluminium- und Kupfer) mit größerem leicht anhaftender Beschichtung. Beide Fraktionen werden auf jeweils ein Sieb zur weiteren Trennung in Beschichtung und Separatorfolie beziehungsweise Beschichtung und Metallfolien gegeben. Die entstehenden Fraktionen werden getrennt weiter verarbeitet.

Das Aufschlussmaterial 66 wird dem Sieb 62 mittels einem dritten Förderer 68

zugeführt. Ein vierter Förderer 70 führt gesichtetes Material 72, insbesondere das Material der Leichtfraktion und das Material der Schwerfraktion, das den Siehter 62 verlässt, einer oder zwei Klassiervorrichtungen 74 zu. Die Klassiervorrichtung 74 umfasst vorzugsweise ein Luftstrahlsieb, das gleichzeitig als

5 Trennvorrichtung im Falle der Schwerfraktion zum Trennen des Aktivmaterials von dem Träger fungiert. Im Falle der Leichtfraktion wird das Aktivmaterial vom Separator getrennt. Durch das Trennen entsteht eine Aktivmaterialfraktion 76, die in ein Transportbehältnis 78 abgefüllt wird.

10 Es entsteht zudem eine Trägerfraktion (Schwergut) 80 und eine Separatorfraktion (Leichtgut), die in der vorliegenden Ausführungsform mit einem fünften Förderer 82 einer Abfülleinheit 84 zugeführt wird, die die Trägerfraktion 80 in einen Behälter 86 füllt. Die Abfülleinheit 84 ist zusammen mit einer zweiten Abfülleinheit 88 Teil einer zweiten Abfüllvorrichtung.

15

Figur 4 zeigt ein Flussdiagramm einer zweiten erfindungsgemäßen Batterie-Verarbeitungsanlage 52, die zwei Trockenvorrichtungen 26.1, 26.2 aufweist. Jede der Trockenvorrichtungen 26.1, 26.2 besitzt jeweils ein Rührwerk 41.1 bzw. 41.2. In Materialflussrichtung vor der Zerkleinerungseinheit 18 befindet sich die

20 Schleuse 27, die im vorliegenden Fall als Dosierschleuse ausgebildet ist und mit welcher die Zerkleinerungseinheit 18 befüllt werden kann, ohne dass die Gasatmosphäre im Zerkleinerer mit Umgebungsluft vermischt wird. In Materialflussrichtung hinter der Zerkleinerungseinheit 18 befindet sich die Schleuse 28, die im vorliegenden Fall als Dosierschleuse ausgebildet ist und mittels der die Trockenvorrichtungen 26.1, 26.2 einzeln oder simultan beschickt werden können.

25

Jedes der Rührwerke 41.1, 41.2 besitzt eine Leistung von zumindest 4 kW, im vorliegenden Fall 5 kW pro Kubikmeter Trockenvolumen. Die eingebrachte mechanische Energie wird auf das in der jeweiligen Trockenvorrichtung 26.1, 26.2

30 enthaltene Zerkleinerungsgut 24 übertragen. Ein Teil der mechanischen Energie führt zur Trennung von Bestandteilen des Zerkleinerungsguts, beispielsweise zu einer Trennung von Beschichtungsmaterial von der Trägerfolie. Der überwiegende Teil der mechanischen Leistung wird jedoch in Wärmeenergie umgewandelt.

Diese Wärmeenergie wird von dem verdampfenden Elektrolyten, der noch Bestandteil des Zerkleinerungsguts 24 ist, aufgenommen.

- Die in den Trockenvorrichtungen 26.i ($i = 1, 2$) entstehenden Gase werden zu-
- 5 nächst mittels einer Partikel-Entfernvorrichtung 90 von mitgerissenen Partikeln gereinigt. Die Partikel werden in einem Behälter 92 aufgefangen oder direkt weiterverarbeitet. Bei der Partikelentfernvorrichtung 90 kann es sich beispielsweise um einen Filter und/oder einen Zyklon handeln.
- 10 In Strömungsrichtung hinter der Partikelentfernvorrichtung 90 ist die Vakuumpumpe 30 angeordnet. Günstig ist es, wenn in Gas-Strömungsrichtung hinter der Vakuumpumpe 30 oder parallel dazu mindestens eine zweite Pumpe anderer Bauart angeordnet ist.
- 15 Hinter der Vakuumpumpe 30 ist der Kondensator 34 angeordnet, in dem ein Druck p_{34} herrscht. Der Druck p_{34} entspricht im Wesentlichen dem Umgebungsdruck, das heißt, dass er beispielsweise um höchstens 100 hPa vom Umgebungsdruck abweicht. Da der Druck p_{34} deutlich größer ist als der Druck p_{26} in den Trockenvorrichtungen 26.1, 26.2, kondensieren insbesondere die Carbon-
- 20 säureester, insbesondere Dimethylcarbonat, Propylencarbonat, Diethylcarbonat, Ethylencarbonat und Ethylmethylcarbonat, aus. Die entstehende Kondensationswärme wird durch Kühlung abgeführt. Dabei ist es möglich, dass der Kondensator auf eine Temperatur T_{34} gekühlt wird, die sich um weniger als 20 Kelvin von der Umgebungstemperatur $T_{\text{Um}}g$ unterscheidet. Das hat den Vorteil,
- 25 dass der Energieaufwand für das Trocknen des Zerkleinerungsgutes 24 vergleichsweise gering ist und gleichzeitig viel Elektrolyt zurückgewonnen werden kann.
- In Materialflussrichtung hinter dem Kondensator 34 kann ein Aktivkohlefilter 36
- 30 angeordnet sein, das ist aber nicht notwendig. Es ist zudem möglich, dass in Strömungsrichtung hinter dem Kondensator 34 eine Oxidationsvorrichtung 94 angeordnet ist, mittels der verbleibenden Reste oxidierbaren Materials, insbesondere von organischen Bestandteilen des Elektrolyten, katalytisch oder ther-

misch oxidiert werden, sodass das aus der Oxidationsvorrichtung 94 austretende Gas gefahrlos in die Umgebung abgegeben werden kann.

Es ist möglich, dass die Batterieverarbeitungsanlage 52 eine Abfüllvorrichtung 44 aufweist, mittels der das getrocknete Zerkleinerungsgut 24 in Form des inaktiven Zerkleinerungsgutes 42 in einen Transportbehälter 46 abgefüllt werden kann. Es ist aber auch möglich, dass die Batterieverarbeitungsanlage 52 keine solche Abfüllvorrichtung 44 aufweist.

Die Trockenvorrichtung 26.1, 26.2 (es ist auch möglich, dass die Batterieverarbeitungsanlage in dieser Ausführungsform lediglich eine Trockenvorrichtung 26 aufweist) besitzen jeweils eine Ausgangs-Schleuse 96.1, 96.2 in Form einer Dosier- und Umlenkschleuse. Das inaktive Zerkleinerungsgut 42 wird beispielsweise in einem Silo 98 zwischengelagert oder direkt einem Schwergutabscheider 100 zugeführt. Der Schwergutabscheider 100 ist ausgebildet zum Abscheiden von Material mit einer Dichte von zumindest 2,6 Gramm pro Kubikzentimeter, insbesondere Aluminium- und/oder Eisenbestandteile.

Nachfolgend wird das verbleibende Material in einem Zerkleinerer 102 weiter zerkleinert und danach in einem Sieb 62 klassiert in Leichtgut 108 (Separator und Beschichtungsmaterial) und in Schwergut 110 (Trägerfolien und Beschichtungsmaterial). Beide Fraktionen werden gesiebt 74.1, 74.2. Es entstehen die wiederverwertbaren Aluminium- und Kupferfolien in Behälter 88.3, eine Separatorfraktion in Behälter 88.1, sowie reines Beschichtungsmaterial in Behälter 88.4 und 88.2, welches auf Grund seiner großen Reinheit in folgenden metallurgischen Prozessschritten weiterverarbeitet werden kann.

Bezugsleistenliste

10	Batterie	60	Aufschlusszerkleinerer
12	Entladeeinheit	62	Sichter
14	Demotagesstation	64	Transportbehälter- Entleervorrichtung
16	Zelle	66	Aufschlussmaterial
18	Zerkleinerungseinheit	68	dritter Förderer
19	Flüssigstickstoffquelle		
20	Schutzgas	70	vierter Förderer
22	Schutzgasflasche	72	gesichtetes Material
24	Zerkleinerungsgut	74	Klassiervorrichtung
26	Trockenvorrichtung	76	Aktivmaterialfraktion
27	Schleuse vor Zerkleinerer	78	Transportbehältnis
28	Schleuse		
29	Vakuumanlage	80	Trägerfraktion
30	Vakuumpumpe	82	fünfter Förderer
31	Gas	84	Abfülleinheit
32	Gasreinigungsvorrichtung	86	Behälter
34	Kondensator	88	weitere Abfülleinheit
36	Aktivkohlefilter	90	Partikelentfernvorrichtung
38	Kondensatbehälter	92	Behälter
40	Steuerventil	94	Oxidationsvorrichtung
41	Rührwerk	96	Ausgangsschleuse
42	inaktives Zerkleinerungsgut	98	Silo
44	Abfüllvorrichtung	100	Schwergutabscheider
46	Transportbehälter	102	Zerkleinerer
48	Spüleleitung	108	Leichtgut
50	Druckgasflasche	110	Schwergut
52	Batterie-Verarbeitungsanlage	p	Druck
54	Standard-Container		
56	erster Förderer		
58	zweiter Förderer		

Patentansprüche

1. Verfahren zum Behandeln gebrauchter Lithium-Batterien (10) mit den Schritten:
 - 5 (a) Zerkleinern der Batterien (10), sodass Zerkleinerungsgut (24) erhalten wird, und
 - (b) Inaktivieren des Zerkleinerungsguts (24) durch Trocknen, sodass ein inaktiviertes Zerkleinerungsgut (42) erhalten wird, dadurch gekennzeichnet, dass
 - 10 (c) das Trocknen bei einem Druck von höchstens 300 hPa und höchstens 80 °C erfolgt und
 - (d) das inaktivierte Zerkleinerungsgut (42) nach dem Trocknen nicht in einen Transportbehälter abgefüllt und/oder direkt weiterverarbeitet wird.
- 15 2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, dass
 - die Batterie bei einer Temperatur getrocknet wird, die unterhalb einer Zersetzungstemperatur eines Binders der Batterie liegt und
 - das Zerkleinerungsgut (24) durch das Trocknen inaktiviert wird, sodass eine elektrochemische Reaktion unmöglich ist, und.
- 20 3. Verfahren nach einem der vorstehenden Ansprüche, gekennzeichnet durch den Schritt: Kondensieren der beim Trocknen der entstandenen Gase, insbesondere bei Umgebungsdruck und/oder bei einer Temperatur von mehr als 0°C und höchstens 50°C.
- 25 4. Verfahren nach einem der vorstehenden Ansprüche, gekennzeichnet durch die Schritte:
 - beim Trocknen kontinuierliches Überwachen einer Konzentration an organischen Karbonaten in der Atmosphäre der Trockenvorrichtung, und
 - 30 - Beenden des Trocknens erst dann, wenn eine untere Explosionsgrenze unterschritten ist.

5. Verfahren nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, dass
- das Trocknen während zumindest 50% der Trockenzeit bei einem Druck von höchstens 30 hPa erfolgt und /oder
 - 5 - ein Minimaldruck beim Trocknen höchstens 50 hPa beträgt.
6. Verfahren nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, dass
- das Zerkleinerungsgut (24, 42) in der Trockenvorrichtung, insbesondere
 - 10 beim Entnehmen aus der Trockenvorrichtung, mittels eines Rührwerks bewegt wird und
 - mittels des Rührwerks zumindest 50%, insbesondere zumindest 80%, einer zum Trocknen des Zerkleinerungsguts (24) notwendigen Verdampfungswärme zugeführt wird.
 - 15
7. Verfahren nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, dass
- beim Trocknen entstehende Gase abgesaugt werden und/oder
 - das Bewegen mittels des Rührwerks so durchgeführt wird, dass zumin-
 - 20 dest 50 Gew.-% des Beschichtungsmaterials des Zerkleinerungsguts (42) abgesaugt werden.
 - 15
8. Verfahren nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, dass das Zerkleinern und das Trocknen in nur einem Behälter durchgeführt wird.
- 25

9. Batterie-Verarbeitungsanlage zum Behandeln von Batterien, insbesondere gebrauchten Lithium-Batterien, mit:

(a) einer Zerkleinerungseinheit (18) zum Zerkleinern der Batterien (10), sodass Zerkleinerungsgut (24) erhalten wird, und

(b) einer Inaktivierungsvorrichtung in Form einer Trockenvorrichtung (26) zum Inaktivieren des Zerkleinerungsguts (24),

dadurch gekennzeichnet, dass

(c) eine Vakuumanlage mit der Trockenvorrichtung (26) zum Erzeugen eines Vakuums in der Trockenvorrichtung (26) von zumindest 300 hPa verbunden ist und

(d) die Trockenvorrichtung (26) zum Trocknen bei einer Temperatur von höchstens 80 °C, insbesondere unter 80°C, ausgebildet ist.

10. Batterie-Verarbeitungsanlage nach Anspruch 9, dadurch gekennzeichnet, dass die Zerkleinerungseinheit (18) in der Trockenvorrichtung angeordnet ist.

11. Batterie-Verarbeitungsanlage nach einem der Ansprüche 9 bis 10, gekennzeichnet durch

einen Kondensator zum Kondensieren von aus dem Trockner abgesaugtem gasförmigem Elektrolyten,

wobei in Materialflussrichtung zwischen der Trockenvorrichtung und dem Kondensator und/oder der zumindest einen Pumpe ein Partikelabscheider angeordnet ist.

12. Batterie-Verarbeitungsanlage nach einem der Ansprüche 9 bis 11, gekennzeichnet durch

eine gasdichte und/oder staubdichte Fördervorrichtung, die die Zerkleinerungsvorrichtung und die Trockenvorrichtung (26) miteinander verbindet.

13. Batterie-Verarbeitungsanlage nach einem der Ansprüche 9 bis 12, gekennzeichnet durch
- eine Schleuse, die vor der Zerkleinerungseinheit (18) zum Zuführen der Batterien (10) angeordnet ist, und/oder
 - 5 - einen Partikelabscheider, der in Materialflussrichtung zwischen der Trockenvorrichtung und dem Kondensator angeordnet ist.
14. Batterie-Verarbeitungsanlage nach einem der Ansprüche 9 bis 13, dadurch gekennzeichnet, dass die Trockenvorrichtung eine Heizung umfasst, welche die Wärme vorzugsweise aus der Wärmeabfuhr der Vakuumpumpen und/oder des Kondensators bezieht.
- 10
15. Batterie-Verarbeitungsanlage nach einem der Ansprüche 9 bis 14, dadurch gekennzeichnet, dass die Trockenvorrichtung
- 15 zumindest eine trockenlaufende Vakuumpumpe aufweist, insbesondere zumindest zwei Vakuumpumpen aufweist, die sich in ihrem Volumenstrom bei 400 hPa und ihrem maximal erreichbaren Minimaldruck unterscheiden.
- 20 16. Batterie-Verarbeitungsanlage nach einem der Ansprüche 9 bis 15, dadurch gekennzeichnet, dass die Zerkleinerungseinheit ein Bodensieb zum Begrenzen der maximalen Größe des Zerkleinerungsguts aufweist.

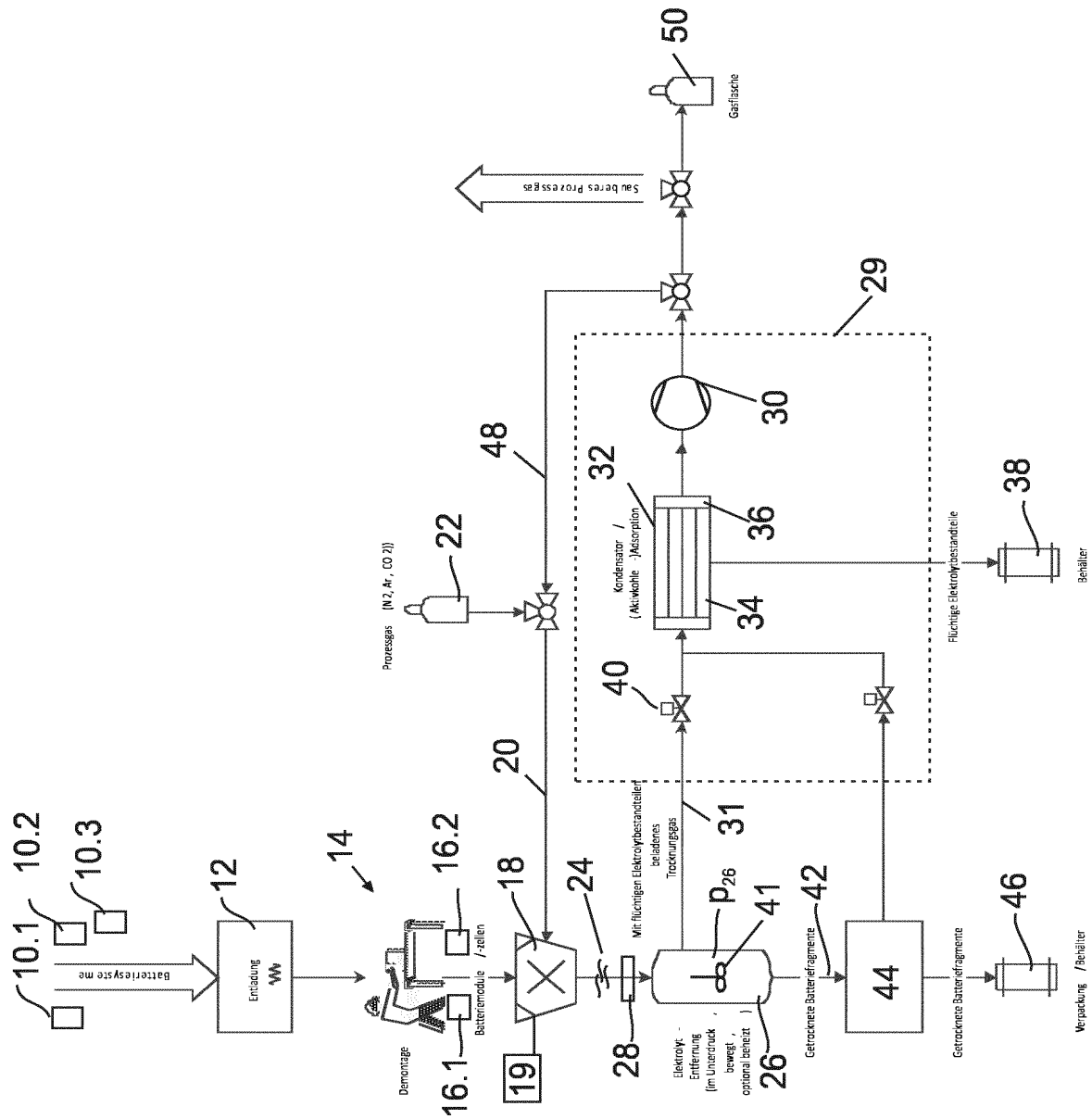


Fig. 1

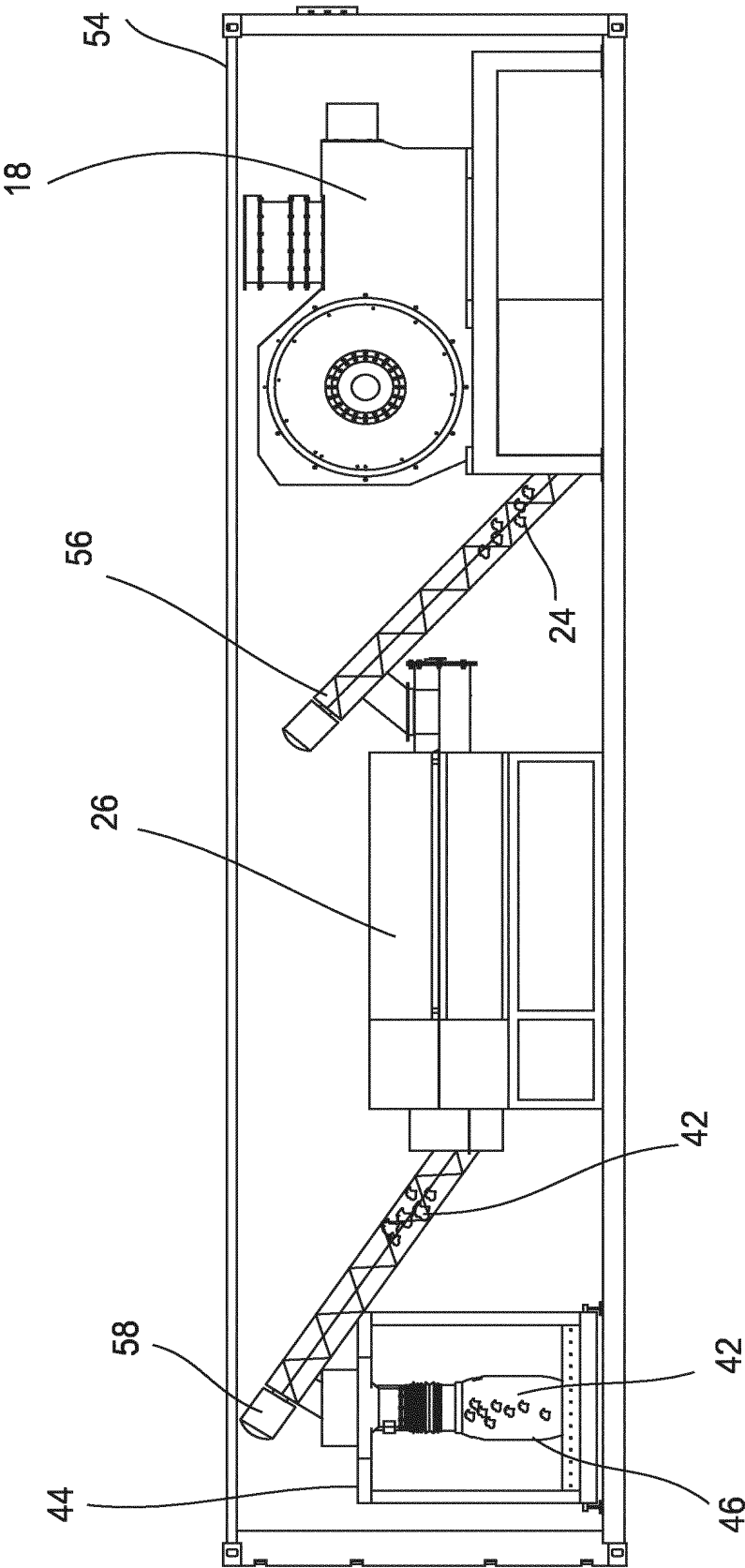


Fig. 2

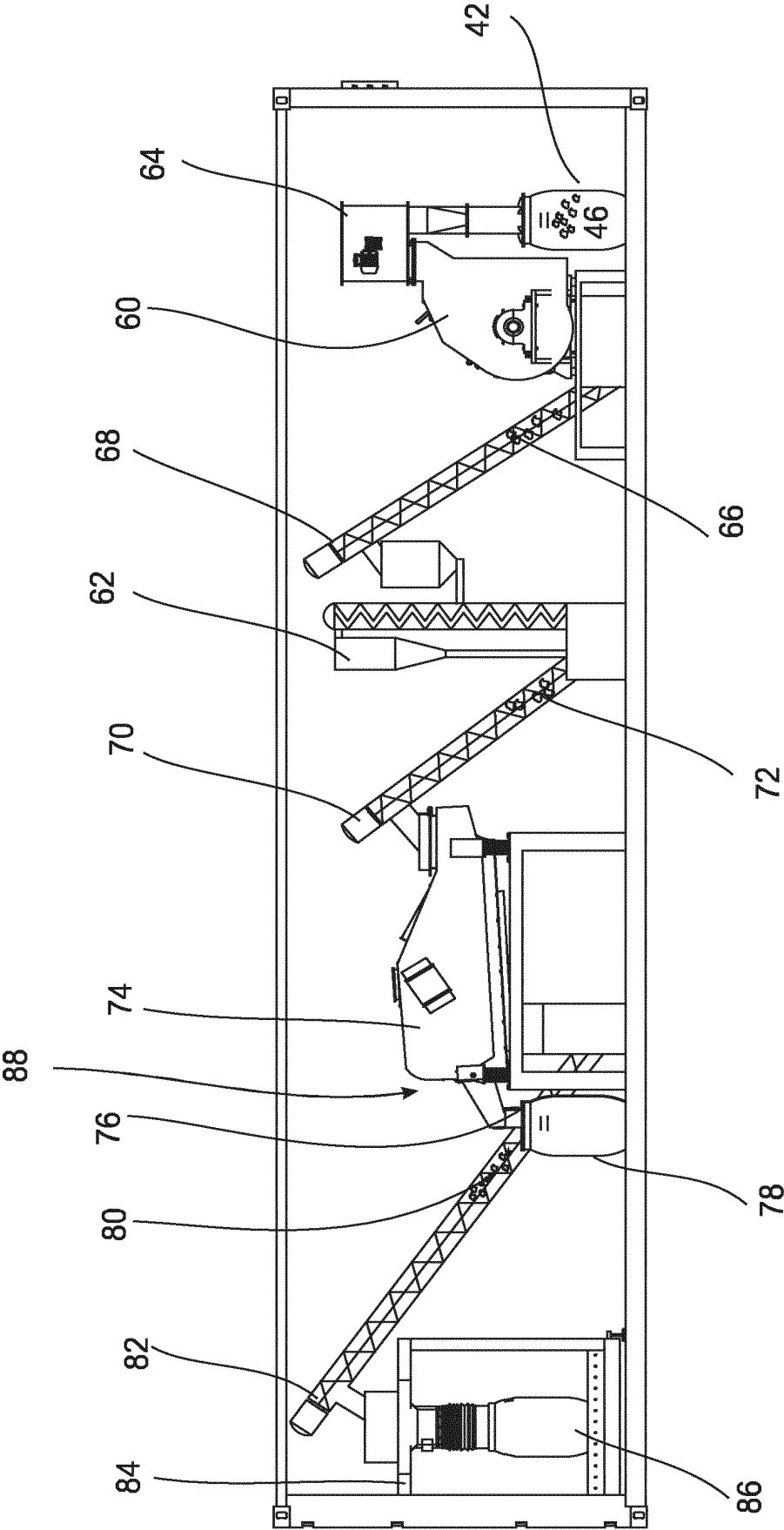
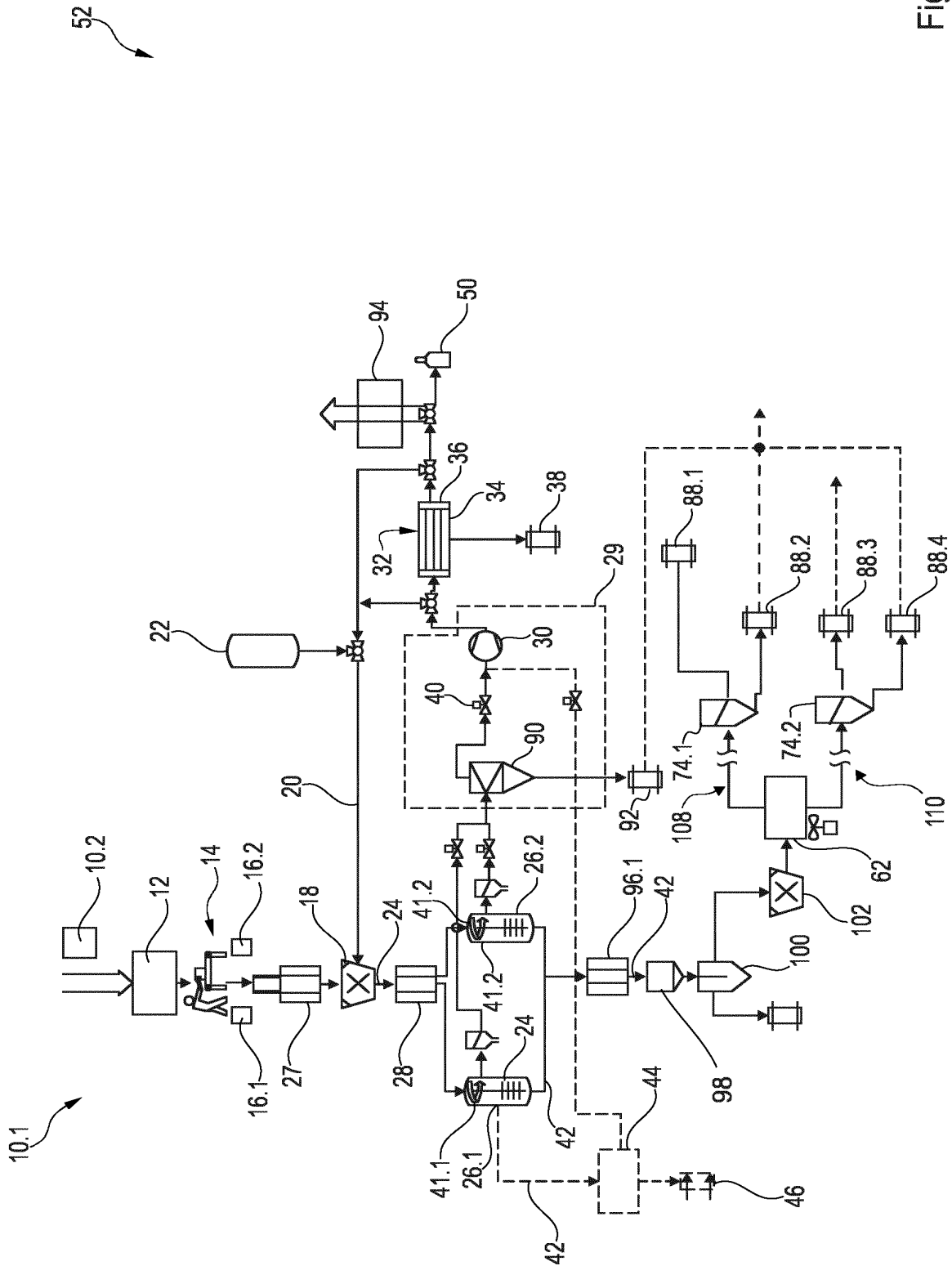


Fig. 3

Fig. 4



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/076113

A. CLASSIFICATION OF SUBJECT MATTER

INV. H01M6/52 C22B7/00 C22B15/00 C22B21/00 H01M10/54
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H01M C22B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 10 2011 110083 A1 (TECH UNI BRAUNSCHWEIG CAROLO WILHELMINA [DE]) 14 February 2013 (2013-02-14) cited in the application paragraph [0021] - paragraph [0036]; claims 1-10	1-16
Y	----- WO 2010/102377 A1 (STEVENS WAYNE C [CA]) 16 September 2010 (2010-09-16) paragraph [0015] - paragraph [0040]; figures 1, 2	1-16
Y	----- DE 10 2012 024876 A1 (ELECTROCYCLING GMBH [DE]; VOLKSWAGEN AG [DE]) 26 June 2014 (2014-06-26) cited in the application paragraph [0029] - paragraph [0040]; claims 1-10	1-16
	----- -/-	



Further documents are listed in the continuation of Box C.



See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search

20 November 2017

Date of mailing of the international search report

28/11/2017

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INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2017/076113

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X, P	WO 2016/174156 A1 (LION ENG GMBH [DE]) 3 November 2016 (2016-11-03) the whole document -----	1-16

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2017/076113

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		DE 102011110083 A1	14-02-2013
		EP 2742559 A1	18-06-2014
		US 2014290438 A1	02-10-2014
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		DE 102015207843 A1	03-11-2016
		WO 2016174156 A1	03-11-2016

A. KLASSIFIZIERUNG DES ANMELDUNGSGEGENSTANDES
 INV. H01M6/52 C22B7/00 C22B15/00 C22B21/00 H01M10/54
 ADD.

Nach der Internationalen Patentklassifikation (IPC) oder nach der nationalen Klassifikation und der IPC

B. RECHERCHIERTE GEBIETE

Recherchierter Mindestprüfstoff (Klassifikationssystem und Klassifikationssymbole)
 H01M C22B

Recherchierte, aber nicht zum Mindestprüfstoff gehörende Veröffentlichungen, soweit diese unter die recherchierten Gebiete fallen

Während der internationalen Recherche konsultierte elektronische Datenbank (Name der Datenbank und evtl. verwendete Suchbegriffe)

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C. ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie*	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
X	DE 10 2011 110083 A1 (TECH UNI BRAUNSCHWEIG CAROLO WILHELMINA [DE]) 14. Februar 2013 (2013-02-14) in der Anmeldung erwähnt Absatz [0021] - Absatz [0036]; Ansprüche 1-10	1-16
Y	----- WO 2010/102377 A1 (STEVENS WAYNE C [CA]) 16. September 2010 (2010-09-16) Absatz [0015] - Absatz [0040]; Abbildungen 1, 2	1-16
Y	----- DE 10 2012 024876 A1 (ELECTROCYCLING GMBH [DE]; VOLKSWAGEN AG [DE]) 26. Juni 2014 (2014-06-26) in der Anmeldung erwähnt Absatz [0029] - Absatz [0040]; Ansprüche 1-10	1-16
	----- -/-	

☒ Weitere Veröffentlichungen sind der Fortsetzung von Feld C zu entnehmen ☒ Siehe Anhang Patentfamilie

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Datum des Abschlusses der internationalen Recherche

20. November 2017

Absendedatum des internationalen Recherchenberichts

28/11/2017

Name und Postanschrift der Internationalen Recherchenbehörde
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Bevollmächtigter Bediensteter

Wiedemann, Eric

C. (Fortsetzung) ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie*	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
X,P	WO 2016/174156 A1 (LION ENG GMBH [DE]) 3. November 2016 (2016-11-03) das ganze Dokument -----	1-16

INTERNATIONALER RECHERCHENBERICHT

Angaben zu Veröffentlichungen, die zur selben Patentfamilie gehören

Internationales Aktenzeichen

PCT/EP2017/076113

Im Recherchenbericht angeführtes Patentdokument	Datum der Veröffentlichung	Mitglied(er) der Patentfamilie	Datum der Veröffentlichung
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		DE 102015207843 A1	03-11-2016
		WO 2016174156 A1	03-11-2016

From the INTERNATIONAL BUREAU

PCTNOTIFICATION OF THE RECORDING
OF A CHANGE(PCT Rule 92*bis*.1 and
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To:

GRAMM, LINS & PARTNER PATENT- UND
RECHTSANWÄLTE PARTGMBB
Theodor-Heuss-Straße 1
38122 Braunschweig
ALLEMAGNE

Date of mailing (day/month/year) 23 November 2018 (23.11.2018)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference 6110-004 PCT-1	
International application No. PCT/EP2017/076113	International filing date (day/month/year) 12 October 2017 (12.10.2017)

1. The following indications appeared on record concerning:			
☒ the applicant	☐ the inventor	☐ the agent	☐ the common representative
Name and Address DUESENFELD GMBH Friedlandweg 5 38114 Braunschweig Germany		State of Nationality DE	State of Residence DE
		Telephone No.	
		Facsimile No.	
		E-mail address	
2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:			
☐ the person	☐ the name	☒ the address	☐ the nationality
☐ the residence			
Name and Address DUESENFELD GMBH Rothbergstrasse 8 38176 Wendeburg Germany		State of Nationality DE	State of Residence DE
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VIII-3-1	<p>Erklärung: Berechtigung, Priorität zu beanspruchen Erklärung hinsichtlich der Berechtigung des Anmelders, zum Zeitpunkt des internationalen Anmeldedatums, eine Priorität zu beanspruchen, in Fällen, in denen der Anmelder nicht der Anmelder der früheren Anmeldung, deren Priorität beansprucht wird, ist oder in Fällen, in denen sich der Name des Anmelders seit dem Einreichen der früheren Anmeldung geändert hat (Regeln 4.17 Ziffer iii und 51bis.1 Absatz a Ziffer iii): Name</p>	<p>In bezug auf diese internationale Anmeldung</p> <p>DUESENFELD GmbH ist kraft des nachfolgend Aufgeführten berechtigt, die Priorität der früheren Anmeldung Nr. 10 2016 120 046.8 zu beanspruchen:</p>
VIII-3-1(i ii)		<p>auf Grund einer Vereinbarung zwischen HANISCH, Christian und DUESENFELD GmbH, datiert 05. Oktober 2017 (05.10.2017)</p>

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VIII-2-1	Erklärung: Berechtigung, ein Patent zu beantragen und zu erhalten Erklärung hinsichtlich der Berechtigung des Anmelders, zum Zeitpunkt des internationalen Anmeldedatums, ein Patent zu beantragen und zu erhalten (Regeln 4.17 Ziffer ii und 51bis.1 Absatz a Ziffer ii), für den Fall, daß eine Erklärung nach Regel 4.17 Ziffer iv nicht einschlägig ist: Name (FAMILIENNAME, Vorname)	In bezug auf diese internationale Anmeldung DUESENFELD GmbH ist kraft des nachfolgend Aufgeführten berechtigt, ein Patent zu beantragen und zu erhalten:
VIII-2-1(i ii)		auf Grund einer Vereinbarung zwischen DUESENFELD GmbH und HANISCH, Christian, datiert 05. Oktober 2017 (05.10.2017)

BUNDESREPUBLIK DEUTSCHLAND



Prioritätsbescheinigung DE 10 2016 120 046.8 über die Einreichung einer Patentanmeldung

Aktenzeichen: 10 2016 120 046.8

Anmeldetag: 20. Oktober 2016

Anmelder/Inhaber: Duesenfeld GmbH, 38114 Braunschweig, DE

Erstanmelder: Lion Engineering GmbH,
38106 Braunschweig, DE

Bezeichnung: Recycling-Verfahren zum Behandeln gebrauchter
Batterien, insbesondere wieder aufladbarer Batterien
und Batterie-Verarbeitungsanlage

IPC: H01M 10/54; H01M 6/52

Die angehefteten Stücke sind eine richtige und genaue Wiedergabe der Teile der am 20. Oktober 2016 eingereichten elektronischen Dokumente dieser Patentanmeldung unabhängig von gegebenenfalls durch das Druckverfahren bedingten Farbabweichungen.

München, den 20. Oktober 2017
Deutsches Patent- und Markenamt
Die Präsidentin
Im Auftrag

Sebel

Recycling-Verfahren zum Behandeln gebrauchter Batterien, insbesondere wieder aufladbarer Batterien und Batterie-Verarbeitungsanlage

Die Erfindung betrifft ein Verfahren zum Behandeln gebrauchter Batterien, insbesondere gebrauchter Lithium-Batterien, beispielsweise Lithium-Ionen-Batterien, mit den Schritten (a) Zerkleinern der Batterien, sodass Zerkleinerungsgut erhalten wird, und (b) Inaktivieren des Zerkleinerungsguts, sodass ein inaktiviertes Zerkleinerungsgut erhalten wird.

Gemäß einem zweiten Aspekt betrifft die Erfindung eine Batterie-Verarbeitungsanlage zum Behandeln gebrauchter Batterien, insbesondere zum Behandeln gebrauchter Lithium-Batterien, mit (a) einer Zerkleinerungseinheit zum Zerkleinern der Batterien, sodass Zerkleinerungsgut erhalten wird, und (b) einer Inaktivierungsvorrichtung zum Inaktivieren des Zerkleinerungsguts.

Aus der US 2005/0241943 A1 ist ein Verfahren zum Aufarbeiten gebrauchter Batterien bekannt, bei dem die Batterien vor einem Zerkleinerungsschritt erwärmt werden, sodass Kunststoffbestandteile der Batterien zerstört werden. Nachteilig an einem derartigen Vorgehen ist, dass die verbleibenden Komponenten der Batterien mit Abbauprodukten des Kunststoffs verunreinigt sein können.

Aus der DE 10 2012 024 876 A1 ist ein System zum Überführen transportkritischer Elektrolytzellen zunächst unter Inertgas zerkleinert und danach mit einem Desaktivierungspulver bestäubt werden, um eine Selbstentzündung des elektrochemisch aktiven Materials zu verhindern. Nachteilig daran ist, dass das entstehende Material dennoch ein vergleichsweise hohes Gefährdungspotential besitzt und dass das Bestäubungspulver selbst ein Expositionsrisiko darstellt und dass die Bildung einer entzündlichen und explosiven Atmosphäre in dem Transportbehälter nicht ausgeschlossen werden kann.

Aus der DE 10 2011 110 083 A1 ist ein Verfahren zum Wiedergewinnen von Aktivmaterial aus einer galvanischen Zelle bekannt, bei dem die galvanischen Zellen zunächst mechanisch zerkleinert, dann vorgetrocknet und nachfolgend gesichtet werden. Schließlich wird der Binder in einem Ofen zersetzt. Eine derartige Vorrichtung eignet sich sehr gut zum effizienten Recyceln größerer Mengen von galvanischen Elementen. Für den Teillast-Betrieb ist diese Anlage jedoch vergleichsweise komplex aufgebaut. Es hat sich zudem gezeigt, dass sich hochtoxische fluororganische Verbindungen und Fluorwasserstoff bilden können, die nur mit großem Aufwand entsorgbar sind.

In der WO 2010/102377 A1 ist ein Verfahren beschrieben, bei dem die zu recyklierenden Batterien, beispielsweise Lithium-Batterien, in einem Drehrohr ofen erhitzt und die entstehenden Gase abgesaugt werden. Nachteilig an diesem Verfahren ist, dass der Elektrolyt so nur schlecht wiederverwertet werden kann und große Mengen Fluorwasserstoff sowie fluororganische Verbindungen entstehen.

Der Erfindung liegt die Aufgabe zugrunde, Nachteile im Stand der Technik zu vermindern.

Die Erfindung löst das Problem durch ein Verfahren mit den Merkmalen von Anspruch 1. Gemäß einem zweiten Aspekt löst die Erfindung das Problem durch eine gattungsgemäße Batterie-Verarbeitungsanlage, bei der eine Vakuumanlage mit der Trockenvorrichtung zum Erzeugen eines Vakuums in der Trockenvorrichtung von zumindest 300 hPa verbunden ist und die Trockenvorrichtung zum Trocknen bei einer Temperatur von höchstens 80 °C ausgebildet ist.

Vorteilhaft an der Erfindung ist, dass durch das Trocknen dem Zerkleinerungsgut so viel Elektrolyt entzogen werden kann, dass eine elektrochemische Reaktion nicht mehr oder nur noch zu vernachlässigbar kleinem Ausmaß möglich ist. Zudem bildet sich keine entzündliche oder explosive Gasphase über den Batteriefragmenten, da diesen insbesondere die leichtsiedenden organischen Karbo-

nate des Elektrolyten entzogen wurden. Das Zerkleinerungsgut ist daher weitgehend inert und kann, insbesondere dann, wenn es unter Vakuum verpackt wird, sicher transportiert oder weiterverarbeitet werden.

- 5 Ein weiterer Vorteil ist es, dass zum Inaktivieren des Zerkleinerungsmaterials kein zusätzliches Material hinzugegeben werden muss. Das verringert den Aufwand beim Aufarbeiten der Batterien, verringert das Gewicht des inaktivierten Zerkleinerungsguts und erhöht die Reinheit in den folgenden Trenn- und Recycling-
- 10 schritten. Insbesondere in potentiell folgenden hydrometallurgischen Aufarbeitungsschritten ist eine hohe Produktreinheit ohne Eintrag von Fremdionen vorteilhaft.

- Vorteilhaft ist zudem, dass die Bildung von Fluorophosphaten, Fluorwasserstoff, Kohlenstoffmonoxid, polyfluorierten Dibenzodioxinen und Dibenzofuranen, Stickoxiden, Carbonylfluorid und/oder Cyanwasserstoff in relevanter Menge
- 15 ausgeschlossen werden kann. Fluorophosphate sind oft starke Nervengifte, deren Bildung sicher verhindert werden muss. Zudem ist sichergestellt, dass es aufgrund des geringen Elektrolytgehalts nicht zu einer durch eine elektrochemische Reaktion ausgelöste, selbstverstärkend fortschreitende Wärmeentwicklung
- 20 kommen kann. Es hat sich herausgestellt, dass sich Fluorwasserstoff und Fluorophosphate bereits bei vergleichsweise niedrigen Temperaturen von über 80°C in signifikanter Menge bilden können.

- Vorteilhaft ist zudem, dass das Entfernen des Elektrolyten mit geringem Energieaufwand möglich ist. Zudem kann der Elektrolyt weitgehend wiederverwertet werden.
- 25

- Das gemäß einer bevorzugten Ausführungsform vorgesehene Kondensieren des verdampften Elektrolyten führt zudem zu einer emissionsarmen Wiederverwertung von Lithium-Batterien.
- 30

Mit der erfindungsgemäßen Batterie-Verarbeitungsanlage sind stofflichen Recyclingquoten von über 80% erreichbar, was mit bisherigen Anlagen nicht er-

reichbar ist.

Im Rahmen der vorliegenden Beschreibung wird unter dem Trocknen insbesondere das Entfernen zumindest eines Lösungsmittels des Leitsalzes verstanden.

- 5 Insbesondere wird das Trocknen so durchgeführt, dass Kohlensäuredimethylester und/oder Kohlensäureethylmethylester zu zumindest 90 Gewichtsprozent entfernt wird.

- 10 Unter einer Lithium-Batterie wird insbesondere ein Akkumulator verstanden, bei dem die elektrochemische Reaktion Lithium und/oder Lithium-Ionen und/oder eine Lithium-Verbindung involviert.

Unter einer Batterie-Verarbeitungsanlage wird insbesondere auch eine Akku-Verarbeitungsanlage zum Verarbeiten von Akkumulatoren verstanden.

15

Unter dem Transportbehälter wird insbesondere auch eine oder eine Transportverpackung verstanden. Vorzugsweise wird die Transportverpackung durch Vakuumverschweißung verschlossen. Gut geeignet als Transportverpackung ist insbesondere Aluminium-Verbundfolie.

20

Unter der Zerkleinerungseinheit wird insbesondere eine Vorrichtung verstanden, die beim Betrieb die Batterien zerkleinert. Beispielsweise ist die Zerkleinerungseinheit (i) eine Druckzerkleinerungseinheit, bei der die Batterien zwischen zwei Werkzeugflächen zerdrückt werden, (ii) eine Schlagzerkleinerungseinheit, bei der die Batterien auf einer Werkzeugfläche aufliegen und durch Schlag mit einem zweiten beweglichen Werkzeug zertrümmert werden, (iii) eine Scherzerkleinerungseinheit, bei der die Batterien durch zwei sich gegensätzlich bewegende Werkzeugflächen zerkleinert werden, (iv) eine Schneidzerkleinerungseinheit, bei der die Batterien mittels zwei Schneiden in zwei Teile geschnitten werden und/oder (v) eine Prallzerkleinerung, bei der die Batterien gegen eine Wand geworfen werden, gegen ein bewegtes Werkzeug prallen oder zwei Partikel gegeneinander stoßen. Selbstverständlich kann die Zerkleinerungseinheit auch durch zwei oder mehr der genannten Zerkleinerungsmechanismen wirken.

25

30

Die Zerkleinerungseinheit ist gemäß einer bevorzugten Ausführungsform Teil einer Zerkleinerungsvorrichtung, die einen Behälter aufweist, in der die Zerkleinerungseinheit angeordnet ist.

- 5 Die angegebenen Temperaturen und Drücke beziehen sich stets auf die Temperatur der Atmosphäre in der jeweiligen Vorrichtung. So ist unter dem Merkmal, dass das Trocknen bei einem Druck von höchstens 300 hPa und höchstens 80 °C erfolgt, insbesondere zu verstehen, dass die Temperatur in der Atmosphäre des Trockners höchstens 80°C beträgt. Dass die Temperatur lokal höher
10 sein kann, ist irrelevant.

- Günstig ist, wenn das Trocknen nach dem Zerkleinern der Batterien erfolgt. Zwar ist es möglich und stellt eine Ausführungsform der Erfindung dar, dass die Batterien im unzerkleinerten Zustand einem Vakuum ausgesetzt werden, sodass
15 zumindest Teile des Elektrolyten verdampfen, wobei das entstehende Gas entweder durch ein Sicherheitsventil im Akkumulator entweicht oder die Batterie durch die Druckdifferenz zwischen der äußeren Umgebung und dem Innendruck zerstört wird, sodass verdampfender Elektrolyt austreten kann. Da der Elektrolyt zumeist zwischen eng gewickelten oder gestapelten und verpressten Schichten
20 aus Elektroden und Separator und in deren Poren vorliegt und mit anderen Bestandteilen der Batterien verbunden vorliegt, kann dieses Vorgehen jedoch zeitintensiv sein. Es ist daher oft günstiger und stellt eine bevorzugte Ausführungsform der Erfindung dar, dass die Batterien mechanisch zerkleinert werden, beispielsweise durch Schneiden, Scheren, Pralleinwirkung, Zertrennen und/oder
25 Quetschen. So steht für den Stoffübergang in die Gasphase eine größere Grenzfläche zur Verfügung.

- Vorzugsweise erfolgt das Trocknen zumindest 50% der Trockenzeit bei einem Druck von höchstens 30 hPa. Alternativ oder zusätzlich beträgt ein Minimaldruck
30 beim Trocknen höchstens 50 hPa. So wird ein sehr hoher Anteil des Elektrolyten entfernt. Unter dem Minimaldruck ist insbesondere der kleinste Atmosphärendruck in der Trockenvorrichtung zu verstehen, der für zumindest eine Minute herrscht.

Es ist gemäß einer bevorzugten Ausführungsform zudem möglich, dass das Trocknen simultan mit dem Zerkleinern erfolgt. In anderen Worten wird an eine Zerkleinerungsvorrichtung, in der die Batterien zerkleinert werden, ein Vakuum mit einem Druck von höchstens 300 hPa angelegt. Vorteilhaft hieran ist, dass die beim Zerkleinern eingebrachte mechanische Energie das Verdampfen des Elektrolyten unterstützt. Es ist daher entbehrlich, zusätzliche Heizenergie zum Verdampfen des Elektrolyten in das Zerkleinerungsgut einzubringen (obwohl dies möglich und von der Erfindung umfasst ist). Außerdem ist es entbehrlich, das Zerkleinerungsgut beim Zerkleinern zu kühlen (obwohl dies möglich und von der Erfindung umfasst ist). Die Zerkleinerungseinheit bewirkt zudem ein Umwälzen des Zerkleinerungsguts, was das Trocknen beschleunigt.

Günstig ist es, wenn das Trocknen unter Rühren und/oder Umwälzen des Zerkleinerungsguts erfolgt. So werden die galvanischen Elemente aus Anode, Separator und Kathode voneinander getrennt. Eine Behinderung der Verdampfung durch zusammenklebende Folien wird verhindert. Es wird mechanische Energie zur Trennung von Stromsammelrfolie und Beschichtung eingebracht und die resultierende Reibungswärme führt dem System die Verdampfungswärme zu.

Vor dem Zerkleinern werden die gebrauchten Batterien vorzugsweise demon- tiert. Das heißt, dass größere Batteriesysteme in ihre kleineren Unterbausteine, die Module oder Stacks, demontiert werden oder sogar die Zellen, die das elekt- rochemisch wirksame Material enthalten, von der Ansteuerelektronik getrennt werden. Die Ansteuerelektronik umfasst beispielsweise Halbleiterbauelemente und/oder Sensoren und dient der Ladesteuerung der Batterien.

Das Trocknen erfolgt unter Vakuum. Gemäß seiner breitesten Form löst die Er- findung das Problem durch ein gattungsgemäßes Verfahren, bei dem das Vaku- um so groß gewählt ist, dass der Dampfdruck von Kohlendimethylester bei 80°C, insbesondere bei 70°C, unterschritten wird. Besonders günstig ist es je- doch, wenn das Trocknen unter einem Druck von höchstens 300 hPa, insbeson- dere höchstens 100 hPa erfolgt. Bei so niedrigen Drücken verdampfen wesentli-

che Bestandteile der meisten Elektrolyten, insbesondere Kohlensäuredimethylester und Kohlensäureethylmethylester, bereits bei Temperaturen von weniger als 80°C. Niedrige Temperaturen haben den Vorteil, dass die Bildung von Fluorwasserstoff und fluororganischen Verbindungen behindert wird. Beides stellt eine potentielle Gefährdung für die Batterie-Verarbeitungsanlage sowie die Umgebung dar. Es ist daher günstig, deren Entstehen zu verhindern.

Vorzugsweise erfolgt das Trocknen bei einer Temperatur, die unterhalb einer Zersetzungstemperatur liegt. Unter der Zersetzungstemperatur wird insbesondere die kleinste Temperatur verstanden, für die gilt, dass nach dem Halten des Zerkleinerungsguts auf dieser Temperatur für eine Stunde zumindest 80 Masseprozent des Binders der Lithium-Batterien sich in gasförmige Bestandteile zersetzt haben. Die Zersetzungstemperatur kann damit gemessen werden, indem die Temperatur des Zerkleinerungsguts sukzessive erhöht wird und erfasst wird, wann es zu einem Masseverlust, insbesondere durch Gasentwicklung aufgrund einer Zersetzung des Binders, kommt und das angegebene Kriterium erfüllt ist. Gegebenenfalls muss der Versuch mit jeweils einer neuen Probe an Zerkleinerungsgut bei jeweils erhöhter Temperatur mehrfach durchgeführt werden.

Gemäß einer bevorzugten Ausführungsform umfasst das Verfahren das Kondensieren der beim Trocknen der entstandenen Gase. Das erfolgt vorzugsweise bei Umgebungsdruck, wobei eine Abweichung von ± 50 hPa möglich ist. Günstig ist es, wenn die Temperatur beim Kondensieren zumindest 0°C beträgt. Das vermindert die aufzuwendende Kühlleistung und verhindert Eisbildung. Vorzugsweise beträgt die Kühlleistung zumindest 4 Kilowatt und höchstens 40 Kilowatt bezogen auf eine Tonne pro Stunde verarbeiteter Batterien. Alternativ ist die Temperatur beim Kondensieren kleiner als 0°C, sodass der Atmosphäre Wasser durch Bildung von Eis entzogen wird. Es ist möglich, dass der Kondensator zwei oder mehr Zonen unterschiedlicher Temperatur hat.

Günstig ist es, wenn die Temperatur beim Kondensieren höchstens 50°C, vorzugsweise höchstens 30°C, insbesondere höchstens 20°C, beträgt. Auf diese

Weise werden die organischen Karbonate der Batterien fast vollständig zurückgewonnen. Es entstehen zudem kaum Abgase und der Energieaufwand für das Kondensieren ist klein.

- 5 Das Zerkleinern der Batterien wird vorzugsweise so durchgeführt, dass zumindest 90 Gew.-% der Bestandteile des Zerkleinerungsguts ein Siebmaß von höchstens 50 mm, insbesondere höchstens 30 mm, vorzugsweise höchstens 20 mm, haben. Hierunter ist zu verstehen, dass 90 Gew.-% der Bestandteile durch ein Sieb fallen, das eine Maschenweite von 50 mm (bzw. die jeweils andere angegebene Weite) hat. Durch eine solche Zerkleinerung werden Mikrokurzschlüsse vermieden und so die Sicherheit des Transports, der Lagerung und der weiteren Verarbeitung erhöht.

- 15 Günstig ist es, wenn das Trocknen unter einer Atmosphäre erfolgt, in der der Wasser-Partialdruck kleiner ist als 50 Pa, insbesondere kleiner als 10 Pa. Ein geringer Wasser-Partialdruck führt zu einer geringen Reaktionsrate von Lithium-Verbindungen zu Lithium-Hydroxid und damit zu nur geringer Wasserstoff-Entwicklung. Das verhindert die Bildung von zündfähigen Wasserstoff-Sauerstoff-Gemischen und trägt zur Anlagensicherheit bei.

- 20 Günstig ist es zudem, wenn der Sauerstoff-Partialdruck beim Trocknen höchstens 30 Millibar, insbesondere höchstens 10 Millibar beträgt. Die Reaktion von Sauerstoff mit oxidierbaren Bestandteilen der Batterien wird so weitgehend unterdrückt. Es ist möglich, den niedrigen Sauerstoff-Partialdruck durch einen geringen Druck beim Trocknen zu erreichen. Alternativ oder zusätzlich kann das Trocknen in einer Inertgas-Atmosphäre erfolgen.

- 30 Gemäß einer bevorzugten Ausführungsform umfasst das Verfahren die Schritte eines kontinuierlichen Erfassens einer Wasserdampfkonzentration beim Zerkleinern und/oder beim Trocknen und eines Verringerns der Wasserdampfkonzentration, wenn ein vorgegebener Schwellenwert überschritten wird. Unter der Wasserdampfkonzentration wird insbesondere ein Anteil an Wasserdampf bezogen auf die Gesamtheit der Bestandteile der Atmosphäre verstanden. Insbeson-

- dere wird unter der Wasserdampfkonzentration auch ein Wasserdampf-Partialdruck verstanden. Das Verringern der Wasserdampfkonzentration kann beispielsweise ein Vermindern des Drucks und/oder ein Zuführen von Inertgas umfassen. Der Schwellenwert für die Wasserdampfkonzentration ist vorzugsweise
- 5 so gewählt, dass unterhalb des Schwellenwerts eine Bildung nennenswerter Mengen von Fluorwasserstoff durch Zersetzung des Leitsalzes, bspw. LiPF_6 , sowie eine Reduktion des Wassers mit metallischem Lithium in nennenswertem Ausmaß unmöglich ist. Diese Kriterien sind bei einem Taupunkt von -40°C erfüllt. Es ist möglich, nicht aber notwendig, dass die Wasserdampfkonzentration
- 10 direkt gemessen wird, beispielsweise per Spektroskopie, insbesondere Infrarot-Spektroskopie. Es ist beispielsweise auch möglich, dass die Summe der Konzentrationen an Inertgas, Sauerstoff und organischen Verbindungen ermittelt und angenommen wird, dass der Rest aus Wasserdampf besteht.
- 15 Gemäß einer bevorzugten Ausführungsform umfasst das Verfahren die Schritte eines kontinuierlichen Erfassens einer Sauerstoffkonzentration beim Zerkleinern und/oder beim Trocknen und eines Verringerns der Sauerstoffkonzentration, wenn ein vorgegebener Schwellenwert überschritten wird. Unter der Sauerstoffkonzentration wird insbesondere ein Anteil an Sauerstoff bezogen auf die Ge-
- 20 samtheit der Bestandteile der Atmosphäre verstanden. Insbesondere wird unter der Sauerstoffkonzentration auch ein Sauerstoff-Partialdruck verstanden. Das Verringern der Sauerstoffkonzentration kann beispielsweise ein Vermindern des Drucks und/oder ein Zuführen von Inertgas umfassen. Der Schwellenwert für die Sauerstoffkonzentration ist vorzugsweise so gewählt, dass unterhalb des
- 25 Schwellenwerts eine Explosion unmöglich ist. Es ist möglich, nicht aber notwendig, dass die Sauerstoffkonzentration direkt gemessen wird, beispielsweise per Nernst-Sonde, Lamda-Sonde, mit paramagnetischen Sensoren oder mit einer Widerstandssonde. Es ist beispielsweise auch möglich, dass die Konzentrationen des Sauerstoffs durch die Messung von in Luft mit Sauerstoff vergesell-
- 30 schafteten Gasen, wie bspw. Kohlenstoffdioxid, zu bestimmen, indem angenommen wird, dass Sauerstoff im gleichen Mischungsverhältnis zum gemessenen Gas wie in der Luft vorliegt,

Insbesondere umfasst das Verfahren die Schritte (i) beim Trocknen kontinuierliches Überwachen einer Konzentration an organischen Karbonaten in der Atmosphäre der Trockenvorrichtung und (ii) Beenden des Trocknens erst dann, wenn eine untere Explosionsgrenze unterschritten ist. Die untere Explosionsgrenze ist die Konzentration an organischen Bestandteilen, für die gilt, dass nach Füllen des Zerkleinerungsguts in einen Behälter in Luft bei 23°C unter 1013 hPa und 80%-Luftfeuchte eine Zündung zu keiner Explosion führt, wohl aber eine höhere Konzentration. Ist diese untere Explosionsgrenze noch nicht unterschritten, wird das Trocknen fortgesetzt.

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Die Konzentration an Inertgas wird vorzugsweise auf zumindest 90 Gew.-%, insbesondere zumindest 95 Gew.-%, vorzugsweise zumindest 97 Gew.-% eingestellt. Die Messung der Konzentration erfolgt beispielsweise spektroskopisch.

15 Alternativ oder zusätzlich wird ein Fortschrittsparameter erfasst, der den Fortschritt des Trocknens beschreibt, und das Trocknen wird beendet, wenn der Fortschrittsparameter einen vorgegebenen Fortschrittsparameter-Schwellenwert erreicht. Der Fortschrittsparameter ist zu Beginn des Trocknens klein und wächst mit Fortschreiten des Trocknens. Äquivalent dazu ist der Fall, dass der Fortschrittsparameter zu Beginn des Trocknens groß ist und mit Fortschreiten des Trocknens abnimmt.

Beispielsweise ist der Fortschrittsparameter die Konzentration an gasförmigem Elektrolyten im abgesaugten Gas. Es ist möglich, nicht aber notwendig, dass dazu die Konzentration an gasförmigem Elektrolyten, insbesondere organischen Karbonaten, direkt gemessen wird, beispielsweise per Spektroskopie, insbesondere Infrarot-Spektroskopie. Es ist alternativ oder zusätzlich möglich, dass der Fortschrittsparameter der Kondensat-Strom (gemessen beispielsweise in Volumen, Masse, Gewicht oder Stoffmenge pro Zeiteinheit) an kondensierten Gasbestandteilen in einem etwaig vorhandenen Kondensator ist. Wiederum alternativ ist der Fortschrittsparameter der Druck im Trocknungsbehälter oder der Gasstrom aus dem Trocknungsbehälter. Bei konstanter Pumpleistung hängt der Druck in guter Näherung nur von dem Trocknungsfortschritt und der Temperatur

des Zerkleinerungsguts ab. Ist der Elektrolyt weitgehend verdampft, sinkt der Druck. Zudem sinkt der Gasstrom.

5 Gemäß einer bevorzugten Ausführungsform wird das Zerkleinerungsgut nach dem Trocknen direkt weiterverarbeitet wird. Darunter wird insbesondere verstanden, dass das Zerkleinerungsgut nach dem Trocknen nicht in einen Transportbehälter abgefüllt wird. Insbesondere wird das Zerkleinerungsgut nach dem Trocknen mittels einem kontinuierlich förderndem Förderer zur weiteren Verarbeitung, beispielsweise einer Trennvorrichtung, transportiert. Beispiele für kontinuierlich fördernde Förderer sind staubdichte Rohrkettenförderer, vorzugsweise mit zwei regelbaren Auslass-Schiebern, Förderbänder, Fördertröge, Förderschnecken, Becherförderer oder semi-kontinuierliche Förderer.

15 Bevorzugt ist ein Verfahren, bei dem das Trocknen des Zerkleinerungsguts erst beendet wird, wenn sich nach Beenden des Trocknens kein entzündliches oder explosives Gasgemisch über dem abgefüllten Zerkleinerungsgut mehr bilden kann und/oder wenn das Zerkleinerungsgut so trocken ist, dass sich im Transportbehälter oder während der Weiterverarbeitung ein entzündliches oder explosives Gasgemisch ergeben kann. Unter dem Merkmal, dass das Trocknen beendet wird, wenn sich nach Beenden des Trocknens kein entzündliches oder explosives Gasgemisch über dem abgefüllten Zerkleinerungsgut bilden kann, wird insbesondere verstanden, dass sich in einem Transportbehälter in Form eines 50-Literbehälter, der zur Hälfte (bezogen auf sein Volumen) mit dem Zerkleinerungsgut gefüllt ist, innerhalb von einer Woche bei 50°C und 1013 hPa 20 kein zündfähiges Gasgemisch bildet. Ob das Kriterium erfüllt ist, wird in Vorversuchen ermittelt. Bildet sich ein zündfähiges Gasgemisch, muss das Trocknen länger und/oder bei niedrigerem Druck durchgeführt werden. Die Vorversuche werden so lange wiederholt, bis eine Trocknungsdauer und/oder ein Trocknungsdruck ermittelt ist, bei der das Merkmal bei einem Testsatz von drei 30 Transportbehälter für alle drei Transportbehälter erfüllt ist.

Vorzugsweise wird das Zerkleinerungsgut so lange getrocknet, bis ein Elektrolytgehalt im Zerkleinerungsgut so klein ist, dass eine elektrochemische Reaktion

unmöglich ist. In anderen Worten ist der Elektrolytgehalt kleiner als ein Schwellenwert, wobei der Schwellenwert so gewählt ist, dass die Zellspannung bei Unterschreiten dieses Schwellenwerts auf höchstens ein Viertel abgesunken ist.

- 5 Dieser Schwellenwert wird beispielsweise dadurch bestimmt, dass die Zellspannung einer Batterie in Abhängigkeit vom Elektrolytgehalt bestimmt wird. Kurz vor dem Erreichen des Schwellenwerts bricht die Zellspannung zusammen, das heißt, dass sie um zumindest 75% absinkt. Ist der Schwellenwert unterschritten, enthält die Batterie so wenig Elektrolyt, dass in guter Näherung keine elektrochemische Reaktion mehr möglich ist.

10

Vorzugsweise wird das Zerkleinerungsgut so lange getrocknet, dass eine Menge von 50 kg an Zerkleinerungsmaterial, das kompaktiert in einem 50 Liter-Fass enthalten ist, keine oder eine nur so geringe Wärmeentwicklung zeigt, dass ein thermisches Durchgehen, also eine thermisch induzierte Kettenreaktion, für zumindest zwei Monate ausgeschlossen ist und dass eine etwaige Gasentwicklung zudem so gering ausgebildet ist, dass nach zwei Wochen kein Überdruck entsteht, wenn zu Beginn ein Unterdruck von 500 hPa herrscht.

20

Günstig ist es, wenn das Zerkleinerungsgut so lange getrocknet wird, bis der Elektrolytgehalt an organischen Komponenten, die bei 50°C flüchtig sind, höchstens 3 Gew.-%, höchstens insbesondere 2 Gew.-%, besonders bevorzugt höchstens 1,5 Gew.-%, beträgt.

25

Vorzugsweise wird das Trocknen so lange durchgeführt, dass der akkumulierte Gehalt an organischen Karbonaten aus dem Elektrolyten, die bei 80°C flüchtig sind, in der Atmosphäre über dem Zerkleinerungsgut 3 Vol.-% unterschreitet.

30

Insbesondere wird das Trocknen so lange durchgeführt, bis der Gehalt an Kohlendimethylester 4 Vol.-%, insbesondere 3 Vol.-%, unterschreitet und/oder der Gehalt an Cyclohexylbenzol 1 Vol.-%, insbesondere 0,5 Vol.-%, unterschreitet.

Vorzugsweise erfolgt das Trocknen unmittelbar nach dem Zerkleinern. Hierunter

wird insbesondere verstanden, dass zwischen dem Beginn des Zerkleinerns der Batterien und dem Zeitpunkt, zu dem zumindest ein Teil des dadurch entstandenen Zerkleinerungsguts anfängt zu Trocknen, höchstens fünf Minuten beträgt, insbesondere höchstens eine Minute. Durch die schnelle Trocknung nach dem

5 Zerkleinern wird die Masse an Material klein gehalten, die potentiell elektrochemisch reagieren könnte, zudem wird die elektrochemische Reaktionszeit potentieller exothermer Reaktionen klein gehalten. Das senkt das Risiko für die Anlage und die Umgebung.

10 Gemäß einer bevorzugten Ausführungsform wird das Zerkleinerungsgut in der Trockenvorrichtung, insbesondere beim Entnehmen aus der Trockenvorrichtung, mittels eines Rührwerks bewegt. Bei dem Rührwerk kann es sich um die Zerkleinerungseinheit handeln, das ist aber nicht notwendig. Das Rührwerk dient insbesondere zum Verhindern von Verstopfungen und/oder zum Eintrag von Wärmeenergie in das Zerkleinerungsgut und/oder der Trennung der geschichteten

15 Folien, so dass die Elektrolytverdampfung nicht sterisch behindert wird. Zudem bewirkt der mechanische Energieeintrag eine zumindest teilweise Ablösung der Beschichtung von den Stromsammelrfolien. Dadurch entsteht weitere freie Oberfläche der Beschichtungsfragmente, welche die Trocknung begünstigt und

20 die folgende Trennung von Beschichtung und Folien erleichtert. Vorzugsweise hat das Rührwerk eine Leistung von zumindest 1 kW pro Kubikmeter Trockner-volumen. Günstig ist es, wenn das Rührwerk zumindest ein Rührblatt aufweist, das so angeordnet ist, dass es das Zerkleinerungsgut nach oben bewegt.

25 Vorzugsweise wird mittels des Rührwerks mehr als 35%, insbesondere zumindest 50%, einer zum Trocknen des Zerkleinerungsguts notwendigen Verdampfungswärme zugeführt. In anderen Worten ist im Idealfall eine zusätzliche Heizung zum Beheizen des Zerkleinerungsguts entbehrlich. Ist eine solche Heizung vorhanden, ist ihre Leistung vorzugsweise kleiner als die Leistung des

30 Rührwerks. Das Einbringen von Energie in das Zerkleinerungsgut per Rührwerk hat den Vorteil, dass es zu einem Trennen beispielsweise von Beschichtung und Trägerfolie und anderen Komponenten der Batterie kommt.

Das Rührwerk hat vorzugsweise eine Leistung von zumindest 1 Kilowatt pro Kubikmeter an Volumen der Trockenvorrichtung.

Vorzugsweise besitzt die Trockenvorrichtung eine Heizung, die welche die
 5 Wärme aus der Wärmeabfuhr der zumindest einen Vakuumpumpe und/oder des
 Kondensators bezieht. Durch das Kondensieren des Elektrolyten im Kondensa-
 tor entsteht Kondensationswärme. Im Kondensator kann daher eine Temperatur
 von zumindest 60°C herrschen. Die Wärme wird beispielsweise mittels eines
 Wärmeübertragungsfluids, insbesondere eines Gases oder einer Flüssigkeit,
 10 übertragen. Beispielsweise wird das Wärmeübertragungsfluids zum Heizen einer
 Außenwand der Trockenvorrichtung verwendet.

Ein unabhängiger Gegenstand der vorliegenden Erfindung ist ein Verfahren
 zum Behandeln gebrauchter Lithium-Batterien mit den Schritten (a) Zerkleinern
 15 der Batterien, sodass Zerkleinerungsgut erhalten wird, und (b) Trocknen des
 Zerkleinerungsguts, sodass Elektrolyt der Batterie verdampft, wobei (c) die zum
 Verdampfungswärme zu zumindest 50% mittels mechanischer Energie in das
 Zerkleinerungsgut eingebracht wird. Insbesondere wird die mechanische Ener-
 gie mittels einer Zerkleinerungseinheit und/oder eines Rührwerks in das Zerklei-
 20 nerungsgut eingebracht. Besonders günstig ist es, wenn das das Trocknen bei
 einem Druck von höchstens 300 hPa und höchstens 80 °C erfolgt, das ist aber
 nicht notwendig. Die in der Beschreibung genannten bevorzugten Ausführungs-
 formen beziehen sich auch auf diesen Aspekt der Erfindung.

Vorzugsweise wird das Zerkleinern und das Trocknen in nur einem Behälter,
 insbesondere der Zerkleinerungsvorrichtung, durchgeführt. In anderen Worten
 finden das Zerkleinern und das Trocknen im Unterdruck gleichzeitig in einem
 Behälter statt. Vorteilhaft hieran ist, dass die mechanische Energie, die zum
 Zerkleinern zugeführt wird und in Wärmeenergie umgewandelt wird, beim Ver-
 30 dampfen des Elektrolyten aufgenommen und so abgeführt wird. So wird einer-
 seits eine übermäßige Erwärmung des Zerkleinerungsguts verhindert, anderer-
 seits ist eine Heizung zum Trocknen entbehrlich.

Besonders günstig ist es, wenn das Vakuum von einem Absolutdruck von höchstens 300 hPa mittels einer Strahlpumpe erzeugt wird. Strahlpumpen sind, insbesondere bei geeigneter Wahl des Strahlmediums, weitgehend unempfindlich gegen aggressive abzupumpende Gase. Günstig ist es, wenn das Strahlmedium, das eine Flüssigkeit ist, einen pH-Wert von zumindest 8, insbesondere von zumindest 9, beispielsweise zumindest 12, hat. In diesem Fall können sich unerwünschte Bestandteile des Gases, das abgepumpt wird, zersetzen oder zu weniger schädlichen Substanzen reagieren. So kann beispielsweise Kohlensäure-dimethylester und/oder Kohlensäureethylmethylester durch eine Verseifungsreaktion abgebaut werden. Etwaig im Strahlmedium enthaltener Fluorwasserstoff kann im basischen Milieu in einer Säure-Base-Reaktion zu einem ungefährlichen Salz umgesetzt werden.

Vorzugsweise enthält das Strahlmedium eine Fluor fällende Substanz. Beispielsweise kann das Strahlmedium Natriumkarbonat, Kaliumkarbonat oder Calciumkarbonat enthalten. Die bei der Reaktion mit einer Fluorverbindung, insbesondere Fluorwasserstoff, entstehenden Salze werden vorzugsweise abgetrennt, insbesondere abgefiltert oder aussedimentiert. Auf diese Weise wird zumindest weitgehend verhindert, dass Fluorwasserstoff oder andere giftige fluorhaltige Verbindungen in die Umgebung abgegeben werden können.

Vorzugsweise erfolgt das Trocknen bei einer Temperatur von höchstens 80°C. In diesem Fall entsteht kaum Fluorwasserstoff. Das erhöht die Lebensdauer der Batterie-Verarbeitungsanlage und verringert die Umweltgefährdung.

Gemäß einer bevorzugten Ausführungsform umfasst das Verfahren die Schritte des Kondensierens von Bestandteilen des Elektrolyten durch Abkühlen und/oder Druckerhöhen, sodass ein Elektrolytkondensat entsteht. Beispielsweise wird das Kondensieren an einer Stelle durchgeführt, die bezüglich des Gasflusses zwischen dem Trockner und der Vakuumpumpe liegt. Vom Trockner kommende Gase müssen daher in diesem Fall zunächst einen Kondensator passieren, bevor sie zur Vakuumpumpe gelangen können. Das führt dazu, dass gasförmiger Elektrolyt, der in dem Gas vorliegt, das beim Trocknen entsteht, zumindest zu

einem überwiegenden Teil im Kondensator abgeschieden wird, bevor das verbleibende Gas zur Pumpe gelangt. So kann Elektrolyt zurückgewonnen werden. Zudem verringert sich der Gasstrom durch die Vakuumpumpe, was deren Lebensdauer verlängert und deren Energieverbrauch reduziert.

5

Gemäß einer bevorzugten Ausführungsform umfasst das Verfahren alternativ den Schritt der Gasreinigung durch Adsorption der flüchtigen organischen Bestandteile an einem Aktivkohlefilter vor oder nach der Verdichtereinheit.

- 10 Vorzugsweise umfasst das erfindungsgemäße Verfahren alternativ oder zusätzlich den Schritt eines Reinigens des Gases, das beim Trocknen entsteht, bevor dieses die Vakuumpumpe erreicht. Das kann beispielsweise auch dadurch erfolgen, dass das Gas einen Aktivkohlefilter und/oder einen Filter passiert, in dem mit Fluorwasserstoff reagierende Substanzen enthalten sind, beispielsweise ein
- 15 Calziumsalz wie Calziumkarbonat oder ein Kaliumsalz wie Kaliumkarbonat.

- Vorzugsweise wird das Hochtemperatur-Trocknen, bei dem sich der Binder zersetzt, so durchgeführt, dass die entstehenden Zersetzungsgase sich nicht mit den Gasen mischen, die beim Niedrigtemperatur-Trocknen entstehen. Es ist
- 20 möglich, dass das Hochtemperatur-Trocknen und das Niedertemperatur-Trocknen bei unterschiedlichen Drücken erfolgt. Beispielsweise kann das Hochtemperatur-Trocknen bei Normaldruck erfolgen.

- Unter dem Aktivmaterial wird der Stoff verstanden, der beim Betrieb der Batterien elektrochemisch reagiert. Unter dem Träger für das Aktivmaterial wird insbesondere eine Trägerfolie verstanden, auf der das Aktivmaterial in Form von Partikeln aufgebracht ist. Beispielsweise handelt es sich bei der Trägerfolie um eine Folie aus Aluminium oder eine Aluminiumlegierung. Der Binder ist der Stoff, der das Aktivmaterial mit dem Träger verbindet, beispielsweise enthält der Bin-
- 25
- 30 der Polyvinylidenfluorid.

Günstig ist es, wenn beim Zerkleinern der Batterien flüssiger Stickstoff zugegeben wird. Das kühlt die Zerkleinerungsmaschine und das Zerkleinerungsgut und

verdrängt zudem Sauerstoff und Wasserdampf aus der Atmosphäre.

Günstig ist es, wenn das Zerkleinern bei dem Taupunkt - 40 °C und/oder einem Sauerstoff-Partialdruck von höchstens 40 hPa, insbesondere höchstens 15 hPa erfolgt.

Gemäß einer bevorzugten Ausführungsform umfasst das Verfahren die Schritte eines Abtrennens von Hartteilen und/oder eines Separierens von Aktivmaterial vom Träger, insbesondere durch eine zweite Zerkleinerungsstufe und/oder Luftstrahlsieben, sodass eine Aktivmaterialfraktion und eine Trägerfraktion entstehen, und eines getrennten Verpackens von Aktivmaterialfraktion und Trägerfraktion in jeweilige Transportbehältnisse. Günstig ist es, wenn diese Transportbehältnisse luftdicht ausgebildet sind. Durch das Trennen von Aktivmaterialfraktion und Trägerfraktion ist ein Transport in der Regel ohne Genehmigungen möglich. Ein weiterer Vorteil ist, dass derartig getrennte Fraktionen nur eine geringe Gefährdung darstellen.

Das Entnehmen des Zerkleinerungsguts aus dem Transportbehälter erfolgt vorzugsweise unter Vakuum und/oder unter Schutzgas.

20

Es ist möglich, nicht aber notwendig, dass das Zerkleinerungsgut unter Vakuum in den Transportbehälter abgefüllt wird. Günstig ist es, wenn der Transportbehälter ein Vakuumbehälter ist, insbesondere ein evakuierter Vakuumbehälter, sodass im Transportbehälter nach dem Verschließen ein Unterdruck oder Vakuum herrscht. Alternativ kann der Transportbehälter mit einem Inertgas gefüllt werden.

25

Gemäß einer bevorzugten Ausführungsform wird das Verfahren so durchgeführt, dass ein Druck von 100 hPa für zumindest eine Minute unterschritten wird.

30

In einer bevorzugten Batterie-Verarbeitungsanlage sind die Trennungseinheit und die Trockenvorrichtung in einem gemeinsamen Standard-Container angeordnet. Das hat den Vorteil, dass die Batterie-Verarbeitungsanlage besonders

einfach transportiert werden kann.

Die Trockenvorrichtung ist eingerichtet zum Trocknen des Zerkleinerungs-
guts für eine so lange Zeit, bis ein Elektrolytgehalt so klein ist, dass eine elektro-
chemische Reaktion unmöglich ist. Wird die Trockenvorrichtung im Chargenbe-
trieb betrieben, was eine mögliche Ausführungsform darstellt, so wird das
Trocknen beispielsweise für eine vorgegebene Zeitspanne durchgeführt. Altern-
ativ oder zusätzlich wird der Gehalt an organischen Substanzen, beispielswei-
se an organischen Carbonaten, in der Atmosphäre in der Trockenvorrichtung
kontinuierlich gemessen und das Trocknen beendet, wenn eine vorgegebene
Schwellen-Konzentration unterschritten wird.

Gemäß einer bevorzugten Ausführungsform umfasst die Batterie-Verarbei-
tungsanlage, insbesondere die Vakuumanlage, einen Kondensator, der einge-
richtet ist zum Kondensieren von organischen Bestandteilen der Atmosphäre im
Trockner, insbesondere von organischen Carbonaten, beispielsweise von Dime-
thylcarbonat, Ethylmethylcarbonat und/oder Ethylencarbonat. Der Kondensator
kann auch als Kondensiervorrichtung oder als Verflüssiger bezeichnet werden.
Vorzugsweise ist der Kondensator in Materialflussrichtung hinter einer Vakuum-
pumpe angeordnet, mittels der der Trockner evakuiert wird. Günstig ist es, wenn
der Kondensator gekühlt ist, vorzugsweise auf eine Temperatur von höchstens
90°C, vorzugsweise höchstens 80°C, insbesondere höchstens 70°C. Um den
Kühlaufwand klein zu halten wird der Kondensator, sofern er gekühlt wird, auf
eine Temperatur von zumindest -10°C, insbesondere zumindest 10 °C, gekühlt.

Günstig ist es, wenn die Trockenvorrichtung ein Rührwerk aufweist, beispiels-
weise einen Ankerrührer oder einen Stabrührer, dessen Rührstäbe quer zu einer
Rührwelle angebracht sein können. Alternativ oder zusätzlich ist das Rührwerk
ein externes Rührwerk, das den Trockner als Ganzes bewegt.

Die Batterie-Verarbeitungsanlage besitzt eine Vakuumanlage, die mit der Tro-
ckenvorrichtung zum Erzeugen eines Vakuums in der Trockenvorrichtung ver-
bunden ist. Besonders günstig ist es, wenn auch die Vakuumanlage im Stan-

Standard-Container angeordnet ist. Bei dem Standard-Container handelt es sich vorzugsweise um einen Container nach ISO-Norm 668, vorzugsweise um einen 40-Fuß-Container oder einen 20-Fuß-Container.

- 5 Beispielweise umfasst die Vakuumanlage eine Strahlpumpe, bei der ein Strahlmedium zum Erzeugen des Unterdrucks verwendet wird.

- 10 Günstig ist es, wenn die Zerkleinerungseinheit in der Trockenvorrichtung angeordnet ist. Es existiert in anderen Worten in diesem Fall ein Behälter, in dem die Batterien sowohl zerkleinert werden und in dem das Zerkleinerungsgut getrocknet wird. Beide Prozesse laufen simultan und unter Vakuum ab. In diesem Fall ist ein Rührwerk entbehrlich.

- 15 Vorzugsweise umfasst die Batterie-Verarbeitungsanlage eine Hartmetallabtrennvorrichtung und/oder eine Leichtfraktionabtrennvorrichtung, eine Separier-
vorrichtung, insbesondere eine Klassiervorrichtung, zum Separieren von Aktivmaterial vom Träger, insbesondere durch eine zweite Zerkleinerungsstufe
und/oder Luftstrahlsieben, sodass eine Aktivmaterialfraktion und eine Trägerfraktion entsteht, und vorzugsweise eine zweite Abfüllvorrichtung zum getrennten
20 Abfüllen von Aktivmaterialfraktion und Trägerfraktion. Günstig ist es, wenn diese Abfüllvorrichtung zum Abfüllen unter Unterdruck und/oder unter Inertgas mindestens jedoch staubdicht ausgebildet ist.

- 25 Unter einer Hartmetallabtrennvorrichtung wird insbesondere eine Vorrichtung zur Abtrennung von Fragmenten peripherer Bestandteile des Betriebssystems, der Batteriezellhülle und der Strom-Kontakte verstanden. Beispielsweise umfasst die Hartmetallabtrennvorrichtung eine Magnetseparationsvorrichtung und/oder einen Siebtrichter, insbesondere einen Querstromsiebtrichter und/oder einen Zickzack-Siebtrichter. Unter der Separiervorrichtung wird insbesondere eine Vorrichtung
30 zum zur Abtrennen der Separatorfolie verstanden.

Die Leichtfraktionabtrennvorrichtung umfasst vorzugsweise einen Zickzack-Siebtrichter und/oder einen Lufttrenner, wobei es günstig ist, wenn die Luft im Kreis-

lauf geführt wird. Das reduziert die Staubexposition der Umwelt mit gesundheitsschädlichem Staub.

5 Vorzugsweise sind die zweite Abfüllvorrichtung und die Separiervorrichtungen in einem gemeinsamen Standard-Container angeordnet, beispielsweise im oben beschriebenen ersten Standard-Container, oder einem zweiten Standard-Container. Günstig ist es, wenn der Container staubdicht gekapselt ist.

10 Vorzugsweise umfasst die Batterie-Verarbeitungsanlage eine Schleuse zwischen der Zerkleinerungseinheit und der Inaktivierungsvorrichtung, insbesondere der Trocknungsvorrichtung. Beispielsweise handelt es sich um eine Zellenradschleuse oder einen Flachschieber. Durch die Schleuse wird der Gaseintrag in die Inaktivierungsvorrichtung, insbesondere die Trocknungsvorrichtung, vermindert. Die Schleuse ist vorzugsweise als Dosierschleuse ausgebildet. So kann
15 die Inaktivierungseinheit während des Betriebes der Zerkleinerungseinheit evakuiert werden.

20 Wenn das Zerkleinern und das Trocknen in unterschiedlichen Behältern durchgeführt werden, besitzt die Batterie-Verarbeitungsanlage vorzugsweise eine staubdichte, insbesondere eine gasdichte, Fördervorrichtung, die die Zerkleinerungsvorrichtung und die Trockenvorrichtung miteinander verbindet. Als staubdicht wird eine Fördervorrichtung insbesondere dann betrachtet, wenn höchstens 5 Gew.-% aller Partikel mit einem Durchmesser von zumindest 0,1 Mikrometer die Fördervorrichtung in die Umgebung verlassen.

25

Um die Trockenzeit zwischen Beginn und Ende des Trocknens zu verringern, ist es günstig, wenn die Trockenvorrichtung eine Heizung umfasst. Es kann sich bei der Heizung um eine konduktive oder eine konvektive Heizung handeln, welche vorzugsweise die Kompressionswärme der Pumpen und die Kondensations-
30 wärme in den Trockner einbringt.

Es hat sich herausgestellt, dass die Qualität des zurückgewonnenen Elektrolyten besonders hoch ist, wenn die Trockenvorrichtung zumindest eine trockenlau-

fende Vakuumpumpe, vorzugsweise ausschließlich trockenlaufende Vakuumpumpen, aufweist.

- 5 Die Pumpleistung der Vakuumanlage beträgt bei 300 hPa zumindest das Fünzigfache des Volumens des Innenraums der Trockenvorrichtung pro Stunde. Auf diese Weise kann die Trockenzeit klein gehalten werden.

- 10 Die Trockenzeit lässt sich zudem vermindern, wenn – wie gemäß einer bevorzugten Ausführungsform vorgesehen – die Trockenvorrichtung zumindest zwei Vakuumpumpen aufweist, die sich in ihrem Volumenstrom bei 400 hPa und ihrem maximal erreichbaren Minimaldruck unterscheiden. So hat eine der beiden Vakuumpumpen vorzugsweise eine hohe Volumenstromleistung (gemessen in Litern pro Sekunde bei 400 hPa), aber einen geringeren Minimaldruck. Der maximal erreichbar Minimaldruck ist der kleinste Druck, der mit der Pumpe erreichbar ist. Es ist dann möglich, die Pumpen in ihren optimalen Arbeitsbereichen einzusetzen. Die in Materialflussrichtung ersten Pumpen gewährleisten einen hohen Volumenstrom bei niedrigen Drücken, während nachgelagerte Pumpen kleinere Volumenströme gegen Umgebungsdruck verdichten.

- 20 Beispielsweise besitzt die Vakuumanlage zumindest eine trocken laufende Wälzkolbenpumpe und/oder zumindest eine trocken laufende Schraubenvakuumpumpe.

- 25 Die Zerkleinerungseinheit besitzt vorzugsweise ein Bodensieb zum Begrenzen der maximalen Größe des Zerkleinerungsguts. Das erleichtert die Weiterverarbeitung des Zerkleinerungsguts und vermindert die Gefahr einer Nachträglichen Erhitzung und Selbstentzündung des Zerkleinerungsgutes durch Kurzschlüsse von Batteriefragmenten. Vorzugsweise hat das Bodensieb eine Maschenweite von höchstens 35 mm.

- 30 Zum Zuführen von Inertgas zur Trockenvorrichtung besitzt diese vorzugsweise ein Zulassventil, das mit einer Inertgas-Versorgungsvorrichtung zum Zuführen von Inertgas in einen Innenraum der Trockenvorrichtung verbunden ist. Insbe-

sondere wird verflüssigtes, also bei 22°C und 1013 hPa gasförmigem, Inertgas mit einer Temperatur von höchstens -30°C zugeführt. Zum gleichen Zweck besitzt die Zerkleinerungsvorrichtung alternativ oder zusätzlich ein Zuführventil, das mit einer Inertgas-Versorgungsvorrichtung zum Zuführen von Inertgas in einen Innenraum der Zerkleinerungsvorrichtung verbunden ist. Die Inertgas-Versorgungsvorrichtung ist vorzugsweise zum Bereitstellen von verflüssigtem Inertgas.

10 Zum Messen einer Sauerstoffkonzentration, insbesondere zum Ermitteln, ob eine Explosionsgrenze überschritten ist, besitzt die Zerkleinerungseinheit eine Sauerstoff-Erfassungsvorrichtung zum Erfassen einer Sauerstoffkonzentration in der Zerkleinerungseinheit.

15 Die Batterie-Verarbeitungsanlage kann eine Verbrennungsvorrichtung zur thermischen oder katalytischen Verbrennung von gasförmigen Bestandteilen des Elektrolyten besitzen. Diese ist vorzugsweise in Materialflussrichtung hinter dem Kondensator und/oder vor einer Abgasöffnung angeordnet. So werden keine Bestandteile des Elektrolyten durch die Abgasöffnung in die Umgebung entlassen.

20 Vorzugsweise besitzt die Batterie-Verarbeitungsanlage eine Partikel-Entfernvorrichtung zum Entfernen von Partikeln aus dem aus der Trockenvorrichtung abgezogenen Gasstrom. Die Partikel-Entfernvorrichtung kann zum Beispiel einen Zyklon und/oder einen Filter und/oder Aktivkohle umfassen.

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Im Folgenden wird die Erfindung anhand der beigefügten Zeichnungen näher erläutert. Dabei zeigt

Figur 1 ein Ablaufdiagramm eines erfindungsgemäßen Verfahrens,

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Figur 2 einen Querschnitt durch eine erfindungsgemäße Batterie-Verarbeitungsanlage und

Figur 3 einen Querschnitt durch weitere, optionale Bestandteile einer erfindungsgemäßen Batterie-Verarbeitungsanlage.

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Figur 4 zeigt ein Ablaufdiagramm eines erfindungsgemäßen Verfahrens gemäß einer zweiten Ausführungsform.

Figur 1 zeigt das Ablaufdiagramm eines erfindungsgemäßen Verfahrens. Zunächst werden Batterien 10.1, 10.2, ..., insbesondere Batteriesysteme bestehend aus mehreren Batteriemodulen oder Batteriestacks, welche wiederum aus mehreren Batteriezellen bestehen, in einer Entladeeinheit 12 entladen. Danach folgt an einer Demontagestation 14 die Demontage der Batterien 10, wenn diese erforderlich ist, weil die Batteriesysteme ansonsten aus geometrischen oder gravimetrischen Gründen nicht in die Zerkleinerungseinheit befördert werden können. Dazu werden die Batteriesysteme geöffnet und soweit demontiert, dass die Module/Stacks einzeln entfernt werden können. Gegebenenfalls können auch die Zellen von der Ansteuerelektronik getrennt werden. Die entstehenden Untereinheiten (Module/Stacks) und/oder Zellen 16.1, 16.2, ... werden einer Zerkleinerungseinheit 18 zugeführt, die beispielsweise eine Rotorschere mit einem Rotor und einem Zerkleinerer mit Statoren oder mehreren Rotoren, oder eine Schneidmühle mit einem Rotor und mehreren Rotoren umfasst.

Die Zerkleinerungseinheit 18 zerkleinert die Batterien 10 unter Schutzgas 20, das beispielsweise einer Schutzgasflasche entnommen wird. Alternativ oder zusätzlich kann flüssiger Stickstoff aus einer Flüssigstickstoffquelle 19 zugeführt werden. Bei dem Schutzgas kann es sich beispielsweise um Stickstoff, ein

Edelgas, Kohlendioxid, Lachgas oder ein sonstiges, vorzugsweise nicht giftiges Gas handeln.

Beim Zerkleinern entsteht Zerkleinerungsgut 24, das einer Inaktivierungsvorrichtung in Form einer Trockenvorrichtung 26 zugeführt wird. Zwischen der Zerkleinerungseinheit 18 und der Trockenvorrichtung 26 ist eine Schleuse 28 angeordnet, die soweit gasdicht ist, dass die Druckvorrichtung 26 in guter Näherung von der Zerkleinerungseinheit 18 gasdicht getrennt ist.

Die Trockenvorrichtung 26 ist mit einer Vakuumanlage 29 verbunden, die eine Vakuumpumpe 30 aufweist und ein Vakuum erzeugt. In der Trockenvorrichtung 26 herrscht ein Druck p_{26} von $p_{26} \approx 100$ hPa, zeitweise unter 50 hPa. Es sei darauf hingewiesen, dass im Rahmen der vorliegenden Beschreibung unter einer Vakuumpumpe insbesondere ganz allgemein eine Vorrichtung verstanden wird, die ein Vakuum erzeugt. Es ist dabei möglich und bevorzugt, nicht aber notwendig, dass die Vakuumpumpe gleichzeitig als Verdichter wirkt, so dass von ihr Gas unter einem Druck abgegeben wird, der größer ist als der Umgebungsdruck.

In dem in Figur 1 gezeigten Fall handelt es sich bei der Vakuumpumpe um einen Verdichter, der Gas 31, das in der Trockenvorrichtung 26 vorliegt, ansaugt und verdichtet. Alternativ oder zusätzlich kann die Vakuumanlage 29 eine Strahlpumpe aufweisen, bei der ein Strahlmedium in Form einer Flüssigkeit mit hoher Geschwindigkeit durch Venturi-Düse geleitet wird. Das Strahlmedium ist alkalisch und hat einen pH-Wert von zumindest pH 13 und ist beispielsweise eine 10%ige Kaliumhydroxidlösung.

Die Vakuumanlage 29 umfasst eine Gasreinigungsvorrichtung 32, die zwischen der Trockenvorrichtung 26 und der Vakuumpumpe 30 angeordnet ist und die im vorliegenden Fall einen Kondensator 34 und/oder einen Aktivkohlefilter 36 umfasst. Der Kondensator wird bei einer Temperatur von -10 °C betrieben, so dass Kohlensäuredimethylester und Kohlensäureethylmethylester kondensieren und in einen Kondensatbehälter 38 abgegeben werden können. Zudem wird etwaig

vorhandenes Wasser ausgefroren. Ein Steuerventil 40 ist ausgebildet zum Öffnen, wenn der Druck p_{26} zu groß wird und zum Zufahren, wenn Pumpenkreislauf und Trocknungsbehälter entkoppelt werden sollen.

- 5 Vorzugsweise ist das Trocknungsgut während der Trocknung bewegt. Dies kann beispielsweise durch Rühren mit einem Rührwerk 41, wie einem Ankerrührer oder einem Stabrührer mit senkrecht zur Rührwelle angebrachten Stäben passieren. Alternativ durch einen bewegten Trocknungsbehälter.
- 10 Durch das Trocknen des Zerkleinerungsguts entsteht inaktiviertes Zerkleinerungsgut 42, das einer Abfüllvorrichtung 44 zugeführt wird. Dort wird das inaktivierte Zerkleinerungsgut 42 unter Vakuum und/oder unter Schutzgas in einen Transportbehälter 46 abgefüllt. Der Transportbehälter 46 ist vorzugsweise gasdicht. Es ist möglich, nicht aber notwendig, dass der Transportbehälter 46 vor
15 dem Abtransport mit Inertgas aufgefüllt wird, so dass er unter Normaldruck steht. Alternativ ist es auch möglich, dass der Transportbehälter unter Vakuum verschlossen und transportiert wird. Es ist möglich, dass alternativ zum Transportbehälter eine vakuumverschweißte Folie, beispielsweise eine Aluminiumverbundfolie, gewählt wird.
- 20 Über eine Spülleitung 48 wird der Zerkleinerungseinheit 18 Schutzgas 20 von der Vakuumpumpe 30 zugeführt. Arbeitet die Vakuumpumpe 30 wie im vorliegenden Fall, der eine bevorzugte Ausführungsform darstellt, zudem als Kompressor, kann das Schutzgas auf eine Druckgasflasche 50 gezogen werden. Al-
25 ternativ oder zusätzlich kann das Schutzgas 20, gegebenenfalls nach zusätzlicher Reinigung, in die Umgebung abgegeben werden.

- Figur 2 zeigt schematisch einen Querschnitt durch eine erfindungsgemäße Batterie-Verarbeitungsanlage 52 (vgl. Figur 1), die einen Standard-Container 54
30 aufweist, in dem die Zerkleinerungseinheit 18, die Trockenvorrichtung 26 und die Abfüllvorrichtung 44 angeordnet sind. Hinter der Zerkleinerungseinheit 18 ist ein erster gasdichter Förderer 56 angeordnet, der beispielsweise eine Förderschnecken oder einen Rohrkettentransporter umfasst. Der erste Förderer 56 fördert

das Zerkleinerungsgut 24 zur Trockenvorrichtung 26, die mit der in Figur 2 nicht sichtbaren Vakuum-Erzeugungsvorrichtung verbunden ist. In Materialstromrichtung hinter der Trockenvorrichtung 26 ist ein zweiter Förderer 58 angeordnet, der vorzugsweise ebenfalls gasdicht ausgebildet ist und eine Förderschnecke oder einen Rohrkettenförderer enthalten kann. Der zweite Förderer fördert das inaktivierte Zerkleinerungsgut 42 zur Abfüllvorrichtung 44.

Figur 3 zeigt optionale, in der vorliegenden Ausführungsform vorhandene Einheiten der erfindungsgemäßen Batterie-Verarbeitungsanlage 52 (vgl. Figur 1), die einen Aufschlusszerkleinerer 60 sowie einen Siehter 62 umfasst. Der Aufschlusszerkleinerer 60 enthält eine Transportbehälter-Entleervorrichtung 64, mittels der aus dem Transportbehälter 46 inaktiviertes Zerkleinerungsgut 42 entnommen werden kann. Der Aufschlusszerkleinerer 60 erzeugt Aufschlussmaterial 66, das dem Siehter 62 zugeführt wird. Es kann sich bei dem Siehter beispielsweise um einen Zickzack-Siehter handeln.

Vorzugsweise umfasst die Batterie-Verarbeitungsanlage 52 einen Zerkleinerer, der vorzugsweise im Materialfluss vor der Klassiervorrichtung 74 steht und ein schnell laufendes Zerkleinerungswerkzeug enthält, wobei eine Rotorumfangsgeschwindigkeit größer ist als 1 m/s, vorzugsweise größer als 10 m/s. Dieser Zerkleinerer zerkleinert das Zerkleinerungsmaterial und beansprucht es mechanisch so, dass sich die elektrochemisch aktive Beschichtung mindestens teilweise vom Träger löst. Das Vorhandensein eines solchen Zerkleinerer ist ein allgemeines bevorzugtes Merkmal einer erfindungsgemäßen Batterie-Verarbeitungsanlage.

Im Siehter entstehen eine Leichtfraktion mit Separatorfolie und feinem Beschichtungsmaterial und eine Schwergutfraktion mit Trägerfolien (Aluminium- und Kupfer) mit größerem leicht anhaftender Beschichtung. Beide Fraktionen werden auf jeweils ein Sieb zur weiteren Trennung in Beschichtung und Separatorfolie beziehungsweise Beschichtung und Metallfolien gegeben. Die entstehenden Fraktionen werden getrennt weiter verarbeitet.

Das Aufschlussmaterial 66 wird dem Sieb 62 mittels einem dritten Förderer 68 zugeführt. Ein vierter Förderer 70 führt gesichtetes Material 72, insbesondere das Material der Leichtfraktion und das Material der Schwefraktion, das den Sieb 62 verlässt, einer oder zwei Klassiervorrichtungen 74 zu. Die Klassiervorrichtung 74 umfasst vorzugsweise ein Luftstrahlsieb, das gleichzeitig als Trennvorrichtung im Falle der Schwerfraktion zum Trennen des Aktivmaterials von dem Träger fungiert. Im Falle der Leichtfraktion wird das Aktivmaterial vom Separator getrennt. Durch das Trennen entsteht eine Aktivmaterialfraktion 76, die in ein Transportbehältnis 78 abgefüllt wird.

Es entsteht zudem eine Trägerfraktion (Schwergut) 80 und eine Separatorfraktion (Leichtgut), die in der vorliegenden Ausführungsform mit einem fünften Förderer 82 einer Abfülleinheit 84 zugeführt wird, die die Trägerfraktion 80 in einen Behälter 86 füllt. Die Abfülleinheit 84 ist zusammen mit einer zweiten Abfülleinheit 88 Teil einer zweiten Abfüllvorrichtung.

Figur 4 zeigt ein Flussdiagramm einer zweiten erfindungsgemäßen Batterie-Verarbeitungsanlage 52, die zwei Trockenvorrichtungen 26.1, 26.2 aufweist. Jede der Trockenvorrichtungen 26.1, 26.2 besitzt jeweils ein Rührwerk 41.1 bzw. 41.2. In Materialflussrichtung vor der Zerkleinerungseinheit 18 befindet sich die Schleuse 27, die im vorliegenden Fall als Dosierschleuse ausgebildet ist und mit welcher die Zerkleinerungseinheit 18 befüllt werden kann, ohne dass die Gasatmosphäre im Zerkleinerer mit Umgebungsluft vermischt wird. In Materialflussrichtung hinter der Zerkleinerungseinheit 18 befindet sich die Schleuse 28, die im vorliegenden Fall als Dosierschleuse ausgebildet ist und mittels der die Trockenvorrichtungen 26.1, 26.2 einzeln oder simultan beschickt werden können.

Jedes der Rührwerke 41.1, 41.2 besitzt eine Leistung von zumindest 4 kW, im vorliegenden Fall 5 kW pro Kubikmeter Trockenvolumen. Die eingebrachte mechanische Energie wird auf das in der jeweiligen Trockenvorrichtung 26.1, 26.2 enthaltene Zerkleinerungsgut 24 übertragen. Ein Teil der mechanischen Energie führt zur Trennung von Bestandteilen des Zerkleinerungsguts, beispielsweise zu einer Trennung von Beschichtungsmaterial von der Trägerfolie. Der überwie-

gende Teil der mechanischen Leistung wird jedoch in Wärmeenergie umgewandelt. Diese Wärmeenergie wird von dem verdampfenden Elektrolyten, der noch Bestandteil des Zerkleinerungsguts 24 ist, aufgenommen.

- 5 Die in den Trockenvorrichtungen 26.i ($i = 1, 2$) entstehenden Gase werden zunächst mittels einer Partikel-Entfernvorrichtung 90 von mitgerissenen Partikeln gereinigt. Die Partikel werden in einem Behälter 92 aufgefangen oder direkt weiterverarbeitet. Bei der Partikelentfernvorrichtung 90 kann es sich beispielsweise um einen Filter und/oder einen Zyklon handeln.

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In Strömungsrichtung hinter der Partikelentfernvorrichtung 90 ist die Vakuumpumpe 30 angeordnet. Günstig ist es, wenn in Gas-Strömungsrichtung hinter der Vakuumpumpe 30 oder parallel dazu mindestens eine zweite Pumpe anderer Bauart angeordnet ist.

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Hinter der Vakuumpumpe 30 ist der Kondensator 34 angeordnet, in dem ein Druck p_{34} herrscht. Der Druck p_{34} entspricht im Wesentlichen dem Umgebungsdruck, das heißt, dass er beispielsweise um höchstens 100 hPa vom Umgebungsdruck abweicht. Da der Druck p_{34} deutlich größer ist als der Druck p_{26} in

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den Trockenvorrichtungen 26.1, 26.2, kondensieren insbesondere die Carbon säureester, insbesondere Dimethylcarbonat, Propylencarbonat, Diethylcarbonat, Ethylencarbonat und Ethylmethylcarbonat, aus. Die entstehende Kondensationswärme wird durch Kühlung abgeführt. Dabei ist es möglich, dass der Kondensator auf eine Temperatur T_{34} gekühlt wird, die sich um weniger als 20

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Kelvin von der Umgebungstemperatur T_{Umg} unterscheidet. Das hat den Vorteil, dass der Energieaufwand für das Trocknen des Zerkleinerungsgutes 24 vergleichsweise gering ist und gleichzeitig viel Elektrolyt zurückgewonnen werden kann.

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In Materialflussrichtung hinter dem Kondensator 34 kann ein Aktivkohlefilter 36 angeordnet sein, das ist aber nicht notwendig. Es ist zudem möglich, dass in Strömungsrichtung hinter dem Kondensator 34 eine Oxidationsvorrichtung 94 angeordnet ist, mittels der verbleibenden Reste oxidierbaren Materials, insbe-

sondere von organischen Bestandteilen des Elektrolyten, katalytisch oder thermisch oxidiert werden, sodass das aus der Oxidationsvorrichtung 94 austretende Gas gefahrlos in die Umgebung abgegeben werden kann.

- 5 Es ist möglich, dass die Batterieverarbeitungsanlage 52 eine Abfüllvorrichtung 44 aufweist, mittels der das getrocknete Zerkleinerungsgut 24 in Form des inaktiven Zerkleinerungsgutes 42 in einen Transportbehälter 46 abgefüllt werden kann. Es ist aber auch möglich, dass die Batterieverarbeitungsanlage 52 keine solche Abfüllvorrichtung 44 aufweist.

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Die Trockenvorrichtung 26.1, 26.2 (es ist auch möglich, dass die Batterieverarbeitungsanlage in dieser Ausführungsform lediglich eine Trockenvorrichtung 26 aufweist) besitzen jeweils eine Ausgangs-Schleuse 96.1, 96.2 in Form einer Dosier- und Umlenkschleuse. Das inaktive Zerkleinerungsgut 42 wird beispielsweise in einem Silo 98 zwischengelagert oder direkt einem Schwergutabscheider 100 zugeführt. Der Schwergutabscheider 100 ist ausgebildet zum Abscheiden von Material mit einer Dichte von zumindest 2,6 Gramm pro Kubikzentimeter, insbesondere Aluminium- und/oder Eisenbestandteile.

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- 20 Nachfolgend wird das verbleibende Material in einem Zerkleinerer 102 weiter zerkleinert und danach in einem Sieb 62 klassiert in Leichtgut 108 (Separator und Beschichtungsmaterial) und in Schwergut 110 (Trägerfolien und Beschichtungsmaterial). Beide Fraktionen werden gesiebt 74.1, 74.2. Es entstehen die wiederverwertbaren Aluminium- und Kupferfolien in Behälter 88.3, eine Separatorfraktion in Behälter 88.1, sowie reines Beschichtungsmaterial in Behälter 88.4 und 88.2, welches auf Grund seiner großen Reinheit in folgenden metallurgischen Prozessschritten weiterverarbeitet werden kann.

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Bezugsleistenliste

10	Batterie	60	Aufschlusszerkleinerer
12	Entladeeinheit	62	Sichter
14	Demotagesstation	64	Transportbehälter- Entleervorrichtung
16	Zelle	66	Aufschlussmaterial
18	Zerkleinerungseinheit	68	dritter Förderer
19	Flüssigstickstoffquelle		
20	Schutzgas	70	vierter Förderer
22	Schutzgasflasche	72	gesichtetes Material
24	Zerkleinerungsgut	74	Klassiervorrichtung
26	Trockenvorrichtung	76	Aktivmaterialfraktion
27	Schleuse vor Zerkleinerer	78	Transportbehältnis
28	Schleuse		
29	Vakuumanlage	80	Trägerfraktion
30	Vakuumpumpe	82	fünfter Förderer
31	Gas	84	Abfülleinheit
32	Gasreinigungsvorrichtung	86	Behälter
34	Kondensator	88	weitere Abfülleinheit
36	Aktivkohlefilter	90	Partikelentfernvorrichtung
38	Kondensatbehälter	92	Behälter
40	Steuerventil	94	Oxidationsvorrichtung
41	Rührwerk	96	Ausgangsschleuse
42	inaktives Zerkleinerungsgut	98	Silo
44	Abfüllvorrichtung	100	Schwergutabscheider
46	Transportbehälter	102	Zerkleinerer
48	Spüleleitung	108	Leichtgut
50	Druckgasflasche	110	Schwergut
52	Batterie-Verarbeitungsanlage	p	Druck
54	Standard-Container		
56	erster Förderer		
58	zweiter Förderer		

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Patentansprüche

1. Verfahren zum Behandeln gebrauchter Lithium-Batterien (10) mit den Schritten:
 - (a) Zerkleinern der Batterien (10), sodass Zerkleinerungsgut (24) erhalten wird, und
 - (b) Inaktivieren des Zerkleinerungsguts (24) durch Trocknen, sodass ein inaktiviertes Zerkleinerungsgut (42) erhalten wird, dadurch gekennzeichnet, dass
 - (c) das Trocknen bei einem Druck von höchstens 300 hPa und höchstens 80 °C erfolgt.
2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, dass die Batterie bei einer Temperatur getrocknet wird, die unterhalb einer Zersetzungstemperatur eines Binders der Batterie liegt.
3. Verfahren nach einem der vorstehenden Ansprüche, gekennzeichnet durch den Schritt: Kondensieren der beim Trocknen der entstandenen Gase, insbesondere bei Umgebungsdruck und/oder bei einer Temperatur von mehr als 0°C und höchstens 50°C.
4. Verfahren nach einem der vorstehenden Ansprüche, gekennzeichnet durch die Schritte:
 - beim Trocknen kontinuierliches Überwachen einer Konzentration an organischen Karbonaten in der Atmosphäre der Trockenvorrichtung, und
 - Beenden des Trocknens erst dann, wenn eine untere Explosionsgrenze unterschritten ist.

5. Verfahren nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, dass
- das Trocknen zumindest 50% der Trockenzeit bei einem Druck von höchstens 30 hPa erfolgt und /oder
 - ein Minimaldruck beim Trocknen höchstens 50 hPa beträgt.
6. Verfahren nach einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, dass das Zerkleinerungsgut nach dem Trocknen direkt weiterverarbeitet wird.
7. Verfahren nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, dass
- das Zerkleinerungsgut in der Trockenvorrichtung, insbesondere beim Entnehmen aus der Trockenvorrichtung, mittels eines Rührwerks bewegt wird und
 - mittels des Rührwerks zumindest 50%, insbesondere zumindest 80%, einer zum Trocknen des Zerkleinerungsguts (24) notwendigen Verdampfungswärme zugeführt wird.
8. Verfahren nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, dass
- beim Trocknen entstehende Gase abgesaugt werden und/oder
 - das Rühren so durchgeführt wird, dass zumindest 50 Gew.-% des Beschichtungsmaterials des Zerkleinerungsguts abgesaugt werden.
9. Verfahren nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, dass das Zerkleinern und das Trocknen in nur einem Behälter durchgeführt wird.

10. Batterie-Verarbeitungsanlage zum Behandeln von Batterien, insbesondere gebrauchten Lithium-Batterien, mit:

- (a) einer Zerkleinerungseinheit (18) zum Zerkleinern der Batterien (10), sodass Zerkleinerungsgut (24) erhalten wird, und
- (b) einer Inaktivierungsvorrichtung in Form einer Trockenvorrichtung (26) zum Inaktivieren des Zerkleinerungsguts (24),

dadurch gekennzeichnet, dass

- (c) eine Vakuumanlage mit der Trockenvorrichtung (26) zum Erzeugen eines Vakuums in der Trockenvorrichtung (26) von zumindest 300 hPa verbunden ist und
- (d) die Trockenvorrichtung (26) zum Trocknen bei einer Temperatur von höchstens 80 °C ausgebildet ist.

11. Batterie-Verarbeitungsanlage nach Anspruch 10, dadurch gekennzeichnet, dass die Zerkleinerungseinheit (18) in der Trockenvorrichtung angeordnet ist.

12. Batterie-Verarbeitungsanlage nach einem der Ansprüche 10 bis 11, gekennzeichnet durch einen Kondensator zum Kondensieren von aus dem Trockner abgesaugtem gasförmigem Elektrolyten, wobei in Materialflussrichtung zwischen der Trockenvorrichtung und dem Kondensator und/oder der zumindest einen Pumpe ein Partikelabscheider angeordnet ist.

13. Batterie-Verarbeitungsanlage nach einem der Ansprüche 10 bis 12, gekennzeichnet durch eine gasdichte Fördervorrichtung, die die Zerkleinerungsvorrichtung und die Trockenvorrichtung (26) miteinander verbindet.

14. Batterie-Verarbeitungsanlage nach einem der Ansprüche 10 bis 13, gekennzeichnet durch
- eine Schleuse, die vor der Zerkleinerungseinheit (18) zum Zuführen der Batterien (10) angeordnet ist,
 - wobei die Schleuse insbesondere als Förderschleuse und/oder Dosierschleuse ausgebildet ist.

15. Batterie-Verarbeitungsanlage nach einem der Ansprüche 10 bis 14, dadurch gekennzeichnet, dass die Trockenvorrichtung eine Heizung umfasst, welche die Wärme vorzugsweise aus der Wärmeabfuhr der Vakuumpumpen und/oder des Kondensators bezieht.

16. Batterie-Verarbeitungsanlage nach einem der Ansprüche 10 bis 15, dadurch gekennzeichnet, dass die Trockenvorrichtung zumindest eine trockenlaufende Vakuumpumpe aufweist, insbesondere zumindest zwei Vakuumpumpen aufweist, die sich in ihrem Volumenstrom bei 400 hPa und ihrem maximal erreichbaren Minimaldruck unterscheiden.

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Zusammenfassung

Die Erfindung betrifft ein Verfahren zum Behandeln gebrauchter Lithium-Batterien (10) mit den Schritten: Zerkleinern der Batterien (10), sodass Zerkleinerungsgut (24) erhalten wird, und Inaktivieren des Zerkleinerungsguts (24) durch Trocknen, sodass ein inaktiviertes Zerkleinerungsgut (42) erhalten wird. Erfindungsgemäß ist vorgesehen, dass das Trocknen bei einem Druck von höchstens 300 hPa und höchstens 80 °C erfolgt.

10 Figur 1

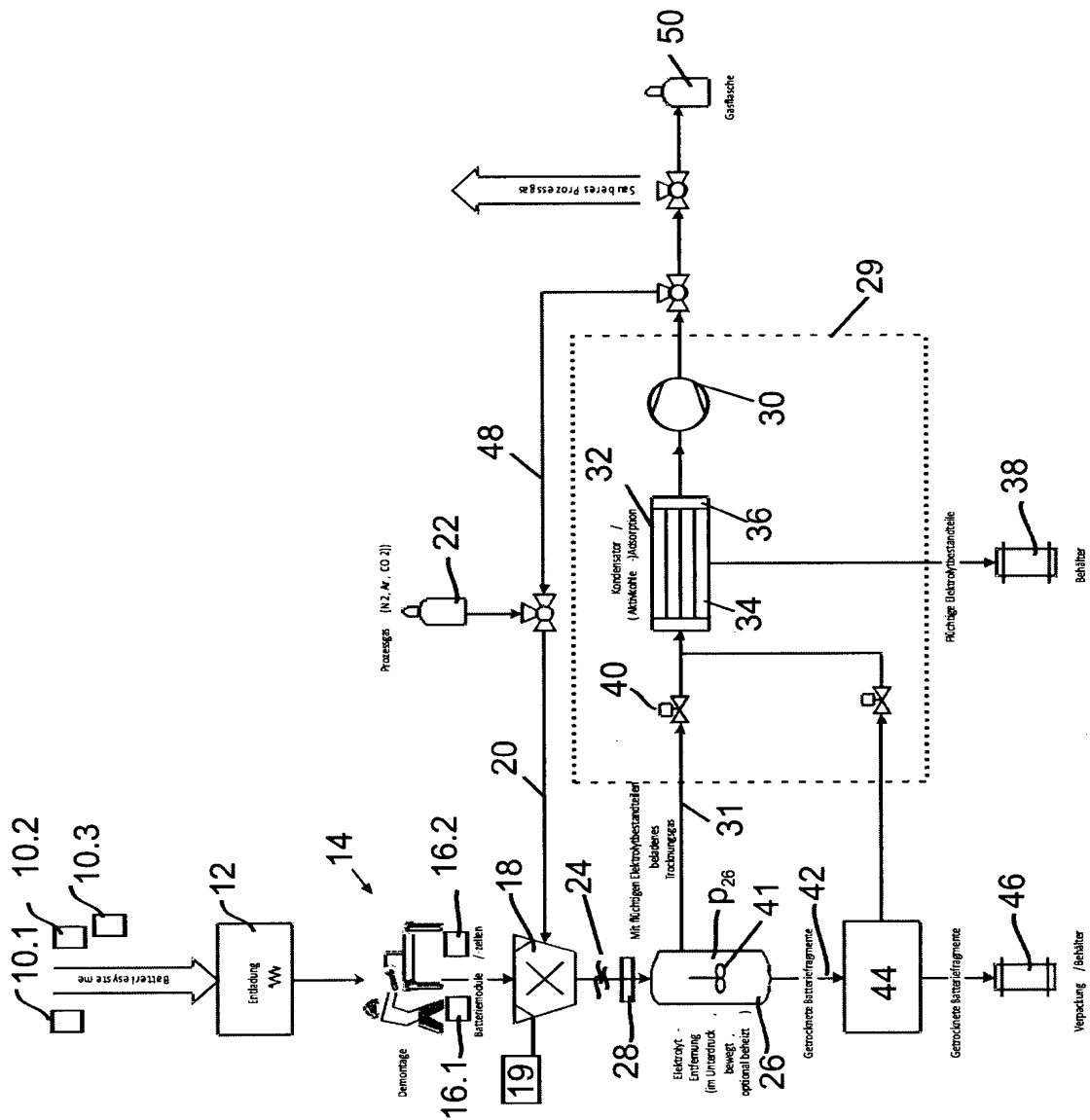


Fig. 1

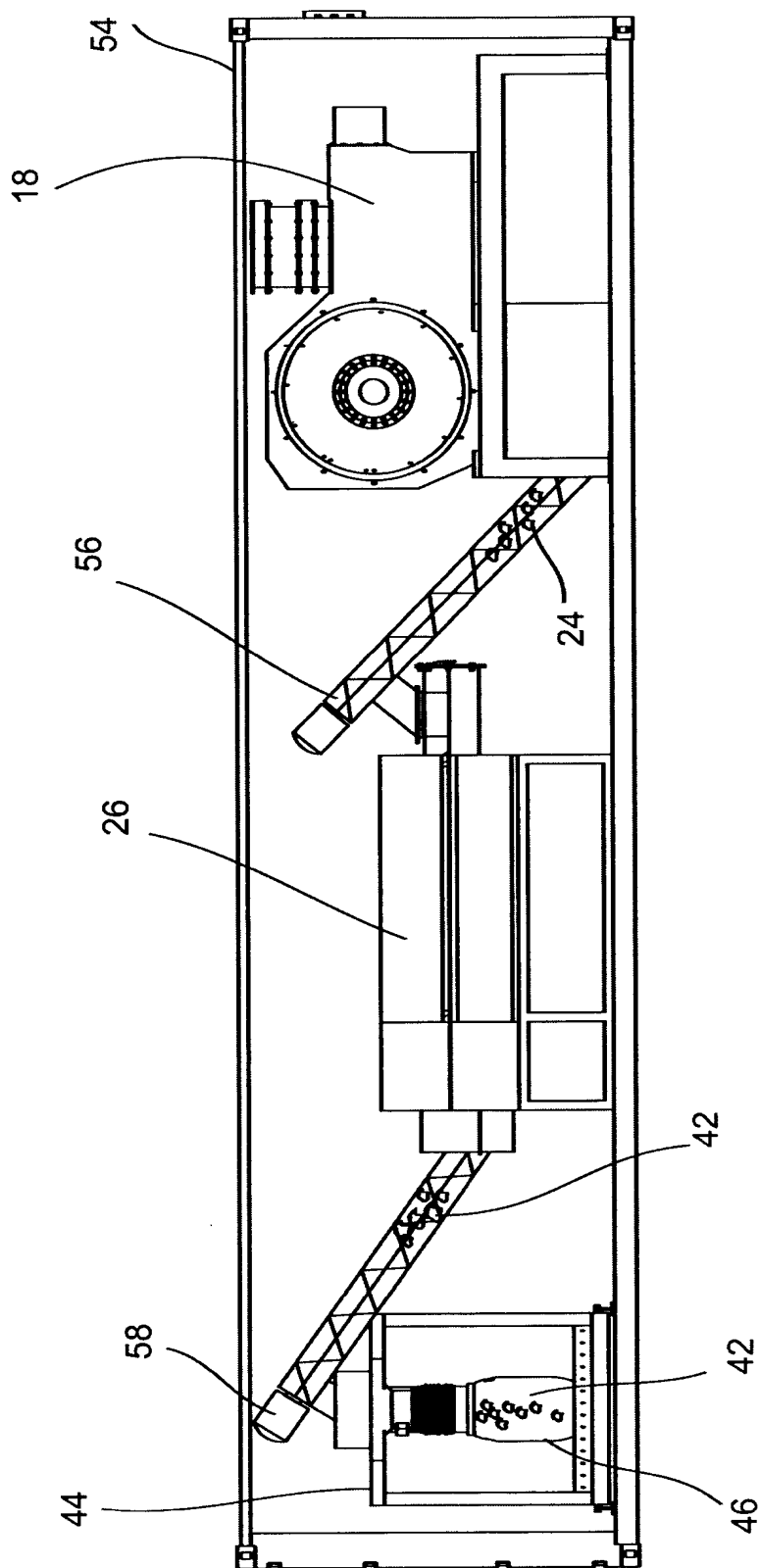


Fig. 2

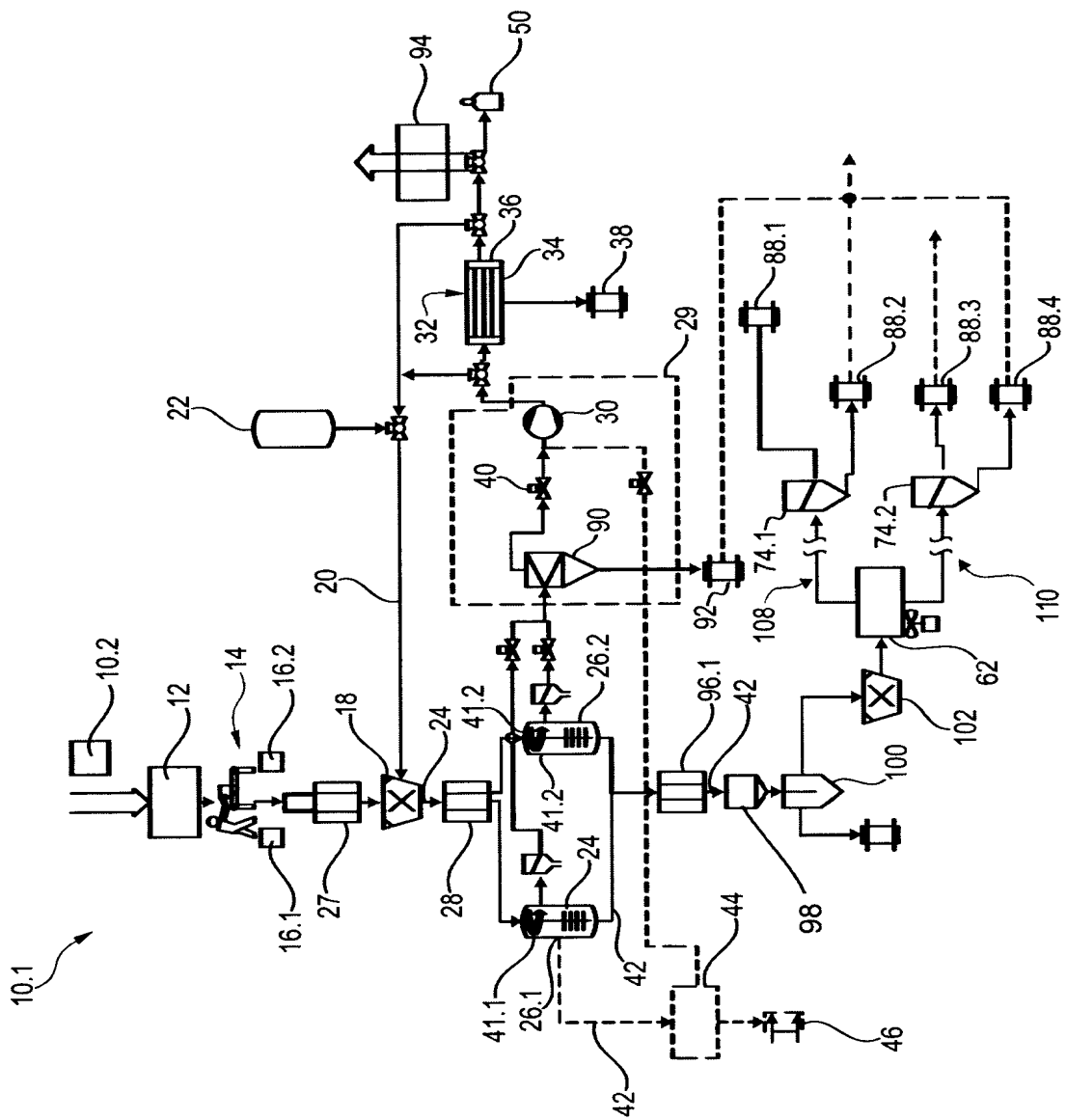


Fig. 4

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38122 Braunschweig
ALLEMAGNE

Date of mailing (<i>day/month/year</i>) 23 November 2018 (23.11.2018)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference 6110-004 PCT-1	
International application No. PCT/EP2017/076113	International filing date (<i>day/month/year</i>) 12 October 2017 (12.10.2017)

1. The following indications appeared on record concerning:									
☐ the applicant	☒ the inventor								
☐ the agent	☐ the common representative								
Name and Address HANISCH, Christian Sophienstraße 14 38118 Braunschweig Germany	<table border="1"> <tr> <td>State of Nationality</td> <td>State of Residence</td> </tr> <tr> <td colspan="2">Telephone No.</td> </tr> <tr> <td colspan="2">Facsimile No.</td> </tr> <tr> <td colspan="2">E-mail address</td> </tr> </table>	State of Nationality	State of Residence	Telephone No.		Facsimile No.		E-mail address	
State of Nationality	State of Residence								
Telephone No.									
Facsimile No.									
E-mail address									
2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:									
☐ the person	☐ the name								
☒ the address	☐ the nationality								
☐ the residence									
Name and Address HANISCH, Christian Madamenweg 112b 38118 Braunschweig Germany	<table border="1"> <tr> <td>State of Nationality</td> <td>State of Residence</td> </tr> <tr> <td colspan="2">Telephone No.</td> </tr> <tr> <td colspan="2">Facsimile No.</td> </tr> <tr> <td colspan="2">E-mail address ☐ Notifications by e-mail authorized</td> </tr> </table>	State of Nationality	State of Residence	Telephone No.		Facsimile No.		E-mail address ☐ Notifications by e-mail authorized	
State of Nationality	State of Residence								
Telephone No.									
Facsimile No.									
E-mail address ☐ Notifications by e-mail authorized									
3. Further observations, if necessary:									
4. A copy of this notification has been sent to:									
☒ the receiving Office	☐ the International Preliminary Examining Authority								
☒ the International Searching Authority	☒ the designated Offices concerned								
☐ the Authority(ies) specified for supplementary search	☐ the elected Offices concerned								
	☐ other:								

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer Schraner Franziska e-mail pct.team5@wipo.int Telephone No. +41 22 338 74 05
Facsimile No. +41 22 338 70 80	

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A SUBMISSION UNDER 35 U.S.C. 371		Attorney Docket No. 03101253US
		U.S. Application No. (if known, see 37 CFR 1.5)
International Application No. PCT/EP2017/076113	International Filing Date 12 October 2017	Priority Date Claimed 20 October 2016
Title of Invention RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION		
First Named Inventor Christian HANISCH		
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information.		
1. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). NOTE: The express request under 35 U.S.C. 371(f) will not be effective unless the requirements under 35 U.S.C. 371(c)(1), (2), and (4) for payment of the basic national fee, copy of the International Application and English translation thereof (if required), and the oath or declaration of the inventor(s) have been received.		
2. ☒ A copy of the International Application (35 U.S.C. 371(c)(2)) is attached hereto (not required if the International Application was previously communicated by the International Bureau or was filed in the United States Receiving Office (RO/US)).		
3. An English language translation of the International Application (35 U.S.C. 371(c)(2))		
a. ☒ is attached hereto.		
b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).		
4. An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4))		
a. ☐ is attached.		
b. ☐ was previously filed in the international phase under PCT Rule 4.17(iv).		
Items 5 to 8 below concern amendments made in the international phase.		
<u>PCT Article 19 and 34 amendments</u>		
5. ☐ Amendments to the claims under PCT Article 19 are attached (not required if communicated by the International Bureau) (35 U.S.C. 371(c)(3)).		
6. ☐ English translation of the PCT Article 19 amendment is attached (35 U.S.C. 371(c)(3)).		
7. ☐ English translation of annexes (Article 19 and/or 34 amendments only) of the International Preliminary Examination Report is attached (35 U.S.C. 371(c)(5)).		
<u>Cancellation of amendments made in the international phase</u>		
8a. ☐ Do not enter the amendment made in the international phase under PCT Article 19.		
8b. ☐ Do not enter the amendment made in the international phase under PCT Article 34.		
NOTE: A proper amendment made in English under Article 19 or 34 will be entered in the U.S. national phase application absent a clear instruction from applicant not to enter the amendment(s).		
The following items 9 to 17 concern a document(s) or information included.		
9. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.		
10. ☒ A preliminary amendment.		
11. ☒ An Application Data Sheet under 37 CFR 1.76.		
12. ☐ A substitute specification. NOTE: A substitute specification cannot include claims. See 37 CFR 1.125(b).		
13. ☐ A power of attorney and/or change of address letter.		
14. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.3 and 37 CFR 1.821-1.825 (not required if sequence listing in text format was indicated on the PCT Request as part of the International Application and the sequence listing was published as part of the international application).		
15. ☐ Assignment papers (cover sheet and document(s)). Name of Assignee: _____		
16. ☐ 37 CFR 3.73(c) Statement (when there is an Assignee). _____		

This collection of information is required by 37 CFR 1.414 and 1.491-1.492. The information is required to obtain or retain a benefit by the public, which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 15 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Mail Stop PCT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

U.S. APPLN. No. (if known – see 37 CFR 1.5)		INTERNATIONAL APPLICATION No. PCT/EP2017/076113		ATTORNEY DOCKET No. 03101253US	
17. ☒ Other items or information: 1. International Search Report 2. 2 Notifications of the Recording of a Change (PCT/IB/306)					
The following fees have been submitted.					CALCULATIONS
18. ☐ Basic national fee (37 CFR 1.492(a)) \$300					\$ 300
19. ☐ Examination fee (37 CFR 1.492(c)) • If the written opinion prepared by ISA/US or the international preliminary examination report prepared by IPEA/US indicates all claims satisfy provisions of PCT Article 33(1)-(4)..... \$0 • All other situations \$760					\$ 760
20. ☐ Search fee (37 CFR 1.492(b)) • If the written opinion prepared by ISA/US or the international preliminary examination report prepared by IPEA/US indicates all claims satisfy provisions of PCT Article 33(1)-(4)..... \$0 • Search fee (37 CFR 1.445(a)(2)) has been paid on the international application to the USPTO as an International Searching Authority \$140 • International Search Report prepared by an ISA other than the US and provided to the Office or previously communicated to the US by the IB..... \$520 • All other situations \$660					\$ 520
TOTAL OF 18, 19, and 20 =					\$ 1580
☐ Additional fee for specification and drawings filed in paper over 100 sheets (excluding sequence listing in compliance with 37 CFR 1.821(c) or (e) in an electronic medium or computer program listing in an electronic medium) (37 CFR 1.492(j)). Fee for each additional 50 sheets of paper or fraction thereof \$400					
Total Sheets	Extra Sheets	Number of each additional 50 or fraction thereof (round up to a whole number)	RATE		
- 100 =	/ 50 =		x \$400		\$
Surcharge for furnishing any of the search fee, examination fee, or the oath or declaration after the date of commencement of the national stage (37 CFR 1.492(h))..... \$140					\$
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	- 20 =		x \$100		\$
Independent claims	- 3 =		x \$460		\$
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ \$820		\$
Fee for submission of Sequence Listing text file of 300 MB to 800 MB (37 CFR 1.21(o)(1))..... \$1,000					\$
Fee for submission of Sequence Listing text file of more than 800 MB (37 CFR 1.21(o)(2))..... \$10,000					\$
Processing fee for furnishing the English translation later than 30 months from the earliest claimed priority date (37 CFR 1.492(i))..... \$140 +					\$ 140
TOTAL OF ABOVE CALCULATIONS =					\$ 140
☐ Applicant asserts small entity status. See 37 CFR 1.27. Fees above are reduced by ½.					
☐ Applicant certifies micro entity status. See 37 CFR 1.29. Fees above are reduced by ¾. Applicant must attach form PTO/SB/15A or B or equivalent.					
TOTAL NATIONAL FEE =					\$ 1720
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31)..... \$50.00 per property +					\$
TOTAL FEES ENCLOSED =					\$ 1720

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

- a. ☐ A check in the amount of \$ _____ to cover the above fees is enclosed.
- b. ☐ Please charge my Deposit Account No. _____ in the amount of \$ _____ to cover the above fees.
- c. ☒ The Director is hereby authorized to charge additional fees which may be required, or credit any overpayment, to Deposit Account No. 502041 as follows:
- i. ☐ any required fee.
- ii. ☒ any required fee except for excess claims fees required under 37 CFR 1.492(d) and (e) and multiple dependent claim fee required under 37 CFR 1.492(f).
- d. ☒ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038. The PTO-2038 should only be mailed or faxed to the USPTO. However, when paying the basic national fee, the PTO-2038 may NOT be faxed to the USPTO.

ADVISORY: If filing by EFS-Web, do **NOT** attach the PTO-2038 form as a PDF along with your EFS-Web submission. Please be advised that this is **not** recommended and by doing so your **credit card information may be displayed via PAIR**. To protect your information, it is recommended to pay fees online by using the electronic payment method.

NOTE: Where an appropriate time limit under 37 CFR 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the International Application to pending status.

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

- ☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013, and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.

NOTE 1: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

NOTE 2: A U.S. national stage application may not claim priority to the international application of which it is the national phase. The filing date of a U.S. national stage application is the international filing date. See 35 U.S.C. 363.

Correspondence Address

- ☒ The address associated with Customer Number: 30743 OR ☐ Correspondence address below

Name					
Address					
City		State		Zip Code	
Country				Telephone	
Email					

Signature	/Michael E. Whitham/	Date	2019-04-17
Name (Print/Type)	Michael E. Whitham	Registration No. (Attorney/Agent)	32635

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/076113

A. CLASSIFICATION OF SUBJECT MATTER

INV. H01M6/52 C22B7/00 C22B15/00 C22B21/00 H01M10/54
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H01M C22B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 10 2011 110083 A1 (TECH UNI BRAUNSCHWEIG CAROLO WILHELMINA [DE]) 14 February 2013 (2013-02-14) cited in the application paragraph [0021] - paragraph [0036]; claims 1-10	1-16
Y	----- WO 2010/102377 A1 (STEVENS WAYNE C [CA]) 16 September 2010 (2010-09-16) paragraph [0015] - paragraph [0040]; figures 1, 2	1-16
Y	----- DE 10 2012 024876 A1 (ELECTROCYCLING GMBH [DE]; VOLKSWAGEN AG [DE]) 26 June 2014 (2014-06-26) cited in the application paragraph [0029] - paragraph [0040]; claims 1-10	1-16
	----- -/-	

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

20 November 2017

Date of mailing of the international search report

28/11/2017

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Wiedemann, Eric

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/076113

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P	<p>WO 2016/174156 A1 (LION ENG GMBH [DE]) 3 November 2016 (2016-11-03) the whole document -----</p>	1-16

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2017/076113

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 102011110083 A1	14-02-2013	CN 103959553 A	30-07-2014
		DE 102011110083 A1	14-02-2013
		EP 2742559 A1	18-06-2014
		US 2014290438 A1	02-10-2014
		WO 2013023640 A1	21-02-2013

WO 2010102377 A1	16-09-2010	CA 2730320 A1	16-09-2010
		CA 2778136 A1	16-09-2010
		EP 2406843 A1	18-01-2012
		US 2010230518 A1	16-09-2010
		US 2011031336 A1	10-02-2011
		US 2012227589 A1	13-09-2012
		WO 2010102377 A1	16-09-2010

DE 102012024876 A1	26-06-2014	NONE	

WO 2016174156 A1	03-11-2016	CA 2983768 A1	03-11-2016
		DE 102015207843 A1	03-11-2016
		WO 2016174156 A1	03-11-2016

INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen

PCT/EP2017/076113

A. KLASSTIFIZIERUNG DES ANMELDUNGSGEGENSTANDES

INV. H01M6/52 C22B7/00 C22B15/00 C22B21/00 H01M10/54
ADD.

Nach der Internationalen Patentklassifikation (IPC) oder nach der nationalen Klassifikation und der IPC

B. RECHERCHIERTE GEBIETE

Recherchierter Mindestprüfstoff (Klassifikationssystem und Klassifikationssymbole)

H01M C22B

Recherchierte, aber nicht zum Mindestprüfstoff gehörende Veröffentlichungen, soweit diese unter die recherchierten Gebiete fallen

Während der internationalen Recherche konsultierte elektronische Datenbank (Name der Datenbank und evtl. verwendete Suchbegriffe)

EPO-Internal, WPI Data, INSPEC

C. ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie*	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
X	DE 10 2011 110083 A1 (TECH UNI BRAUNSCHWEIG CAROLO WILHELMINA [DE]) 14. Februar 2013 (2013-02-14) in der Anmeldung erwähnt Absatz [0021] - Absatz [0036]; Ansprüche 1-10	1-16
Y	----- WO 2010/102377 A1 (STEVENS WAYNE C [CA]) 16. September 2010 (2010-09-16) Absatz [0015] - Absatz [0040]; Abbildungen 1, 2	1-16
Y	----- DE 10 2012 024876 A1 (ELECTROCYCLING GMBH [DE]; VOLKSWAGEN AG [DE]) 26. Juni 2014 (2014-06-26) in der Anmeldung erwähnt Absatz [0029] - Absatz [0040]; Ansprüche 1-10	1-16
	----- -/-	

☒ Weitere Veröffentlichungen sind der Fortsetzung von Feld C zu entnehmen ☒ Siehe Anhang Patentfamilie

* Besondere Kategorien von angegebenen Veröffentlichungen :

"A" Veröffentlichung, die den allgemeinen Stand der Technik definiert, aber nicht als besonders bedeutsam anzusehen ist

"E" frühere Anmeldung oder Patent, die bzw. das jedoch erst am oder nach dem internationalen Anmeldedatum veröffentlicht worden ist

"L" Veröffentlichung, die geeignet ist, einen Prioritätsanspruch zweifelhaft erscheinen zu lassen, oder durch die das Veröffentlichungsdatum einer anderen im Recherchenbericht genannten Veröffentlichung belegt werden soll oder die aus einem anderen besonderen Grund angegeben ist (wie ausgeführt)

"O" Veröffentlichung, die sich auf eine mündliche Offenbarung, eine Benutzung, eine Ausstellung oder andere Maßnahmen bezieht

"P" Veröffentlichung, die vor dem internationalen Anmeldedatum, aber nach dem beanspruchten Prioritätsdatum veröffentlicht worden ist

"T" Spätere Veröffentlichung, die nach dem internationalen Anmeldedatum oder dem Prioritätsdatum veröffentlicht worden ist und mit der Anmeldung nicht kollidiert, sondern nur zum Verständnis des der Erfindung zugrundeliegenden Prinzips oder der ihr zugrundeliegenden Theorie angegeben ist

"X" Veröffentlichung von besonderer Bedeutung; die beanspruchte Erfindung kann allein aufgrund dieser Veröffentlichung nicht als neu oder auf erfinderischer Tätigkeit beruhend betrachtet werden

"Y" Veröffentlichung von besonderer Bedeutung; die beanspruchte Erfindung kann nicht als auf erfinderischer Tätigkeit beruhend betrachtet werden, wenn die Veröffentlichung mit einer oder mehreren Veröffentlichungen dieser Kategorie in Verbindung gebracht wird und diese Verbindung für einen Fachmann naheliegend ist

"&" Veröffentlichung, die Mitglied derselben Patentfamilie ist

Datum des Abschlusses der internationalen Recherche

20. November 2017

Absenddatum des internationalen Recherchenberichts

28/11/2017

Name und Postanschrift der Internationalen Recherchenbehörde

Europäisches Patentamt, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Bevollmächtigter Bediensteter

Wiedemann, Eric

INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen

PCT/EP2017/076113

C. (Fortsetzung) ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie*	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
X,P	WO 2016/174156 A1 (LION ENG GMBH [DE]) 3. November 2016 (2016-11-03) das ganze Dokument -----	1-16

INTERNATIONALER RECHERCHENBERICHT

Angaben zu Veröffentlichungen, die zur selben Patentfamilie gehören

Internationales Aktenzeichen

PCT/EP2017/076113

Im Recherchenbericht angeführtes Patentdokument	Datum der Veröffentlichung	Mitglied(er) der Patentfamilie	Datum der Veröffentlichung
DE 102011110083 A1	14-02-2013	CN 103959553 A	30-07-2014
		DE 102011110083 A1	14-02-2013
		EP 2742559 A1	18-06-2014
		US 2014290438 A1	02-10-2014
		WO 2013023640 A1	21-02-2013

WO 2010102377 A1	16-09-2010	CA 2730320 A1	16-09-2010
		CA 2778136 A1	16-09-2010
		EP 2406843 A1	18-01-2012
		US 2010230518 A1	16-09-2010
		US 2011031336 A1	10-02-2011
		US 2012227589 A1	13-09-2012
		WO 2010102377 A1	16-09-2010

DE 102012024876 A1	26-06-2014	KEINE	

WO 2016174156 A1	03-11-2016	CA 2983768 A1	03-11-2016
		DE 102015207843 A1	03-11-2016
		WO 2016174156 A1	03-11-2016

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/076113

A. CLASSIFICATION OF SUBJECT MATTER INV. H01M6/52 C22B7/00 C22B15/00 C22B21/00 H01M10/54 ADD.		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) H01M C22B		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data, INSPEC		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 10 2011 110083 A1 (TECH UNI BRAUNSCHWEIG CAROLO WILHELMINA [DE]) 14 February 2013 (2013-02-14) cited in the application paragraph [0021] - paragraph [0036]; claims 1-10	1-16
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----- -/--		
☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 20 November 2017		Date of mailing of the international search report 28/11/2017
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Wiedemann, Eric

INTERNATIONAL SEARCH REPORT

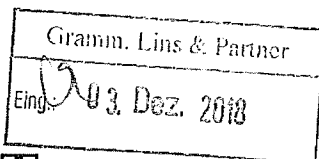
International application No
PCT/EP2017/076113

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P	<p>WO 2016/174156 A1 (LION ENG GMBH [DE]) 3 November 2016 (2016-11-03) the whole document</p> <p>-----</p>	1-16



PATENT COOPERATION TREATY

PCT/EP2017/076113

**PCT**NOTIFICATION OF THE RECORDING
OF A CHANGE(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

GRAMM, LINS & PARTNER PATENT- UND
RECHTSANWÄLTE PARTGMBB
Theodor-Heuss-Straße 1
38122 Braunschweig
ALLEMAGNE

Date of mailing (day/month/year) 23 November 2018 (23.11.2018)	
Applicant's or agent's file reference 6110-004 PCT-1	IMPORTANT NOTIFICATION
International application No. PCT/EP2017/076113	International filing date (day/month/year) 12 October 2017 (12.10.2017)

1. The following indications appeared on record concerning:

☐ the applicant ☒ the inventor ☐ the agent ☐ the common representative

Name and Address HANISCH, Christian Sophienstraße 14 38118 Braunschweig Germany	State of Nationality	State of Residence
	Telephone No.	
	Facsimile No.	
	E-mail address	

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

☐ the person ☐ the name ☒ the address ☐ the nationality ☐ the residence

Name and Address HANISCH, Christian Madamenweg 112b 38118 Braunschweig Germany	State of Nationality	State of Residence
	Telephone No.	
	Facsimile No.	
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PATENT COOPERATION TREATY

PCT/EP2017/076113

PCTNOTIFICATION OF THE RECORDING
OF A CHANGE(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

Gramm. Lins & Partner

Eing.: 03. Dez. 2018

From the INTERNATIONAL BUREAU

To:

GRAMM, LINS & PARTNER PATENT- UND
RECHTSANWÄLTE PARTGMBB
Theodor-Heuss-Straße 1
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IMPORTANT NOTIFICATION

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1. The following indications appeared on record concerning:

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.: WO 2018/073101 A1

PCT International Application No.: PCT/EP2017/076113

VERIFICATION OF A TRANSLATION

I, Megan Skinner B.A.

Freelance translator and interpreter for the language combinations German-English and Dutch-English hereby declare that I am knowledgeable in the German language, in which the international application with the above application number was filed. Furthermore, I hereby confirm that the English translation of the enclosed application papers - number WO 2018/073101 A1- is a true and complete translation to the best of my knowledge and belief.

I hereby declare that all the statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true. Moreover, I hereby confirm that these statements were made in the knowledge that wilful false statements and the like so made are punishable by fine or imprisonment, or both, pursuant to Section 1001 of Title 18 of the United States Code and that such wilful false statements may jeopardize the validity of the subsequent patent application.



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Recycling method for the treatment of used batteries, in particular rechargeable batteries, and battery processing installation

The invention refers to a method for the treatment of used batteries, in particular used lithium batteries, such as lithium ion batteries, with the steps (a) comminuting the batteries such that comminuted material is obtained, (b) inactivating of the comminuted material such that an inactive comminuted material is obtained.

According to a second aspect, the invention refers to a battery processing installation for the treatment of used batteries, in particular for the treatment of used lithium batteries with (a) a comminuting device for comminuting the batteries such that comminuted material is obtained, and (b) an inactivation device for inactivating the comminuted material.

US 2005/0241943 A1 describes a method for processing used batteries in which the batteries are heated prior to a comminuting step, thereby destroying plastic components in the batteries. The disadvantage of this type of procedure is that the remaining components of the batteries may be contaminated with degradation products of the plastic.

DE 10 2012 024 876 A1 describes a system for transferring transport-critical electrolyte cells, in which they are initially comminuted under inert gas and then dusted with a deactivation powder so as to prevent the electrochemically active material from spontaneously combusting. The disadvantage of this is that the resulting material still poses a comparatively high hazard potential and that the dusting power itself poses a risk of exposure and that the formation of a flammable and explosive atmosphere in the transport container cannot be ruled out.

DE 10 2011 110 083 A1 describes a method for recovering active material from a galvanic cell, in which the galvanic cells are initially mechanically comminuted, then pre-dried and subsequently sifted. Finally, the binder is broken down in an oven.

This type of device is very well-suited to the efficient recycling of larger amounts of galvanic elements. However, for partial load operation, the construction of this installation is comparatively complex. It has also been proven that highly toxic fluoro-organic compounds and hydrogen fluoride may form, the disposal of which is highly complex.

WO 2010/102377 A1 describes a method in which the batteries to be recycled, such as lithium batteries, are heated in a rotary kiln and the resulting gases are sucked away. The disadvantage of this method is that it is difficult to reuse the electrolyte and it produces large quantities of hydrogen fluoride and fluoro-organic compounds.

The post-published publication WO 2016/174156 A1 describes a method in which used batteries are first locally deactivated and placed in a transport container. Following the transport of the comminuted material to a central processing plant, the deactivated cell fragments are processed further.

The invention aims to reduce disadvantages of the prior art.

The invention solves the problem by way of a method according to the preamble in which the drying is conducted at a maximum pressure of 300 hPa, preferably at least in part at 50 hPa, and at a maximum of 80 °C. In particular, the deactivation is conducted at least also by drying the comminuted material. According to a second aspect, the invention solves the problem by way of a battery processing installation according to the preamble, wherein a vacuum installation is connected to the drying device in order to generate a vacuum of at least 300 hPa in the drying device, and the drying device is configured to dry at a maximum temperature of 80 °C.

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 that have a low boiling point have been removed [from the fragments]. The comminuted material is therefore largely inert and can be safely transported or processed further, especially if it is packed under vacuum.

A further advantage is that no additional material has to be added to deactivate the comminuted material. This decreases the complexity of the battery processing, reduces the weight of the deactivated comminuted material and increases the purity in the subsequent separation and recycling steps. In particular, in potential subsequent hydrometallurgical processing steps, a high degree of product purity without foreign ions is advantageous.

It is also advantageous that the formation of relevant quantities of fluorophosphates, hydrogen fluoride, carbon monoxide, polyfluorinated dibenzodioxins and dibenzofurans, nitrogen oxides, carbonyl fluoride and/or hydrogen cyanide can be ruled out. Fluorophosphates are often strong neurotoxins, the formation of which must be reliably prevented. Furthermore, due to the low electrolyte content, it is guaranteed that a self-amplifying and intensifying build-up of heat triggered by an electrochemical reaction cannot occur. It has been proven that hydrogen fluoride and fluorophosphate can form in significant quantities at comparatively low temperatures of over 80°C.

Furthermore, it is advantageous that the removal of the electrolyte is possible without expending a considerable amount of energy. The electrolyte can also be largely reused.

The condensation of the vaporised electrolyte, as intended according to a preferred embodiment, also leads to a low-emission recycling of lithium batteries.

The battery processing installation according to the invention enables material re-

cycling rates of over 80%, which is not possible with current installations.

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 at least 90 percent by weight of dimethyl carbonate and/or ethyl methyl carbonate is removed.

A lithium battery should be understood particularly to mean a rechargeable battery whose electrochemical reaction involves lithium and/or lithium ions and/or a lithium compound.

A battery processing installation should also be understood particularly to mean a rechargeable battery processing installation for processing rechargeable batteries.

The transport container should also be understood particularly to mean transport packaging. The transport packaging is preferably sealed by way of a vacuum seal. Aluminium composite foil is especially well-suited as transport packaging.

The comminution unit should be understood especially to mean a device which, when operating, comminutes the batteries. For example, the comminution unit (i) is a pressure comminution unit whereby the batteries are crushed between two tool surfaces, (ii) a striking comminution unit whereby the batteries lie on a tool surface and are smashed by striking them with a second moveable tool, (iii) a cropping comminution unit whereby the batteries are comminuted by two tool surfaces that move in opposite directions, (iv) a cutting comminution unit whereby the batteries are cut into two parts by means of two blades and/or (v) an impact comminution whereby the batteries are thrown against a wall, impact against a moving tool or two particles collide. Of course, the comminution unit may also work by way of two or more of the named comminution mechanisms.

According to a preferred embodiment, the comminution unit forms part of a comminuting device which comprises a container in which the comminution unit is arranged.

The given temperatures and pressures always relate to the atmospheric temperature in the respective device. In this way, the characteristic that the drying occurs at a maximum pressure of 300 hPa and at a maximum of 80 °C should be understood particularly to mean that the temperature of the atmosphere in the dryer is a maximum of 80°C. It is irrelevant that the local temperature may be higher.

It is beneficial if the drying occurs after the comminuting of the batteries. It is indeed possible and represents a preferred embodiment that the batteries are exposed to a vacuum when in an uncomminuted state such that at least parts of the electrolyte vaporise, wherein the resulting gas either escapes through a safety valve in the rechargeable battery or the battery is destroyed by the pressure difference between the external environment and the internal pressure, enabling the vaporising electrolyte to escape. However, since the electrolyte is predominantly located between tightly wound or stacked and pressed layers of electrodes and separators and in their pores, and it is connected to other components of the batteries, this procedure can be very time-consuming. It is thus often more beneficial and represents a preferred embodiment of the invention for the batteries to be mechanically comminuted, for example through cutting, cropping, impact, cutting and/or crushing. This means that a larger interface is available for the transition of materials into the gas phase.

The drying process is preferably conducted at a maximum pressure of 30 hPa for at least 50% of the drying time. Alternatively or additionally, a minimum pressure during the drying process is at most 50 hPa. This allows for the removal of a very large proportion of the electrolyte. The minimum pressure should be understood especially to mean the lowest atmospheric pressure in the drying device that is maintained for at least one minute.

According to a preferred embodiment, it is also possible for the drying to occur at the same time as the comminuting. In other words, a vacuum with a maximum pressure of 300 hPa is attached to a comminuting device in which the batteries are comminuted. The advantage of this is that the mechanical energy introduced during comminuting supports the vaporising of the electrolyte. It is therefore not necessary to introduce additional thermal energy into the comminuted material in order to vaporise the electrolyte (although this is possible and included in the invention). Furthermore, it is not necessary to cool the comminuted material during comminuting (although this is possible and included in the invention). The comminution unit also effects a circulation of the comminuted material, which accelerates the drying process.

It is favourable if the drying occurs while the comminuted material is being agitated and/or circulated. This results in the separation of the galvanic elements, which consist of anode, separator and cathode. An obstruction of the vaporising process by way of foils which stick together is prevented. Mechanical energy is introduced for the separation of current collector foil and coating, and the resulting frictional heat feeds the vaporising heat into the system.

Prior to being comminuted, the used batteries are preferably dismantled. This means that larger battery systems are dismantled into their smaller subcomponents, the modules or stacks, or even that the cells which contain the electrochemically active material are separated from the control electronics. The control electronics comprise, for example, semiconductor elements and/or sensors and are responsible for the charge control of the batteries.

The drying occurs under a vacuum. According to its most general configuration, the invention solves the problem by means of a method according to the preamble, wherein the vacuum is selected to be so large that the pressure is below the vapour pressure of dimethyl carbonate at 80°C, in particular at 70°C. However, it is espe-

cially beneficial if the drying occurs at a maximum pressure of 300 hPa, in particular a maximum 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. The advantage of low temperatures is that the formation of hydrogen fluoride and fluoro-organic compounds is hindered. Both pose a potential risk for the battery processing installation and the surroundings. It is therefore beneficial to prevent their development.

The drying preferably occurs at a temperature that is lower than a decomposition temperature. The decomposition temperature should be understood particularly to mean the lowest temperature at which at least 80 percent by mass of the binder of the lithium batteries has decomposed into gaseous components after keeping the comminuted material at this temperature for an hour. The decomposition temperature can be measured by successively increasing the temperature of the comminuted material and recording when a loss of mass occurs, especially through the build-up of gas due to a decomposition of the binder, and the specified criteria is fulfilled. If necessary, the experiment must be conducted several times, each time using a new sample of comminuted material at an increased temperature.

According to a preferred embodiment, the method comprises the condensation of the gases which result from the drying process. This preferably occurs at ambient pressure, whereby a deviation of ± 50 hPa is possible. It is beneficial if the temperature during condensation is at least 0°C. This reduces the required cooling capacity and prevents the formation of ice. The cooling capacity is preferably at least 4 kilowatts and at most 40 kilowatts relative to one tonne of processed batteries per hour. Alternatively, the temperature upon condensation is lower than 0°C, such that water is removed from the atmosphere through the formation of ice. It is possible that the condenser has two or more zones of varying temperature. In this case, the temperature in one of the two zones is so high that no ice forms and so low in another zone that water is separated as ice.

It is favourable if the maximum temperature upon condensation is at most 50°C, preferably a maximum of 30°C, in particular a maximum of 20°C. This means that the organic carbonates in the batteries can be almost completely recovered. Moreover, virtually no emissions are produced and the amount of energy required for condensation is low.

The comminuting of the batteries is preferably executed such that at least 90% by weight of the components of the comminuted material has a maximum sieve size of 50mm, in particular a maximum of 30mm, preferably a maximum of 20mm. This should be understood to mean that 90% by weight of the components fall through a sieve which has a mesh width of 50mm (or the respective given width). This type of comminuting avoids micro short circuits, thereby increasing the level of safety of transport, storage and further processing.

It is favourable if the drying occurs under an atmosphere in which the partial pressure of the water is lower than 50 Pa, in particular lower than 10 Pa. A low partial pressure of the water leads to a low reaction rate of lithium compounds to lithium hydroxide and thus only to a low build-up of hydrogen. This prevents the formation of flammable hydrogen-oxygen mixtures and contributes to the safety of the installation.

In addition, it is favourable if the partial pressure of oxygen upon drying has a maximum value of 30 millibars, especially a maximum value of 10 millibars. This largely inhibits the reaction of oxygen with oxidisable components of the batteries. It is possible to achieve the low partial pressure of oxygen by means of drying at a low pressure. Alternatively or additionally, the drying may occur in an inert gas atmosphere.

According to a preferred embodiment, the method comprises the steps of a continuous recording of a water vapour concentration during comminuting and/or drying, and a reduction of the water vapour concentration when a pre-determined threshold

value is exceeded. The water vapour concentration should be understood especially to mean a proportion of water vapour in relation to the entirety of the atmospheric components. In particular, the water vapour concentration should also be understood to mean a partial water vapour pressure. For instance, the reduction of the water vapour concentration may comprise a decrease in the pressure and/or a supply of inert gas. The threshold value for the water vapour concentration is preferably selected such that, below the threshold value, a formation of significant quantities of hydrogen fluoride through decomposition of the conducting salt, such as LiPF_6 , and a significant reaction of the water with metallic lithium is impossible. These criteria are met at a dew point of -40°C . It is possible, but not necessary, for the water vapour concentration to be measured directly, for instance by spectroscopy, especially infrared spectroscopy. It is also possible, for example, to identify the sum of the concentrations of inert gas, oxygen and organic compounds and assume that the rest is made up of water vapour.

According to a preferred embodiment, the method comprises the steps of a continuous recording of an oxygen concentration during comminuting and/or drying, and a reduction of the oxygen concentration when a pre-determined threshold value is exceeded. The oxygen concentration should be understood especially to mean a proportion of oxygen in relation to the entirety of the atmospheric components. In particular, the oxygen concentration should also be understood to mean a partial oxygen pressure. The reduction of the oxygen concentration may comprise, for example, a decrease in the pressure and/or a supply of inert gas. The threshold value for the oxygen concentration is preferably selected such that an explosion is impossible below the threshold value. It is possible, but not necessary, for the oxygen concentration to be measured directly, for instance using a Nernst probe, a lambda probe, paramagnetic sensors or a resistive probe. It is also possible, for example, to determine the concentration of the oxygen by measuring gases in air that are accompanied by oxygen, such as carbon dioxide by assuming that the same mixing ratio of oxygen is present in the measured gas as in the air.

In particular, the method comprises the steps (i) continuous monitoring of a concentration of organic carbonates in the atmosphere of the drying device during drying and (ii) completion of the drying when a lower explosion limit is no longer reached. The lower explosion limit is the concentration of organic components for which the following applies: following the filling of a container with the comminuted material in air with a temperature of 23°C, under 1013 hPa and at 80% humidity, an ignition does not cause an explosion but does lead to a higher concentration. If this lower explosion limit is still reached, the drying continues.

The concentration of inert gas is preferably set at at least 90% by weight, in particular at least 95% by weight, preferably at least 97% by weight. The measurement of the concentration is preferably done, for example, spectroscopically.

Alternatively or additionally, a progress parameter is recorded which describes the progress of the drying, and the drying is completed when the progress parameter reaches a pre-determined progress parameter threshold value. The progress parameter is small at the beginning of the drying and increases with the progression of the drying. An equivalent situation is for the progress parameter to be large at the beginning of the drying and to decrease with the progression of the drying.

For instance, the progress parameter is the concentration of a gaseous electrolyte in the gas which has been sucked out. In this situation, it is possible, but not necessary, to directly measure the concentration of a gaseous electrolyte, in particular organic carbonates, for instance by spectroscopy, especially infrared spectroscopy. Alternatively or additionally, it is possible that the progress parameter is the condensate flow (measured, for example, in volume, mass, weight or quantity of substance per time unit) of condensed gas components in an available condenser. Alternatively, the progress parameter is the pressure in the drying container or the gas flow out of the drying container. If a pump output is constant, the pressure only depends, in good approximation, on the drying progress and the temperature of the comminuted material. If the electrolyte has largely been vaporised, the pressure

decreases. The gas flow also reduces.

According to a preferred embodiment, the comminuted material is further processed immediately after the drying process. In particular, the comminuted material is not put in a transport container after drying. In particular, the comminuted material is transported after drying by means of a continuously or discontinuously feeding conveyor for further processing, for example a separating device. In particular, the conveyor is connected to the dryer such that it is dust-tight. Examples of a continuously feeding conveyor are dust-tight tube chain conveyors, preferably with two adjustable outlet slides, conveyors, conveyor troughs, screw conveyors, bucket conveyors or semi-continuous conveyors.

A method is preferred in which the drying of the comminuted material is only completed if, after the completion of the drying process, no flammable or explosive gas mixture can form above the comminuted material that has been filled [in the container] and/or when the comminuted material is so dry that no flammable or explosive gas mixture can emerge in the transport container or during the subsequent processing. The property that the drying is completed if, after the completion of the drying process, no flammable or explosive gas mixture can form above the comminuted material that has been filled [in the container] should be understood particularly to mean that, within the space of one week at 50°C and 1013 hPa, no flammable gas mixture forms in a transport container in the form of a 50 litre container that has been half-filled (relative to its volume) with the comminuted material. Preliminary tests determine whether the criteria has been fulfilled. If a flammable gas mixture does form, the drying must be conducted for a longer time and/or at a lower pressure. The preliminary tests are repeated until a drying time and/or drying pressure has been identified at which, in a set of tests of three transport containers, the requirements for the property have been fulfilled for all three transport containers.

The comminuted material is preferably dried until an electrolyte content in the comminuted material is so low that an electrochemical reaction is impossible. In

other words, the electrolyte content is lower than a threshold value, the threshold value being selected such that, if this threshold value is not achieved, the cell voltage is reduced to a maximum of one quarter. This threshold value is determined, for example, by defining the cell voltage of a battery in relation to the electrolyte content. Shortly before achieving the threshold value, the cell voltage collapses, i.e. it decreases by at least 75%. If the threshold value is not achieved, the battery contains so little electrolyte that, to a good approximation, an electrochemical reaction is no longer possible.

The comminuted material is preferably dried for so long that a 50kg amount of comminuted material, which is contained in a compacted form in a 50 litre drum, does not experience a build-up of heat, or the build-up of heat is so low that a thermal runaway, i.e. a thermally induced chain reaction, is ruled out for at least two months, and that any build-up of gas is also so low that after two weeks, no excess pressure occurs if a negative pressure of 500 hPa is present to begin with.

It is beneficial if the comminuted material is dried until the electrolyte content of organic components that are volatile at 50°C has a maximum value of 3% by weight, in particular a maximum of 2% by weight, especially preferably a maximum of 1.5% by weight.

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.

In particular, 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.

The drying preferably occurs immediately after comminution. This should be under-

stood to mean that the time between the beginning of the comminution of the batteries and the point at which at least a part of the resulting comminuted material begins to dry is a maximum of five minutes, especially a maximum of one minute. The rapid drying after comminution means that the mass of material that may potentially experience an electrochemical reaction remains small; the electrochemical reaction time of potential exothermic reactions also remains small. This reduces the risk for the installation and the surroundings.

According to a preferred embodiment, the comminuted material is moved in the drying device, especially when removing it from the drying device, by means of an agitator. The agitator may refer to a comminution unit; however, this is not necessary. The agitator serves in particular to prevent blockages and/or thermal energy from entering the comminuted material and/or to separate the layered foils, meaning that the vaporisation of the electrolyte is not sterically hindered. In addition, the mechanical energy input effects an at least partial detachment of the coating from the current collector foils. This results in more surfaces of the coating fragments becoming free, which benefits the drying process and facilitates the subsequent separation of coating and foils. The agitator preferably exhibits a power output of at least 1 kW per cubic metre of drying volume. It is beneficial if the agitator has at least one stirring blade, which is arranged such that it moves the comminuted material upwards.

The agitator is preferably used to supply at least 35%, in particular at least 50%, of a vaporisation heat required for the drying of the comminuted material. In other words, in an ideal situation, it is not necessary to provide an additional heater to heat the comminuted material. If such a heater is provided, its power output is preferably smaller than the power output of the agitator. The introduction of energy into the comminuted material by way of an agitator is advantageous as it results in the separation of, for example, coating and carrier foil and other components of the battery.

The agitator preferably has a power output of at least 1 kilowatt per cubic meter of volume of the drying device.

The drying device preferably has a heater which draws heat from the heat dissipation of the at least one vacuum pump and/or of the condenser. The condensation of the electrolyte in the condenser results in condensation heat. Consequently, a temperature of at least 60°C may be present in the condenser. The heat is transferred, for example, by means of a heat transfer fluid, in particular a gas or a liquid. For instance, the heat transfer fluid is used to heat an exterior wall of the drying device.

An independent subject of the present invention is a method for treating used lithium batteries with the steps (a) comminuting of the batteries, such that comminuted material is obtained, and (b) drying of the comminuted material, such that the battery electrolyte vaporises, wherein (c) at least 50% of the heat required for vaporisation is introduced into the comminuted material by means of mechanical energy. In particular, the mechanical energy is introduced into the comminuted material by means of a comminution unit and/or an agitator. It is especially beneficial if the drying is conducted at a maximum pressure of 300 hPa and a maximum of 80 °C; however, this is not necessary. The preferred embodiments presented in the description refer to this aspect of the invention.

The comminution and drying are preferably executed in a single container, especially in the comminution unit. In other words, the comminution and drying occur simultaneously under negative pressure in a single container. The advantage of this situation is that the mechanical energy, which is supplied for comminution and converted into thermal energy, is absorbed during the vaporisation of the electrolyte and discharged in this form. This means that, on the one hand, an excessive heating of the comminuted material is prevented; on the other hand, there is no need for a heater to conduct the drying.

It is especially favourable if the vacuum of a maximum absolute pressure of 300

hPa is generated by a jet pump. Jet pumps are largely resistant to aggressive gases that are due to be pumped, particularly if the appropriate blasting medium is selected. It is beneficial if the blasting medium, which is a fluid, has a pH value of at least 8, in particular of at least 9, for example at least 12. In this case, unwanted components of the gas that is being pumped can decompose or react to become less damaging substances. In this way, for example, dimethyl carbonates and/or ethyl methyl carbonates can be broken down by a saponification reaction. Any hydrogen fluoride contained in the blasting medium can be converted in the alkaline environment into a non-hazardous salt by way of an acid-base reaction.

The jet pump fluid preferably contains a substance that precipitates fluoride. For example, the jet pump fluid may contain sodium carbonate, potassium carbonate or calcium carbonate. The salts that result from the reaction with a fluorine compound, in particular hydrogen fluoride, are preferably separated, in particular filtered or removed by sedimentation. This at least largely prevents hydrogen fluoride or other poisonous fluorine compounds from being emitted into the surroundings.

The drying preferably occurs at a maximum temperature of 80°C: this produces almost no hydrogen fluoride. This increases the service life of the battery processing installation and reduces the environmental risk.

According to a preferred embodiment, the method comprises the steps of condensing components of the electrolyte by cooling and/or increasing the pressure such that an electrolyte condensate occurs. For example, the condensation is conducted at a point that lies between the dryer and the vacuum pump relative to the flow of gas. In this case, gases coming from the dryer must initially pass through a condenser before reaching the vacuum pump. This causes the gaseous electrolyte in the gas, which is produced during the drying, to be at least largely separated in the condenser before the remaining gas reaches the pump. Electrolyte can be recovered in this way. In addition, the flow of gas through the vacuum pump decreases, which increases its [the vacuum pump's] service life and reduces its energy con-

sumption.

According to a preferred embodiment, the method alternatively comprises the step of purifying the gas through the adsorption of the volatile organic components of an activated carbon filter in front of or behind the compressor unit.

Alternatively or additionally, the method according to the invention preferably comprises the step of purifying the gas produced during the drying before it reaches the vacuum pump. This may also occur, for example, by the gas through passing an activated charcoal filter and/or a filter that contains substances which react with hydrogen fluoride, such as a calcium salt like calcium carbonate or a potassium salt such as potassium carbonate.

High temperature drying, during which the binder decomposes, is preferably conducted such that the resulting decomposition gases do not mix with the gases resulting from low temperature drying. It is possible that the high temperature drying and the low temperature drying occur at different pressures. For example, the high temperature drying can be executed at normal pressure.

The active material should be understood to mean the material that reacts electrochemically during operation of the batteries. The carrier for the active material should be understood particularly to mean a carrier foil to which the active material is applied in the form of particles. For example, the carrier foil refers to a foil made of aluminium or an aluminium alloy. The binder is the material which binds the active material with the carrier; for example, the binder contains polyvinylidene fluoride.

It is beneficial if liquid nitrogen is added when comminuting the batteries. This cools the comminuting machine and the comminuting material, and also drives oxygen and water vapour out of the atmosphere.

It is beneficial if the comminution occurs at a dew point of -40°C and/or when a partial pressure of the oxygen is a maximum of 40 hPa, especially a maximum of 15 hPa.

According to a preferred embodiment, the method comprises the steps of detaching hard parts and/or separating active material from the carrier, particularly via a second comminuting stage and/or air jet sieving, thereby producing an active material fraction and a carrier fraction; and a separate packing of the active material fraction and carrier fraction in suitable transport containers. It is beneficial if these transport containers are designed to be airtight. By separating an active material fraction and a carrier fraction, transportation generally does not require any permits. An additional advantage is that fractions separated in this way only pose a small risk.

The removal of the comminuted material from the transport container is preferably conducted under vacuum and/or shielding gas.

It is possible, but not necessary, for the the transport container to be filled with communitied material under vacuum. It is beneficial if the transport container is a vacuum container, in particular an evacuated vacuum container, such that a negative pressure or vacuum occurs in the transport container once it has been sealed. Alternatively, the transport container may be filled with an inert gas.

According to a preferred embodiment, the method is conducted such that a pressure lower than 100 hPa is maintained for at least one minute.

In a preferred battery processing installation, the separation unit and the drying device are arranged in a joint standard container. The advantage of this is that it renders the battery processing installation especially easy to transport.

The drying device is configured to dry the comminuted material until an electrolyte content is so low that an electrochemical reaction is impossible. If the drying

device is operated in batch mode, which represents a preferred embodiment, the drying shall be performed, for example, for a pre-determined period of time. Alternatively or additionally, the content of organic substances, such as organic carbonates, in the atmosphere in the drying device is continually measured and the drying stopped once the concentration is lower than a pre-determined threshold concentration.

According to a preferred embodiment, the battery processing installation, in particular the vacuum installation, comprises a condenser that is configured to condense organic components of the atmosphere in the dryer, especially organic carbonates such as dimethyl carbonate, ethyl methyl carbonate and/or ethylene carbonate. The condenser may also be described as a condensation device or a plasticizer. The condenser is preferably arranged in the direction of material flow behind a vacuum pump, by means of which the dryer is evacuated. It is beneficial if the condenser is cooled, preferably to a maximum temperature of 90°C, preferably a maximum of 80°C, especially preferably a maximum of 70°C. In order to keep the energy required for cooling low, the condenser, insofar as it is cooled, is cooled to a temperature of at least -10°C, in particular at least 10 °C.

It is beneficial if the drying device comprises an agitator, for example an anchor agitator or a rod agitator, whose stirring rods can be arranged transversely to an agitator shaft. Alternatively or additionally, the agitator is an external agitator that moves the dryer as a whole.

The battery processing installation has a vacuum installation that is connected to the drying device for the purpose of generating a vacuum in the drying device. It is especially favourable if the vacuum installation is also arranged in the standard container. The standard container preferably refers to a container that conforms to ISO standard 668, preferably a 40 foot container or a 20 foot container.

For example, the vacuum installation comprises a jet pump with a blasting medium

that is used to generate the negative pressure.

It is beneficial if the comminuted unit is arranged in the drying device. In other words, in this case a container is present in which the batteries are both comminuted and in which the comminuted material is dried. Both processes occur at the same time and under a vacuum. An agitator is not necessary in this case.

The battery processing installation preferably has a hard metal detachment device and/or a light fraction separation device; a separation device, especially a classification device, for separating active material from the carrier, in particular by means of a second comminution stage and/or air jet sieving, such that an active material fraction and a carrier fraction occur; and preferably a second filling device for the separate filling of the active material fraction and the carrier fraction. It is beneficial if this filling device is designed, however, to be at least dust-tight for the purpose of filling under negative pressure and/or inter gas.

A hard metal detachment device should be understood particularly to mean a device for detaching fragments of peripheral components of the operating system, the battery cell casing and the electrical contacts. For example, the hard metal detachment device has a magnet separation device and/or a separator, in particular a cross-flow separator and/or a zigzag separator. The separation device should be understood particularly to mean a device for detaching the separator foil.

The 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 standard container, for example in the first standard container described above or a second standard container. It is beneficial if the container is sealed so as to be dust-tight.

The battery processing installation preferably has an airlock between the comminution unit and the deactivation device, especially the drying device. For example, this refers to a rotary feeder or a flat slider. The airlock reduces the amount of gas introduced into the deactivation device, especially the drying device. The airlock is preferably designed to be a rotary airlock. This renders it possible to empty the inactivation unit during operation of the comminution unit.

If the comminution and drying are conducted in different containers, the battery processing installation preferably has a dust-tight, in particular a gas-tight, conveyor that connects the comminuting device and the drying device. A conveyor is deemed particularly dust-tight if a maximum of 5% by weight of all particles with a diameter of at least 0.1 micrometres leave the conveyor into the atmosphere.

In order to reduce the drying time between the beginning and end of the drying process, it is beneficial if the drying device comprises a heater. The heater may refer to a conductive or convective heater that preferably introduces the heat produced during compression into the pumps and the condensation heat into the dryer.

It has been proven that the quality of the recovered electrolyte is especially high when the drying device comprises at least one dry-running vacuum pump, preferably exclusively dry-running vacuum pumps.

At 300 hPa, the pump output of the vacuum installation is at least fifty times the volume of the interior of the drying device per hour. This means that the drying time can be kept short.

The drying time can also be reduced if - as is intended with a preferred embodiment - the drying device has at least two vacuum pumps which differ in their flow rate at 400 hPa and their maximum possible minimum pressure. In this case, one of the two vacuum pumps preferably has a high flow rate capacity (measured in litres

per second at 400 hPa) but a lower minimum pressure. The maximum possible minimum pressure is the lowest pressure that can be achieved with the pump. It is then possible to use the pumps in their optimal operating ranges. The first pumps, arranged in the direction of material flow, guarantee a high flow rate at low pressures, whereas pumps arranged downstream compress smaller flow rates against ambient pressure.

For example, the vacuum installation has at least one dry-running roots pump and/or at least one dry-running screw vacuum pump.

The comminution unit preferably has a bottom sieve for restricting the maximum size of the comminuted material. This facilitates the further processing of the comminuted material and reduces the risk of a subsequent heating and spontaneous combustion of the comminuted material through short-circuiting of battery fragments. The bottom sieve preferably has a maximum mesh width of 35mm.

The drying device preferably has an entry valve for supplying it (the drying device) with inert gas; this entry valve is connected to an inert gas supply device for feeding an interior of the drying device with inert gas. In particular, liquefied inert gas, i.e. gaseous at 22°C and 1013 hPa, is supplied, wherein this gas has a maximum temperature of -30°C. Alternatively or additionally, the comminuting device has a supply valve that serves the same purpose; this supply valve is connected to an inert gas supply device for feeding an interior of the comminuting device with inert gas. The inert gas supply device preferably serves to supply liquefied inert gas.

In order to measure an oxygen concentration, especially to determine whether an explosion limit has been exceeded, the comminution unit has an oxygen detection device for detecting an oxygen concentration in the comminution unit.

The battery processing installation may have a combustion device for the thermal or catalytic combustion of gaseous components of the electrolyte. This is preferably

arranged behind the condenser in the direction of material flow and/or in front of an exhaust outlet. This means that no components of the electrolyte are released through the exhaust outlet into the atmosphere.

The battery processing installation preferably comprises a particle removal device for removing particles from the gas flow that is drawn out of the drying device. The particle removal device may comprise, for example, a cyclone and/or a filter and/or activated carbon.

In the following, the invention will be explained in more detail by way of the attached drawings. They show

- Figure 1 a flow diagram of a method according to the invention,
- Figure 2 a cross-section through a battery processing installation according to the invention and
- Figure 3 a cross-section through further optional components of a battery processing installation according to the invention.
- Figure 4 shows a flow diagram of a method according to the invention according to a second embodiment.

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

(modules/stacks) and/or cells 16.1, 16.2, ... are fed into a comminution unit 18, which comprises, for example, a rotary shear with a rotor and a comminutor with stators or several rotors, or a cutting mill with a rotor and several rotors.

The comminution unit 18 comminutes the batteries 10 under shielding gas 20, which is extracted, for example, from a shielding gas cylinder. Alternatively or additionally, liquid nitrogen from a liquid nitrogen source 19 may be injected. The shielding gas may refer, for example, to nitrogen, a noble gas, carbon dioxide, nitrous oxide or another gas which is preferably not toxic.

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 between the comminution unit 18 and the drying device 26, the airlock being so gas-tight that the pressure device 26 is - to a good approximation - separated from the comminution unit 18 so as to be gas-tight.

The drying device 26 is connected to a vacuum installation 29 that comprises a vacuum pump 30 and creates a vacuum. A pressure p_{26} from $p_{26} \approx 100$ hPa, at times below 50 hPa, 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 figure 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, the vacuum installation 29 may have a jet pump which uses a blasting medium in the form of a liquid that is conducted at a high speed through Venturi nozzles. The blasting medium is alkaline and has a pH value of at least pH 1 and is, for example, a 10% potassium hydroxide solution.

The vacuum installation 29 comprises a gas purification device 32 that is arranged between the drying device 26 and the vacuum pump 30, and which has a condenser 34 and/or an activated carbon filter 36 in the present case. The condenser is operated at a temperature of -10°C so that dimethyl carbonate and ethyl methyl carbonate condense and can be dispensed into a condensate container 38. In addition, any water present is separated by freezing. A control valve 40 is designed to open when the pressure p_{26} becomes too great and to close when the pump circuit and drying container are to be decoupled.

The drying material is preferably moved during drying. This may be achieved via agitating with an agitator 41, such as an anchor agitator or a rod agitator with rods arranged perpendicular to the agitator shaft. Alternatively, it can be achieved by way of a drying container that is moved.

The drying of the comminuted material results in deactivated comminuted material 42, which is fed into a filling device 44. A transport container 46 is then filled with the deactivated 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 20 from the vacuum pump 30 via a flushing line 48. If the vacuum pump 30 also functions as a compressor - as in the present case - which represents a preferred embodiment, the shielding gas can be drawn over a pressurised gas cylinder 50. Alternatively or additionally, the shielding gas 20 can be given off into the surroundings, following additional cleaning if necessary.

Figure 2 schematically depicts a cross-section through a battery processing installation 52 according to the invention (see figure 1), which comprises a standard container 54 in which the comminution unit 18, the drying device 26 and the filling device 44 are arranged. A first gas-tight conveyor 56 is arranged behind the comminution unit 18; the conveyor comprises, for example, a screw conveyor or a tube chain conveyor. The first conveyor 56 delivers the comminuted material 24 to the drying device 26, which is connected to the vacuum generation device, not depicted in figure 2. A second conveyor 58 is arranged behind the drying device 26 in the direction of material flow; preferably, the conveyor is also designed to be gas-tight and may include a screw conveyor or a tube chain conveyor. The second conveyor delivers the inactivated comminuted material 42 to the filling device 44.

Figure 3 depicts optional units - available in the present embodiment - of the battery processing installation 52 according to the invention (see figure 1) which comprise a breakdown comminutor 60, as well as a separator 62. The breakdown comminutor 60 contains a transport container draining device 64, by means of which inactivated comminuted material 42 can be removed from the transport container 46. The breakdown comminutor 60 produces breakdown material 66, which is fed into the separator 62. The separator may refer, for example, to a zigzag separator.

The battery processing installation 52 preferably comprises a comminutor, which is preferably situated in the material flow in front of the classification device 74 and includes a rapid comminution tool, wherein a peripheral speed of the rotor is greater than 1 m/s, preferably greater than 10 m/s. This comminutor comminutes the comminuted material and subjects it to such mechanical stress that the electrochemically active coating at least partially detaches from the carrier. The presence of such a comminutor is a generally preferred feature of a battery processing installation according to the invention.

A light fraction with a separator foil and fine coating material, and a heavy material fraction with carrier foils (aluminium and copper) with an easy-adhesive coating occur in the separator. Both fractions are each placed on a sieve for further separation into coating and separator foil, or coating and metal foil. The further processing of the resulting fractions is conducted separately.

The breakdown material 66 is fed to the separator 62 by means of a third conveyor 68. A fourth conveyor 70 guides sifted material 72, in particular the material of the light fraction and the material of the heavy fraction, which leaves the separator 62, into one or two classification devices 74. The classification device 74 preferably has an air jet sieve, which simultaneously functions as a separation device in the case of the heavy fraction for separating the active material from the carrier. In the case of the light fraction, the active material is separated by the separator. The separation results in an active material fraction 76, with which a transport container 78 is filled.

In addition, a carrier fraction (heavy material) 80 and a separator fraction (light material) are produced, which - in the present embodiment - are fed into a filling unit 84 using a fifth conveyor 82; the filling unit fills a container 86 with the carrier fraction 80. The filling unit 84 comes together with a second filling unit 88 to form part of a second filling device.

Figure 4 depicts a flow diagram of a second battery processing installation 52 according to the invention, which has two drying devices 26.1, 26.2. Each drying device 26.1, 26.2 has an agitator 41.1 or 41.2. The airlock 27 is located in front of the comminution unit 18 in the flow of material direction, wherein the airlock is designed as a rotary airlock in the present case and can be used to fill the comminution unit 18 without the gas atmosphere in the comminutor mixing with the surrounding air. The airlock 28 is located behind the comminution unit 18 in the direction of material flow, wherein the airlock is designed as a rotary airlock in the present case and can be used to feed the drying devices 26.1, 26.2 one-by-one or

simultaneously.

Each agitator 41.1, 41.2 has a power output of at least 4 kW, in the present case 5 kW, per cubic metre of drying volume. The mechanical energy that is introduced is transferred to the comminuted material 24 contained in the respective drying device 26.1, 26.2. Part of the mechanical energy leads to the separation of components of the comminuted material, for example to a separation of coating material from the carrier foil. However, the mechanical output is largely converted into thermal energy. This thermal energy is absorbed by the vaporising electrolyte, which is still a component of the comminuted material 24.

The gases that develop in the drying devices 26.1 ($i = 1, 2$) are first cleaned of particles that have been picked up; this is done by means of a particle removal device 90. The particles are collected in a container 92 or immediately processed further. The particle removal device 90 may refer, for example, to a filter and/or a cyclone.

The vacuum pump 30 is arranged behind the particle removal device 90 in the direction of flow. It is beneficial if at least a second pump of a different design is arranged behind or parallel to the vacuum pump 30 in the direction of gas flow.

The condenser 34, in which a pressure p_{34} is present, is arranged behind the vacuum pump 30. For the most part, the pressure p_{34} corresponds to the ambient pressure, i.e. it deviates from the ambient pressure by a maximum of 100 hPa, for instance. Given that the pressure p_{34} is considerably greater than the pressure p_{26} in the drying devices 26.1, 26.2, the carboxylic acids in particular, especially dimethyl carbonate, propylene carbonate, diethyl carbonate, ethylene carbonate and ethyl methyl carbonate, condense. The resulting condensation heat is discharged by cooling. In this situation, it is possible that the condenser is cooled to a temperature of T_{34} , which differs from the ambient temperature $T_{Um\text{g}}$ by less than 20 Kelvin. This has the advantage that the amount of energy required for drying the comminuted material 24 is comparatively low and a lot of electrolyte can be recovered at the

same time.

An activated carbon filter 36 may be arranged behind the condenser 34 in the direction of material flow; however, this is not necessary. It is also possible for an oxidation device 94 to be arranged behind the condenser 34 in the direction of flow, by means of which the remaining oxidisable material, especially from organic components of the electrolyte, are oxidised either catalytically or thermally such that the gas leaving the oxidation device 94 can be safely released into the atmosphere.

It is possible for the battery processing installation 52 to comprise a filling device 44, by means of which a transport container 46 can be filled with the dried comminuted material 24 in the form of the inactive comminuted material 42. However, it is also possible that the battery processing installation 52 does not have such a filling device 44.

The drying devices 26.1, 26.2 (it is also possible that the battery processing installation only has one drying device 26 in this embodiment) each comprise an exit airlock 96.1, 96.2 in the form of a rotary and deflection airlock. The inactive comminuted material 42 is temporarily stored, for example, in a silo 98 or directly fed into a heavy material separator 100. The heavy material separator 100 is designed to separate material with a density of at least 2.6 grams per cubic centimetre, particularly aluminium and/or iron components.

The remaining material is subsequently comminuted further in a comminutor 102 and then classified in a separator 62 into light material 108 (separator and coating material) and heavy material 110 (carrier foils and coating material). Both fractions are sieved 74.1, 74.2. This results in the development of the recyclable aluminium and copper foils in container 88.3, a separator fraction in container 88.1, and pure coating material in containers 88.4 and 88.2; due to its high degree of purity, this material can be processed further in subsequent metallurgic process steps.

Reference list

- 10 battery
- 12 discharge unit
- 14 dismantling station
- 16 cell
- 18 comminution unit
- 19 liquid nitrogen source
- 20 shielding gas
- 22 shielding gas cylinder
- 24 comminuted material
- 26 drying device
- 27 airlock in front of comminutor
- 28 airlock
- 29 vacuum installation
- 30 vacuum pump
- 31 gas
- 32 gas purification device
- 34 condenser
- 36 activated charcoal filter
- 38 condensate container
- 40 control valve
- 41 agitator
- 42 inactive comminuted material
- 44 filling device
- 46 transport container
- 48 flushing line
- 50 pressurised gas cylinder
- 52 battery processing installation
- 54 standard container
- 56 first conveyor

58	second conveyor
60	breakdown comminutor
62	separator
64	transport container draining device
66	breakdown material
68	third conveyor
70	fourth conveyor
72	sifted material
74	classification device
76	active material fraction
78	transport container
80	carrier fraction
82	fifth conveyor
84	filling unit
86	container
88	additional filling unit
90	particle removal device
92	container
94	oxidation device
96	exit airlock
98	silo
100	heavy material separator
102	comminutor
108	light material
110	heavy material
p	force

Patent claims

1. A method for treating used lithium batteries (10) containing the steps:
 - (a) comminuting the batteries (10) such that comminuted material (24) is obtained, and
 - (b) inactivating the comminuted material (24) such that an inactivated comminuted material (42) is obtained, characterized by the fact that
 - (c) the drying is conducted at a maximum pressure of 300 hPa and a maximum temperature of 80 °C, and
 - (d) the deactivated comminuted material (42) is not filled into a transport container and/or said deactivated comminuted material is immediately further processed after the drying process.
2. The method according to claim 1, characterized by the fact that
 - the battery is dried at a temperature which is below a decomposition temperature of a binder of the battery, and
 - the comminuted material (24) is deactivated by the drying, such that an electrochemical reaction is not possible.
3. The method according to one of the above claims, characterized by the step: condensing the gases that were created during the drying process, in particular at an ambient pressure and/or a temperature above 0°C and below 50°C.
4. The method according to one of the above claims, characterized by the steps:
 - continuous monitoring of a concentration of organic carbonates in the atmosphere of the drying device during the drying process, and
 - not terminating the drying process until a lower explosion limit has been undercut.

5. The method according to one of the above claims, characterized by the fact that
 - the drying process is conducted at a maximum pressure of 30 hPa for at least 50% of the drying time and/or
 - a minimum pressure during the drying process is at most 50 hPa.
6. The method according to one of the above claims, characterized by the fact that
 - the comminuted material (24, 42) is moved in the drying device, especially when removing it from the drying device, by means of an agitator, and
 - the agitator is used to supply at least 50%, in particular at least 80%, of an evaporation heat required for the drying of the comminuted material (24).
7. The method according to one of the above claims, characterized by the fact that
 - gases created during the drying process are sucked away and/or
 - the movement using the agitator is conducted such that at least 50% by weight of the coating material of the comminuted material (42) is sucked away.
8. The method according to one of the above claims, characterized by the fact that the comminution and drying processes are conducted in one container only.

9. A battery processing installation for the treatment of batteries, in particular lithium batteries, with:
 - (a) a comminution unit (18) for comminuting the batteries (10) such that comminuted material (24) is obtained, and
 - (b) a deactivation device (26) in the form of a drying device (26) for deactivating the comminuted material (24),characterized by the fact that
 - (c) a vacuum installation that is connected to the drying device (26) for the purpose of generating a vacuum in the drying device (26), and
 - (d) the drying device (26) is configured to dry at a maximum temperature of 80°C, especially below 80 °C.
10. The battery processing installation according to claim 9, characterized by the fact that the comminution unit (18) is arranged in the drying device.
11. The battery processing installation according to one of the claims 9 to 10, characterized by
a condenser for condensing gaseous electrolytes that have been sucked out of the dryer,
wherein a particle separator is arranged between the drying device and the condensor and/or the at least one pump in the direction of material flow.
12. The battery processing installation according to one of the claims 9 to 11, characterized by
a gas-tight and or dust-tight conveyor which connects the comminution device and the drying device (26).

13. The battery processing installation according to one of the claims 9 to 12, characterized by
 - an airlock that is arranged in front of the comminution unit (18) for supplying the batteries, and/or
 - a particle separator, which is arranged between the drying device and the condenser in the direction of material flow.
14. The battery processing installation according to one of the claims 9 to 13, characterized by the fact that the drying device comprises a heater which harnesses the heat preferably from the heat dissipation of the vacuum pumps and/or the condenser.
15. The battery processing installation according to one of the claims 9 to 14, characterized by the fact that the drying device comprises at least one dry-running vacuum pump, especially at least two vacuum pumps whose volume flows at 400 hPa and maximum achievable minimum pressures differ.
16. The battery processing installation according to claims 9 to 15, characterized by the fact that the comminution unit comprises a bottom filter for restricting the maximum size of the comminuted material.

Abstract

The invention relates to a method for treating used lithium batteries (10) containing the steps: comminuting the batteries (10) such that comminuted material (24) is obtained, and (b) inactivating of the comminuted material (24) such that an inactive comminuted material (42) is obtained. According to the invention, the drying is conducted at a maximum pressure of 300 hPa and a maximum temperature of 80 °C and the deactivated comminuted material (42) is not filled into a transport container and/or said deactivated comminuted material is immediately further processed after the drying process.

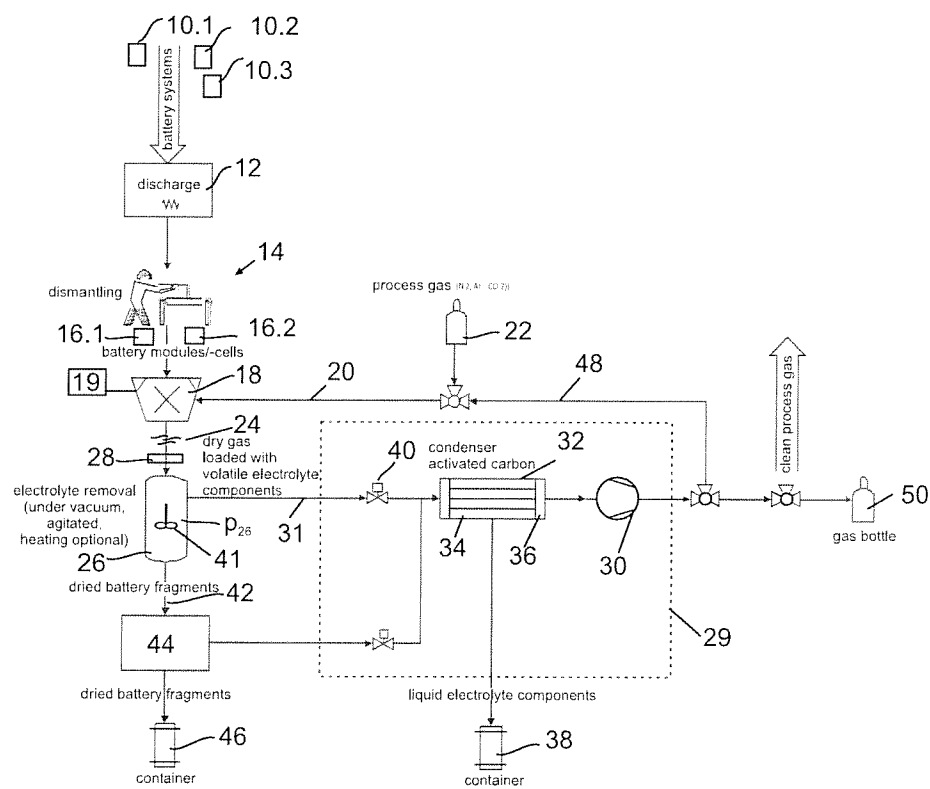


Fig. 1

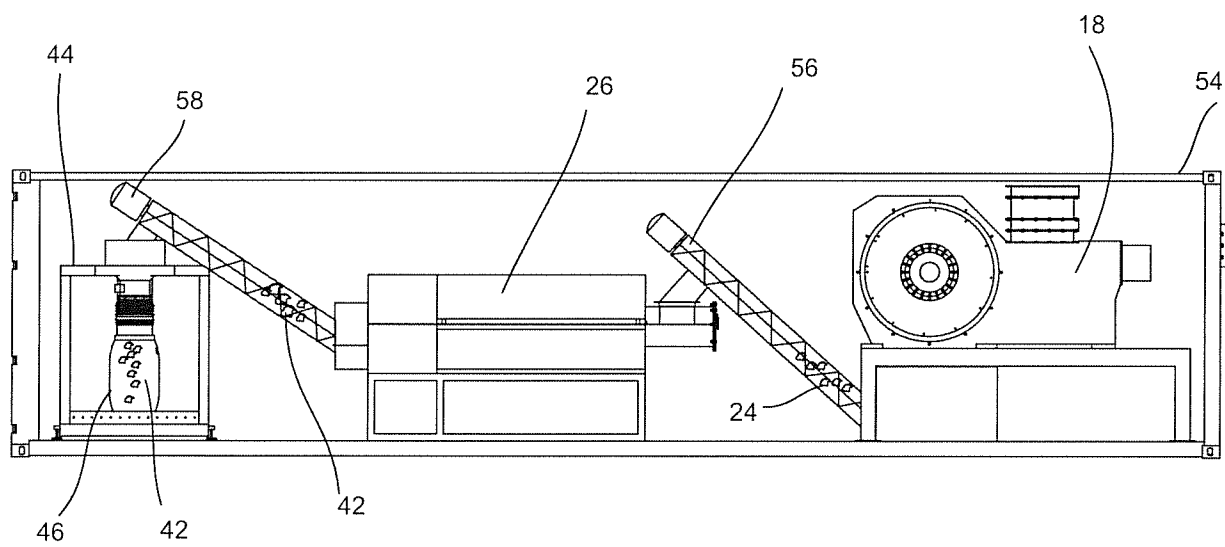


Fig. 2

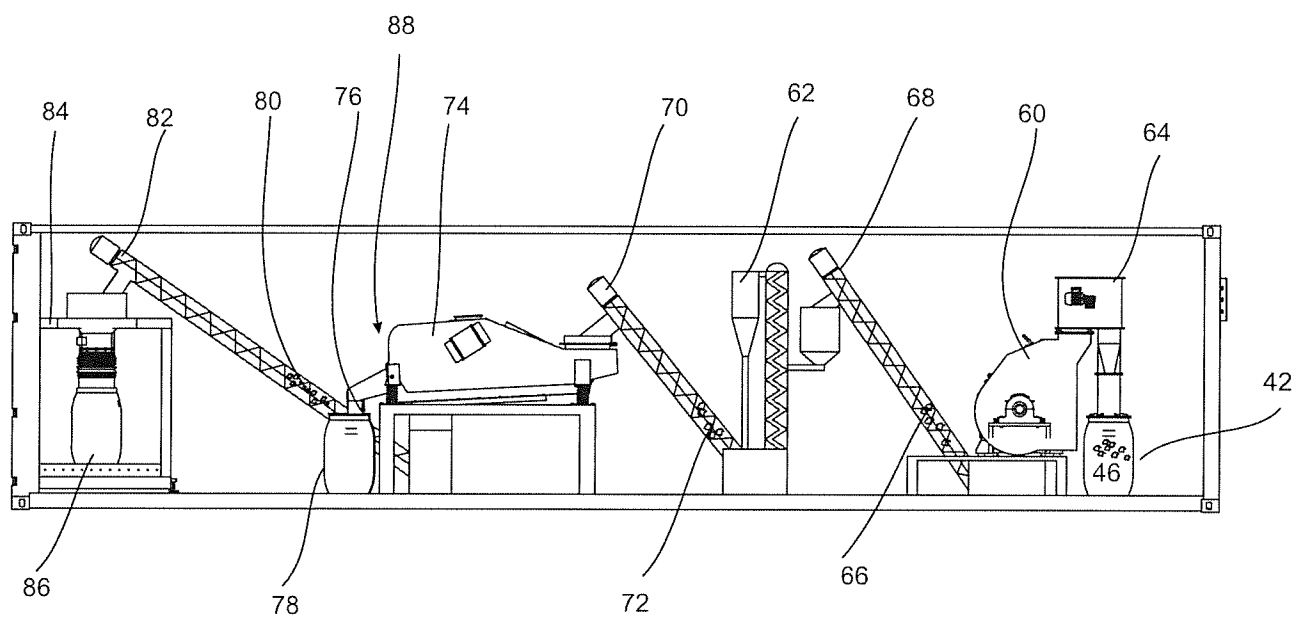


Fig. 3

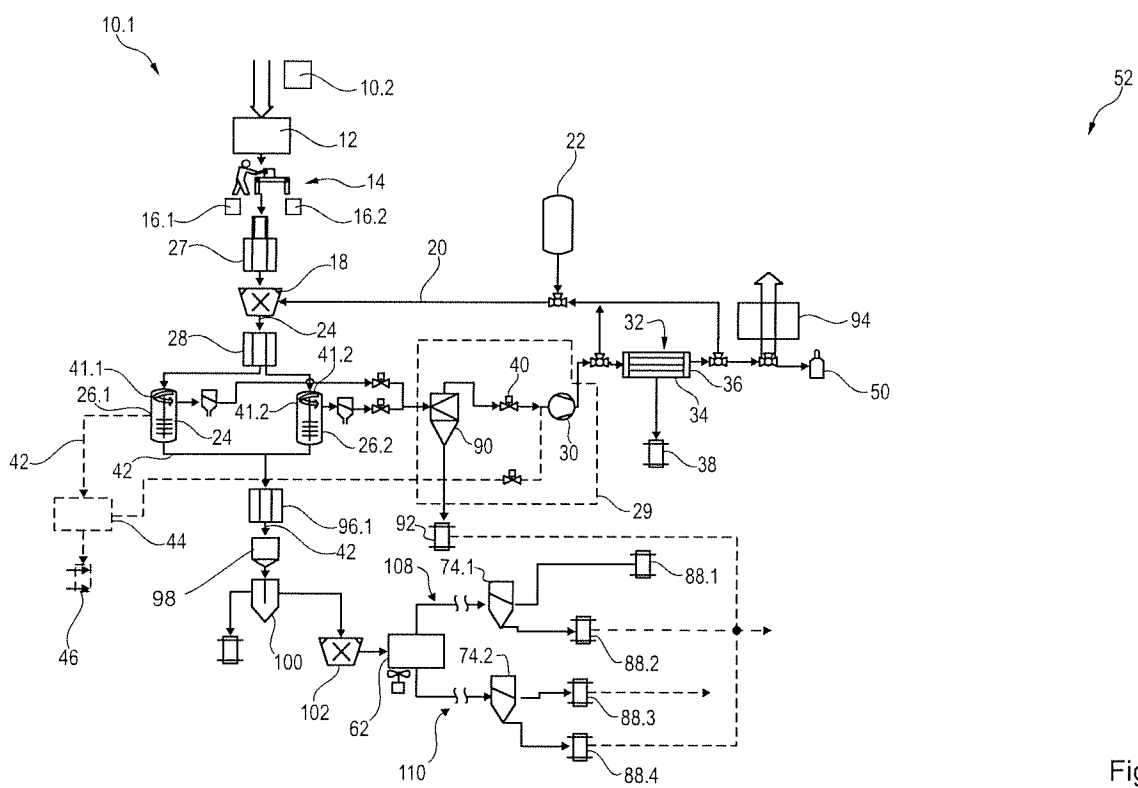


Fig. 4

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	03101253US
		Application Number	
Title of Invention	RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION		
<p>The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.</p> <p>This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.</p>			

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☐	Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)
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Application Information:

Title of the Invention	RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION		
Attorney Docket Number	03101253US	Small Entity Status Claimed	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	4	Suggested Figure for Publication (if any)	

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	03101253US
		Application Number	
Title of Invention	RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION		

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Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not be** the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

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	a 371 of international	PCT/EP2017/076113	2017-10-12

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	03101253US
		Application Number	
Title of Invention	RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION		

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)ⁱ the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Access Code ⁱ (if applicable)
10 2016 120 046.8	DE	2016-10-20	

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button.

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.

NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	03101253US
		Application Number	
Title of Invention	RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION		

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	03101253US
		Application Number	
Title of Invention	RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION		

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant	1	Remove
<p>If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.</p> <p style="text-align: right;">Clear</p>		
☒ Assignee	Legal Representative under 35 U.S.C. 117	Joint Inventor
Person to whom the inventor is obligated to assign.		Person who shows sufficient proprietary interest
If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:		
<div style="border: 1px solid black; height: 20px; width: 100%;"></div>		
Name of the Deceased or Legally Incapacitated Inventor: <div style="border: 1px solid black; width: 450px; height: 20px;"></div>		
If the Applicant is an Organization check here. ☒		
Organization Name	DUESENFELD GMBH	
Mailing Address Information For Applicant:		
Address 1	Rothbergstrasse 8	
Address 2		
City	Wendeburg	State/Province
Country	DE	Postal Code
Phone Number		Fax Number
Email Address		
Additional Applicant Data may be generated within this form by selecting the Add button. Add		

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	03101253US
		Application Number	
Title of Invention	RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION		

Assignee 1				
Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.				
<input type="button" value="Remove"/>				
If the Assignee or Non-Applicant Assignee is an Organization check here. ☐				
Prefix	Given Name	Middle Name	Family Name	Suffix
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Mailing Address Information For Assignee including Non-Applicant Assignee:				
Address 1		<input type="text"/>		
Address 2		<input type="text"/>		
City	<input type="text"/>	State/Province	<input type="text"/>	
Country ⁱ	<input type="text"/>	Postal Code	<input type="text"/>	
Phone Number	<input type="text"/>	Fax Number	<input type="text"/>	
Email Address	<input type="text"/>			
Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button. <input type="button" value="Add"/>				

Signature:

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). However, if this Application Data Sheet is submitted with the **INITIAL** filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Michael E. Whitham/		Date (YYYY-MM-DD)	2019-04-17
First Name	Michael	Last Name	Whitham	Registration Number
				32635
Additional Signature may be generated within this form by selecting the Add button. <input type="button" value="Add"/>				

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	03101253US
		Application Number	
Title of Invention	RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION		

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

- 1 The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
- 2 A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
- 3 A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
- 4 A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
- 5 A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
- 6 A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
- 7 A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
- 8 A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
- 9 A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re patent application of

Hanisch

Confirmation No. (not assigned)

Serial No. (not assigned)

Group Art Unit (not assigned)

Filed Concurrently Herewith

Examiner (not assigned)

For RECYCLING METHOD FOR TREATING USED BATTERIES, IN
PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY
PROCESSING INSTALLATION

This application is a Rule 371 National Stage filing from International Application
PCT/EP2017/076113 filed on October 12, 2017 claiming priority to German
application 10 2016 120 046.8 filed on October 20, 2016

Commissioner for Patents
PO Box 1450
Alexandria, Virginia 22313-1450

PRELIMINARY AMENDMENT

Sir:

Prior to calculation of the filing fees and examination on the merits, please
amend the above-identified patent application as follows:

Amendments to the Claims: begin on page 2

Remarks: begin on page 7

Listing of the Claims:

The following is a complete listing of all the claims in the application, with an indication of the status of each:

1. (currently amended) A method for treating used lithium batteries, comprising ~~(10) containing the steps:~~

- (a) comminuting the batteries ~~(10)~~ such that comminuted material ~~(24)~~ is obtained, and
- (b) inactivating the comminuted material ~~(24)~~ such that an inactivated comminuted material ~~(42)~~ is obtained,

~~characterized by the fact that~~

- (c) wherein inactivating includes a drying process where ~~the~~ drying is conducted at a maximum pressure of 300 hPa and a maximum temperature of 80 °C, and
- (d) wherein the inactivated ~~deactivated~~ comminuted material ~~(42)~~ is not filled into a transport container and/or said inactivated ~~deactivated~~ comminuted material is immediately further processed after the drying process.

2. (currently amended) The method according to claim 1, wherein ~~characterized by the fact that~~

~~[[-]] the batteries are~~ battery is dried at a temperature which is below a decomposition temperature of a binder used in the batteries ~~of the battery~~, and

~~[[-]] the comminuted material (24) is deactivated by the drying, such that an electrochemical reaction is not possible.~~

3. (currently amended) The method according to claim 1, further comprising one ~~of the above claims, characterized by the step:~~ condensing the gases that were created during the drying process, ~~in particular at an ambient pressure and/or a temperature above 0°C and below 50°C.~~

4. (currently amended) The method according to claim 1, further comprising one of the above claims, ~~characterized by the steps:~~

[[-]] continuous monitoring of a concentration of organic carbonates in an ~~the~~ atmosphere of a the drying device used during the drying process, and

[[-]] not terminating the drying process until a lower explosion limit has been undercut.

5. (currently amended) The method according to claim 1, wherein one of the above claims, ~~characterized by the fact that~~

[[-]] the drying process is conducted at a maximum pressure of 30 hPa for at least 50% of the drying time, and/or

[[-]] a minimum pressure during the drying process is at most 50 hPa.

6. (currently amended) The method according to claim 1 wherein one of the above claims, ~~characterized by the fact that~~

[[-]] one or more of the comminuted material and the inactivated comminuted material (24, 42) is moved in a the drying device, ~~especially when removing it from the drying device,~~ by means of an agitator, and

[[-]] the agitator is used to supply at least 50%, ~~in particular at least 80%,~~ of an evaporation heat required for ~~the~~ drying of the comminuted material (24).

7. (currently amended) The method according to claim 6 wherein one of the above claims, ~~characterized by the fact that~~

[[-]] gases created during the drying process are sucked away and/or

[[-]] ~~the~~ movement using the agitator is conducted such that at least 50% by weight of a the coating material of the comminuted material (42) is sucked away.

8. (currently amended) The method according to claim 1 wherein one of the above claims, ~~characterized by the fact that~~ the comminution and drying processes are conducted in one container only.

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

- (a) a comminution unit ~~(18)~~ for comminuting the batteries ~~(10)~~ such that comminuted material ~~(24)~~ is obtained, and
- (b) a deactivation device ~~(26)~~ in the form of a drying device ~~(26)~~ for deactivating the comminuted material ~~(24)~~, and
characterized by the fact that
- (c) a vacuum installation ~~that is~~ connected to the drying device ~~(26)~~ for ~~the purpose of~~ generating a vacuum in the drying device ~~(26)~~, and
- (d) wherein the drying device ~~(26)~~ is configured to dry at or below a maximum temperature of 80°C, ~~especially below 80 °C.~~

10. (currently amended) The battery processing installation according to claim 9, wherein ~~characterized by the fact that~~ the comminution unit ~~(18)~~ is arranged in the drying device.

11. (currently amended) The battery processing installation according to claim 9, further comprising: one of the claims 0 to 10, characterized by

a condenser for condensing gaseous electrolytes which are ~~that have been~~ sucked out of the drying device; and dryer,
~~wherein~~ a particle separator is arranged between the drying device and the condenser ~~condensor~~ and/or the at least one pump which pumps in a the direction of material flow.

12. (currently amended) The battery processing installation according to claim 9, further comprising one of the claims 0 to 11, characterized by

a gas-tight and or dust-tight conveyor which connects the comminution device and the drying device ~~(26)~~.

13. (currently amended) The battery processing installation according to claim 9, further comprising: one of the claims 0 to 12, characterized by

[[-]] an airlock ~~that is~~ arranged in front of the comminution unit ~~(18)~~ for supplying the batteries, and/or

[[-]] a particle separator, ~~which is~~ arranged between the drying device and the condenser in a ~~the~~ direction of material flow.

14. (currently amended) The battery processing installation according to claim 9 wherein one of the claims 0 to 13, characterized by the fact that the drying device comprises a heater which harnesses the heat ~~preferably from the~~ heat dissipation of ~~the~~ vacuum pumps and/or the condenser.

15. (currently amended) The battery processing installation according to claim 9 wherein one of the claims 0 to 14, characterized by the fact that the drying device comprises at least one dry-running vacuum pump;
especially ~~at least two vacuum pumps whose volume flows at 400 hPa and maximum achievable minimum pressures differ.~~

16. (currently amended) The battery processing installation according to claim 9 wherein claims 0 to 15, characterized by the fact that the comminution unit comprises a bottom filter for restricting the maximum size of ~~the~~ comminuted material.

17. (new) The method according to claim 3 wherein condensing is performed at an ambient pressure and/or a temperature above 0°C and below 50°C.

18. (new) The method according to claim 6 where movement by the agitator is performed when removing the inactivated comminuted material from drying device.

19. (new) The battery processing installation of claim 15 wherein the at least on dry-running vacuum pump comprises at least two vacuum pumps whose volume flows at 400 hPa and maximum achievable minimum pressures differ.

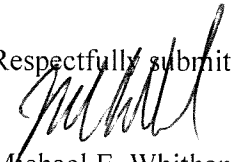
20. (new) A method for treating used lithium batteries with the steps:

- (a) comminuting of the batteries, such that comminuted material is obtained, and
- (b) drying of the comminuted material, such that the battery electrolyte vaporises,
- (c) wherein at least 50% of the heat required for vaporisation is introduced into the comminuted material by mechanical energy.

REMARKS

Claims 1-16 have been amended to eliminate multiple dependent claim format, provide for antecedent basis, and to address formal matters. Claims 17-20 have been added. Please calculate the filing fees based on claims 1-20, and proceed to examination on the merits.

Respectfully submitted,



Michael E. Whitham
Reg. No. 32,635

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11491 Sunset Hills Road, Suite 340
Reston, VA 20190

Tel. (703) 787-9400
Fax. (703) 787-7557

Customer No.: 30743

Electronic Patent Application Fee Transmittal

Application Number:				
Filing Date:				
Title of Invention:	RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION			
First Named Inventor/Applicant Name:	Christian HANISCH			
Filer:	Michael E. Whitham/Walter Richardson			
Attorney Docket Number:	03101253US			
Filed as Large Entity				
Filing Fees for U.S. National Stage under 35 USC 371				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
NATIONAL STAGE FEE	1631	1	300	300
NATL STAGE SEARCH FEE - REPORT PROVIDED	1642	1	520	520
NATIONAL STAGE EXAM - ALL OTHER CASES	1633	1	760	760
Pages:				
Claims:				
Miscellaneous-Filing:				
OATH/DECL > 30 MOS FROM 371 COMMENCEMENT	1617	1	140	140
Petition:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				1720

Electronic Acknowledgement Receipt

EFS ID:	35767816
Application Number:	16343224
International Application Number:	PCT/EP2017/076113
Confirmation Number:	6508
Title of Invention:	RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES, AND BATTERY PROCESSING INSTALLATION
First Named Inventor/Applicant Name:	Christian HANISCH
Customer Number:	30743
Filer:	Michael E. Whitham/Walter Richardson
Filer Authorized By:	Michael E. Whitham
Attorney Docket Number:	03101253US
Receipt Date:	18-APR-2019
Filing Date:	
Time Stamp:	15:30:36
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$ 1720
RAM confirmation Number	041919INTEFSW15322100
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		03101253aa_app.pdf	1969041	yes	53
			29e961edffa3a7af187338bc9e310b124492e24e		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Transmittal of New Application		1	3	
	Abstract		4	5	
	Specification - Not in English		6	43	
	Documents submitted with 371 Applications		44	53	
Warnings:					
Information:					
2		03101253aa_trans.pdf	1401689	yes	40
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	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Translation of Foreign Priority Documents		1	1	
	Specification		2	31	
	Claims		32	35	
	Abstract		36	36	
	Drawings-only black and white line drawings		37	40	
Warnings:					
Information:					

3	Application Data Sheet	03101253US_ADS.pdf	1256041	no	8		
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4		03101253aa_prelim.pdf	171969	yes	7		
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	Multipart Description/PDF files in .zip description						
	Document Description		Start	End			
	Preliminary Amendment		1	1			
	Claims		2	6			
	Applicant Arguments/Remarks Made in an Amendment		7	7			
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Information:							
5	Fee Worksheet (SB06)	fee-info.pdf	36840	no	2		
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Warnings:							
Information:							
Total Files Size (in bytes):			4835580				
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>							

(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
26. April 2018 (26.04.2018)



(10) Internationale Veröffentlichungsnummer

WO 2018/073101 A1

(51) Internationale Patentklassifikation:

H01M 6/52 (2006.01) C22B 21/00 (2006.01)
C22B 7/00 (2006.01) H01M 10/54 (2006.01)
C22B 15/00 (2006.01)

(21) Internationales Aktenzeichen: PCT/EP2017/076113

(22) Internationales Anmeldedatum:
12. Oktober 2017 (12.10.2017)

(25) Einreichungssprache: Deutsch

(26) Veröffentlichungssprache: Deutsch

(30) Angaben zur Priorität:
10 2016 120 046.8
20. Oktober 2016 (20.10.2016) DE

(71) Anmelder: DUESENFELD GMBH [DE/DE]; Friedland-
weg 5, 38114 Braunschweig (DE).

(72) Erfinder: HANISCH, Christian; Sophienstraße 14, 38118
Braunschweig (DE).

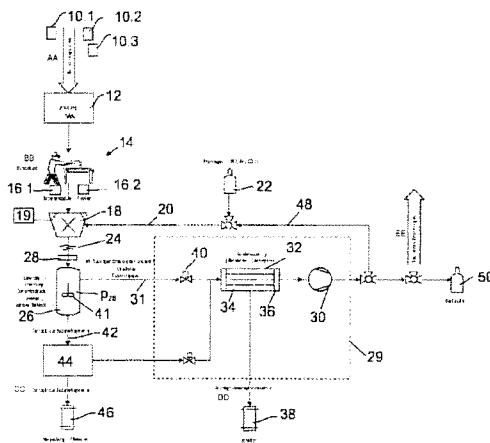
(74) Anwalt: GRAMM, LINS & PARTNER PATENT- UND
RECHTSANWÄLTE PARTGMBB; Theodor-Heuss-
Straße 1, 38122 Braunschweig (DE).

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(54) Title: RECYCLING METHOD FOR TREATING USED BATTERIES, IN PARTICULAR RECHARGEABLE BATTERIES,
AND BATTERY PROCESSING INSTALLATION

(54) Bezeichnung: RECYCLING-VERFAHREN ZUM BEHANDELN GEBRAUCHTER BATTERIEN, INSBESONDERE WIEDER
AUFLADBARER BATTERIEN UND BATTERIE-VERARBEITUNGSANLAGE



AA Battery systems
BB Disassembly
CC Dried battery fragments
DD Volatile electrolyte constituents
EE Clean process gas
12 Discharging
16.1 Battery modules/cells
22 Process gas (N₂, Ar, CO₂)
26 Electrolyte removal, moved under negative pressure, optionally heated
31 Drying gas containing volatile electrolyte constituents
34 Condenser / (activated carbon) adsorption
38 Container
42 Dried battery fragments
46 Packaging/container
50 Gas bottle

(57) Abstract: The invention relates to a method for treating used lithium batteries (10), having the following steps: comminuting the batteries (10) so that comminuted material (24) is obtained, and deactivating the comminuted material (24) by drying so that a deactivated comminuted material (42) is obtained. According to the invention, drying takes place at a pressure of at most 300 hPa and at most 80°C, and, after drying, the deactivated comminuted material (42) is not transferred to a transport container and/or further processed.

(57) Zusammenfassung: Die Erfindung betrifft ein Verfahren zum Behandeln gebrauchter Lithium- Batterien (10) mit den Schritten: Zerkleinern der Batterien (10), sodass Zerkleinerungsgut (24) erhalten wird, und Inaktivieren des Zerkleinerungsguts (24) durch Trocknen, sodass ein inaktiviertes Zerkleinerungsgut (42) erhalten wird. Erfindungsgemäß ist vorgesehen, dass das Trocknen bei einem Druck von höchstens 300 hPa und höchstens 80 °C erfolgt und das inaktivierte Zerkleinerungsgut (42) nach dem Trocknen nicht in einen Transportbehälter abgefüllt und/oder direkt weiterverarbeitet wird.

Fig. 1

WO 2018/073101 A1

SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Erklärungen gemäß Regel 4.17:

- *hinsichtlich der Berechtigung des Anmelders, ein Patent zu beantragen und zu erhalten (Regel 4.17 Ziffer ii)*
- *hinsichtlich der Berechtigung des Anmelders, die Priorität einer früheren Anmeldung zu beanspruchen (Regel 4.17 Ziffer iii)*

Veröffentlicht:

- *mit internationalem Recherchenbericht (Artikel 21 Absatz 3)*

Recycling-Verfahren zum Behandeln gebrauchter Batterien, insbesondere wieder aufladbarer Batterien und Batterie-Verarbeitungsanlage

Die Erfindung betrifft ein Verfahren zum Behandeln gebrauchter Batterien, insbesondere gebrauchter Lithium-Batterien, beispielsweise Lithium-Ionen-Batterien, mit den Schritten (a) Zerkleinern der Batterien, sodass Zerkleinerungsgut erhalten wird, und (b) Inaktivieren des Zerkleinerungsguts, sodass ein inaktiviertes Zerkleinerungsgut erhalten wird.

10 Gemäß einem zweiten Aspekt betrifft die Erfindung eine Batterie-Verarbeitungsanlage zum Behandeln gebrauchter Batterien, insbesondere zum Behandeln gebrauchter Lithium-Batterien, mit (a) einer Zerkleinerungseinheit zum Zerkleinern der Batterien, sodass Zerkleinerungsgut erhalten wird, und (b) einer Inaktivierungsvorrichtung zum Inaktivieren des Zerkleinerungsguts.

15

Aus der US 2005/0241943 A1 ist ein Verfahren zum Aufarbeiten gebrauchter Batterien bekannt, bei dem die Batterien vor einem Zerkleinerungsschritt erwärmt werden, sodass Kunststoffbestandteile der Batterien zerstört werden. Nachteilig an einem derartigen Vorgehen ist, dass die verbleibenden Komponenten der Batterien mit Abbauprodukten des Kunststoffs verunreinigt sein können.

20

Aus der DE 10 2012 024 876 A1 ist ein System zum Überführen transportkritischer Elektrolytzellen zunächst unter Inertgas zerkleinert und danach mit einem Desaktivierungspulver bestäubt werden, um eine Selbstentzündung des elektrochemisch aktiven Materials zu verhindern. Nachteilig daran ist, dass das entstehende Material dennoch ein vergleichsweise hohes Gefährdungspotential besitzt und dass das Bestäubungspulver selbst ein Expositionsrisiko darstellt und dass die Bildung einer entzündlichen und explosiven Atmosphäre in dem Transportbehälter nicht ausgeschlossen werden kann.

25

30 Aus der DE 10 2011 110 083 A1 ist ein Verfahren zum Wiedergewinnen von Ak-

tivmaterial aus einer galvanischen Zelle bekannt, bei dem die galvanischen Zellen zunächst mechanisch zerkleinert, dann vorgetrocknet und nachfolgend gesichtet werden. Schließlich wird der Binder in einem Ofen zersetzt. Eine derartige Vorrichtung eignet sich sehr gut zum effizienten Recyceln größerer Mengen von galvanischen Elementen. Für den Teillast-Betrieb ist diese Anlage jedoch vergleichsweise komplex aufgebaut. Es hat sich zudem gezeigt, dass sich hochtoxische fluororganische Verbindungen und Fluorwasserstoff bilden können, die nur mit großem Aufwand entsorgbar sind.

10 In der WO 2010/102377 A1 ist ein Verfahren beschrieben, bei dem die zu rezyklierenden Batterien, beispielsweise Lithium-Batterien, in einem Drehrohr ofen erhitzt und die entstehenden Gase abgesaugt werden. Nachteilig an diesem Verfahren ist, dass der Elektrolyt so nur schlecht wiederverwertet werden kann und große Mengen Fluorwasserstoff sowie fluororganische Verbindungen entstehen.

15 In der nachveröffentlichten Druckschrift WO 2016/174156 A1 ist ein Verfahren beschrieben, bei dem gebrauchte Batterien zunächst dezentral deaktiviert und in einen Transportbehälter abgefüllt werden. Nach Transport des zerkleinerten Materials zu einer zentralen Verarbeitungsstelle werden die deaktivierten Zellfragmente weiterverarbeitet.

25 Der Erfindung liegt die Aufgabe zugrunde, Nachteile im Stand der Technik zu vermindern.

Die Erfindung löst das Problem durch ein gattungsgemäßes Verfahren, bei dem das Trocknen bei einem Druck von höchstens 300 hPa, vorzugsweise zumindest zeitweise unter 50 hPa, und höchstens 80 °C erfolgt. Insbesondere erfolgt das Inaktivieren zumindest auch durch Trocknen des Zerkleinerungsguts. Gemäß einem zweiten Aspekt löst die Erfindung das Problem durch eine gattungsgemäße Batterie-Verarbeitungsanlage, bei der eine Vakuumanlage mit der Trockenvorrichtung zum Erzeugen eines Vakuums in der Trockenvorrichtung von zumindest 300 hPa verbunden ist und die Trockenvorrichtung zum Trocknen bei

einer Temperatur von höchstens 80 °C ausgebildet ist.

Vorteilhaft an der Erfindung ist, dass durch das Trocknen dem Zerkleinerungsgut so viel Elektrolyt entzogen werden kann, dass eine elektrochemische Reaktion
5 nicht mehr oder nur noch zu vernachlässigbar kleinem Ausmaß möglich ist. Zudem bildet sich keine entzündliche oder explosive Gasphase über den Batteriefragmenten, da diesen insbesondere die leichtsiedenden organischen Karbonate des Elektrolyten entzogen wurden. Das Zerkleinerungsgut ist daher weitgehend inert und kann, insbesondere dann, wenn es unter Vakuum verpackt wird, sicher
10 transportiert oder weiterverarbeitet werden.

Ein weiterer Vorteil ist es, dass zum Inaktivieren des Zerkleinerungsmaterials kein zusätzliches Material hinzugegeben werden muss. Das verringert den Aufwand beim Aufarbeiten der Batterien, verringert das Gewicht des inaktivierten
15 Zerkleinerungsguts und erhöht die Reinheit in den folgenden Trenn- und Recyclingschritten. Insbesondere in potentiell folgenden hydrometallurgischen Aufarbeitungsschritten ist eine hohe Produktreinheit ohne Eintrag von Fremdionen vorteilhaft.

20 Vorteilhaft ist zudem, dass die Bildung von Fluorophosphaten, Fluorwasserstoff, Kohlenstoffmonoxid, polyfluorierten Dibenzodioxinen und Dibenzofuranen, Stickoxiden, Carbonylfluorid und/oder Cyanwasserstoff in relevanter Menge ausgeschlossen werden kann. Fluorophosphate sind oft starke Nervengifte, deren Bildung sicher verhindert werden muss. Zudem ist sichergestellt, dass es
25 aufgrund des geringen Elektrolytgehalts nicht zu einer durch eine elektrochemische Reaktion ausgelöste, selbstverstärkend fortschreitende Wärmeentwicklung kommen kann. Es hat sich herausgestellt, dass sich Fluorwasserstoff und Fluorophosphate bereits bei vergleichsweise niedrigen Temperaturen von über 80°C in signifikanter Menge bilden können.

30 Vorteilhaft ist zudem, dass das Entfernen des Elektrolyten mit geringem Energieaufwand möglich ist. Zudem kann der Elektrolyt weitgehend wiederverwertet werden.

Das gemäß einer bevorzugten Ausführungsform vorgesehene Kondensieren des verdampften Elektrolyten führt zudem zu einer emissionsarmen Wiederverwertung von Lithium-Batterien.

5

Mit der erfindungsgemäßen Batterie-Verarbeitungsanlage sind stofflichen Recyclingquoten von über 80% erreichbar, was mit bisherigen Anlagen nicht erreichbar ist.

- 10 Im Rahmen der vorliegenden Beschreibung wird unter dem Trocknen insbesondere das Entfernen zumindest eines Lösungsmittels des Leitsalzes verstanden. Insbesondere wird das Trocknen so durchgeführt, dass Kohlensäuredimethylester und/oder Kohlensäureethylmethylester zu zumindest 90 Gewichtsprozent entfernt wird.

15

Unter einer Lithium-Batterie wird insbesondere ein Akkumulator verstanden, bei dem die elektrochemische Reaktion Lithium und/oder Lithium-Ionen und/oder eine Lithium-Verbindung involviert.

- 20 Unter einer Batterie-Verarbeitungsanlage wird insbesondere auch eine Akku-Verarbeitungsanlage zum Verarbeiten von Akkumulatoren verstanden.

- Unter dem Transportbehälter wird insbesondere auch eine oder eine Transportverpackung verstanden. Vorzugsweise wird die Transportverpackung durch Vakuumverschweißung verschlossen. Gut geeignet als Transportverpackung ist insbesondere Aluminium-Verbundfolie.
- 25

- Unter der Zerkleinerungseinheit wird insbesondere eine Vorrichtung verstanden, die beim Betrieb die Batterien zerkleinert. Beispielsweise ist die Zerkleinerungseinheit (i) eine Druckzerkleinerungseinheit, bei der die Batterien zwischen zwei Werkzeugflächen zerdrückt werden, (ii) eine Schlagzerkleinerungseinheit, bei der die Batterien auf einer Werkzeugfläche aufliegen und durch Schlag mit einem zweiten beweglichen Werkzeug zertrümmert werden, (iii) eine Scherzerklei-
- 30

nerungseinheit, bei der die Batterien durch zwei sich gegensätzlich bewegende Werkzeugflächen zerkleinert werden, (iv) eine Schneidzerkleinerungseinheit, bei der die Batterien mittels zwei Schneiden in zwei Teile geschnitten werden und/oder (v) eine Prallzerkleinerung, bei der die Batterien gegen eine Wand geworfen werden, gegen ein bewegtes Werkzeug prallen oder zwei Partikel gegeneinander stoßen. Selbstverständlich kann die Zerkleinerungseinheit auch durch zwei oder mehr der genannten Zerkleinerungsmechanismen wirken. Die Zerkleinerungseinheit ist gemäß einer bevorzugten Ausführungsform Teil einer Zerkleinerungsvorrichtung, die einen Behälter aufweist, in der die Zerkleinerungseinheit angeordnet ist.

Die angegebenen Temperaturen und Drücke beziehen sich stets auf die Temperatur der Atmosphäre in der jeweiligen Vorrichtung. So ist unter dem Merkmal, dass das Trocknen bei einem Druck von höchstens 300 hPa und höchstens 80 °C erfolgt, insbesondere zu verstehen, dass die Temperatur in der Atmosphäre des Trockners höchstens 80°C beträgt. Dass die Temperatur lokal höher sein kann, ist irrelevant.

Günstig ist, wenn das Trocknen nach dem Zerkleinern der Batterien erfolgt. Zwar ist es möglich und stellt eine Ausführungsform der Erfindung dar, dass die Batterien im unzerkleinerten Zustand einem Vakuum ausgesetzt werden, sodass zumindest Teile des Elektrolyten verdampfen, wobei das entstehende Gas entweder durch ein Sicherheitsventil im Akkumulator entweicht oder die Batterie durch die Druckdifferenz zwischen der äußeren Umgebung und dem Innendruck zerstört wird, sodass verdampfender Elektrolyt austreten kann. Da der Elektrolyt zumeist zwischen eng gewickelten oder gestapelten und verpressten Schichten aus Elektroden und Separator und in deren Poren vorliegt und mit anderen Bestandteilen der Batterien verbunden vorliegt, kann dieses Vorgehen jedoch zeitintensiv sein. Es ist daher oft günstiger und stellt eine bevorzugte Ausführungsform der Erfindung dar, dass die Batterien mechanisch zerkleinert werden, beispielsweise durch Schneiden, Scheren, Pralleinwirkung, Zertrennen und/oder Quetschen. So steht für den Stoffübergang in die Gasphase eine größere Grenzfläche zur Verfügung.

Vorzugsweise erfolgt das Trocknen während zumindest 50% der Trockenzeit bei einem Druck von höchstens 30 hPa. Alternativ oder zusätzlich beträgt ein Minimaldruck beim Trocknen höchstens 50 hPa. So wird ein sehr hoher Anteil des

5 Elektrolyten entfernt. Unter dem Minimaldruck ist insbesondere der kleinste Atmosphärendruck in der Trockenvorrichtung zu verstehen, der für zumindest eine Minute herrscht.

Es ist gemäß einer bevorzugten Ausführungsform zudem möglich, dass das

10 Trocknen simultan mit dem Zerkleinern erfolgt. In anderen Worten wird an eine Zerkleinerungsvorrichtung, in der die Batterien zerkleinert werden, ein Vakuum mit einem Druck von höchstens 300 hPa angelegt. Vorteilhaft hieran ist, dass die beim Zerkleinern eingebrachte mechanische Energie das Verdampfen des Elektrolyten unterstützt. Es ist daher entbehrlich, zusätzliche Heizenergie zum Ver-

15 dampfen des Elektrolyten in das Zerkleinerungsgut einzubringen (obwohl dies möglich und von der Erfindung umfasst ist). Außerdem ist es entbehrlich, das Zerkleinerungsgut beim Zerkleinern zu kühlen (obwohl dies möglich und von der Erfindung umfasst ist). Die Zerkleinerungseinheit bewirkt zudem ein Umwälzen des Zerkleinerungsguts, was das Trocknen beschleunigt.

20 Günstig ist es, wenn das Trocknen unter Rühren und/oder Umwälzen des Zerkleinerungsguts erfolgt. So werden die galvanischen Elemente aus Anode, Separator und Kathode voneinander getrennt. Eine Behinderung der Verdampfung durch zusammenklebende Folien wird verhindert. Es wird mechanische Energie

25 zur Trennung von Stromsammelrfolie und Beschichtung eingebracht und die resultierende Reibungswärme führt dem System die Verdampfungswärme zu.

Vor dem Zerkleinern werden die gebrauchten Batterien vorzugsweise demontiert. Das heißt, dass größere Batteriesysteme in ihre kleineren Unterbausteine,

30 die Module oder Stacks, demontiert werden oder sogar die Zellen, die das elektrochemisch wirksame Material enthalten, von der Ansteuerelektronik getrennt werden. Die Ansteuerelektronik umfasst beispielsweise Halbleiterbauelemente und/oder Sensoren und dient der Ladesteuerung der Batterien.

Das Trocknen erfolgt unter Vakuum. Gemäß seiner breitesten Form löst die Erfindung das Problem durch ein gattungsgemäßes Verfahren, bei dem das Vakuum so groß gewählt ist, dass der Dampfdruck von Kohlensäuredimethylester bei 5 80°C, insbesondere bei 70°C, unterschritten wird. Besonders günstig ist es jedoch, wenn das Trocknen unter einem Druck von höchstens 300 hPa, insbesondere höchstens 100 hPa erfolgt. Bei so niedrigen Drücken verdampfen wesentliche Bestandteile der meisten Elektrolyten, insbesondere Kohlensäuredimethylester und Kohlensäureethylmethylester, bereits bei Temperaturen von weniger als 80°C. Niedrige Temperaturen haben den Vorteil, dass die Bildung von 10 Fluorwasserstoff und fluororganischen Verbindungen behindert wird. Beides stellt eine potentielle Gefährdung für die Batterie-Verarbeitungsanlage sowie die Umgebung dar. Es ist daher günstig, deren Entstehen zu verhindern.

15 Vorzugsweise erfolgt das Trocknen bei einer Temperatur, die unterhalb einer Zersetzungstemperatur liegt. Unter der Zersetzungstemperatur wird insbesondere die kleinste Temperatur verstanden, für die gilt, dass nach dem Halten des Zerkleinerungsguts auf dieser Temperatur für eine Stunde zumindest 80 Masseprozent des Binders der Lithium-Batterien sich in gasförmige Bestandteile 20 zersetzt haben. Die Zersetzungstemperatur kann damit gemessen werden, indem die Temperatur des Zerkleinerungsguts sukzessive erhöht wird und erfasst wird, wann es zu einem Masseverlust, insbesondere durch Gasentwicklung aufgrund einer Zersetzung des Binders, kommt und das angegebene Kriterium erfüllt ist. Gegebenenfalls muss der Versuch mit jeweils einer neuen Probe an Zerkleinerungsgut bei jeweils erhöhter Temperatur mehrfach durchgeführt werden. 25

Gemäß einer bevorzugten Ausführungsform umfasst das Verfahren das Kondensieren der beim Trocknen der entstandenen Gase. Das erfolgt vorzugsweise bei Umgebungsdruck, wobei eine Abweichung von ± 50 hPa möglich ist. Günstig ist 30 es, wenn die Temperatur beim Kondensieren zumindest 0°C beträgt. Das vermindert die aufzuwendende Kühlleistung und verhindert Eisbildung. Vorzugsweise beträgt die Kühlleistung zumindest 4 Kilowatt und höchstens 40 Kilowatt bezogen auf eine Tonne pro Stunde verarbeiteter Batterien. Alternativ ist die Tem-

peratur beim Kondensieren kleiner als 0°C, sodass der Atmosphäre Wasser durch Bildung von Eis entzogen wird. Es ist möglich, dass der Kondensator zwei oder mehr Zonen unterschiedlicher Temperatur hat. Vorzugsweise ist die Temperatur in einer der beiden Zonen dann so hoch, dass es zu keiner Eisbildung
5 kommt, und in einer anderen Zone so niedrig, dass Wasser als Eis abgeschieden wird.

Günstig ist es, wenn die Temperatur beim Kondensieren höchstens 50°C, vorzugsweise höchstens 30°C, insbesondere höchstens 20°C, beträgt. Auf diese
10 Weise werden die organischen Karbonate der Batterien fast vollständig zurückgewonnen. Es entstehen zudem kaum Abgase und der Energieaufwand für das Kondensieren ist klein.

Das Zerkleinern der Batterien wird vorzugsweise so durchgeführt, dass zumindest 90 Gew.-% der Bestandteile des Zerkleinerungsguts ein Siebmaß von
15 höchstens 50 mm, insbesondere höchstens 30 mm, vorzugsweise höchstens 20 mm, haben. Hierunter ist zu verstehen, dass 90 Gew.-% der Bestandteile durch ein Sieb fallen, das eine Maschenweite von 50 mm (bzw. die jeweils andere angegebene Weite) hat. Durch eine solche Zerkleinerung werden Mikrokurzschlüsse
20 vermieden und so die Sicherheit des Transports, der Lagerung und der weiteren Verarbeitung erhöht.

Günstig ist es, wenn das Trocknen unter einer Atmosphäre erfolgt, in der der Wasser-Partialdruck kleiner ist als 50 Pa, insbesondere kleiner als 10 Pa. Ein
25 geringer Wasser-Partialdruck führt zu einer geringen Reaktionsrate von Lithium-Verbindungen zu Lithium-Hydroxid und damit zu nur geringer Wasserstoff-Entwicklung. Das verhindert die Bildung von zündfähigen Wasserstoff-Sauerstoff-Gemischen und trägt zur Anlagensicherheit bei.

Günstig ist es zudem, wenn der Sauerstoff-Partialdruck beim Trocknen höchstens 30 Millibar, insbesondere höchstens 10 Millibar beträgt. Die Reaktion von Sauerstoff mit oxidierbaren Bestandteilen der Batterien wird so weitgehend unterdrückt. Es ist möglich, den niedrigen Sauerstoff-Partialdruck durch einen ge-

ringen Druck beim Trocknen zu erreichen. Alternativ oder zusätzlich kann das Trocknen in einer Inertgas-Atmosphäre erfolgen.

Gemäß einer bevorzugten Ausführungsform umfasst das Verfahren die Schritte
5 eines kontinuierlichen Erfassens einer Wasserdampfkonzentration beim Zerkleinern und/oder beim Trocknen und eines Verringerns der Wasserdampfkonzentration, wenn ein vorgegebener Schwellenwert überschritten wird. Unter der Wasserdampfkonzentration wird insbesondere ein Anteil an Wasserdampf bezogen auf die Gesamtheit der Bestandteile der Atmosphäre verstanden. Insbesondere wird unter der Wasserdampfkonzentration auch ein Wasserdampf-Partialdruck verstanden. Das Verringern der Wasserdampfkonzentration kann beispielsweise ein Vermindern des Drucks und/oder ein Zuführen von Inertgas umfassen. Der Schwellenwert für die Wasserdampfkonzentration ist vorzugsweise
10 so gewählt, dass unterhalb des Schwellenwerts eine Bildung nennenswerter Mengen von Fluorwasserstoff durch Zersetzung des Leitsalzes, bspw. LiPF_6 , sowie eine Reduktion des Wassers mit metallischem Lithium in nennenswertem Ausmaß unmöglich ist. Diese Kriterien sind bei einem Taupunkt von -40°C erfüllt. Es ist möglich, nicht aber notwendig, dass die Wasserdampfkonzentration direkt gemessen wird, beispielsweise per Spektroskopie, insbesondere Infrarot-
15 Spektroskopie. Es ist beispielsweise auch möglich, dass die Summe der Konzentrationen an Inertgas, Sauerstoff und organischen Verbindungen ermittelt und angenommen wird, dass der Rest aus Wasserdampf besteht.

Gemäß einer bevorzugten Ausführungsform umfasst das Verfahren die Schritte
25 eines kontinuierlichen Erfassens einer Sauerstoffkonzentration beim Zerkleinern und/oder beim Trocknen und eines Verringerns der Sauerstoffkonzentration, wenn ein vorgegebener Schwellenwert überschritten wird. Unter der Sauerstoffkonzentration wird insbesondere ein Anteil an Sauerstoff bezogen auf die Gesamtheit der Bestandteile der Atmosphäre verstanden. Insbesondere wird unter
30 der Sauerstoffkonzentration auch ein Sauerstoff-Partialdruck verstanden. Das Verringern der Sauerstoffkonzentration kann beispielsweise ein Vermindern des Drucks und/oder ein Zuführen von Inertgas umfassen. Der Schwellenwert für die Sauerstoffkonzentration ist vorzugsweise so gewählt, dass unterhalb des

- Schwellenwerts eine Explosion unmöglich ist. Es ist möglich, nicht aber notwendig, dass die Sauerstoffkonzentration direkt gemessen wird, beispielsweise per Nernst-Sonde, Lamda-Sonde, mit paramagnetischen Sensoren oder mit einer Widerstandssonde. Es ist beispielsweise auch möglich, dass die Konzentrationen des Sauerstoffs durch die Messung von in Luft mit Sauerstoff vergesellschafteten Gasen, wie bspw. Kohlenstoffdioxid, zu bestimmen, indem angenommen wird, dass Sauerstoff im gleichen Mischungsverhältnis zum gemessenen Gas wie in der Luft vorliegt,
- 5
- 10 Insbesondere umfasst das Verfahren die Schritte (i) beim Trocknen kontinuierliches Überwachen einer Konzentration an organischen Karbonaten in der Atmosphäre der Trockenvorrichtung und (ii) Beenden des Trocknens erst dann, wenn eine untere Explosionsgrenze unterschritten ist. Die untere Explosionsgrenze ist die Konzentration an organischen Bestandteilen, für die gilt, dass nach Füllen
- 15 des Zerkleinerungsguts in einen Behälter in Luft bei 23°C unter 1013 hPa und 80%-Luftfeuchte eine Zündung zu keiner Explosion führt, wohl aber eine höhere Konzentration. Ist diese untere Explosionsgrenze noch nicht unterschritten, wird das Trocknen fortgesetzt.
- 20 Die Konzentration an Inertgas wird vorzugsweise auf zumindest 90 Gew.-%, insbesondere zumindest 95 Gew.-%, vorzugsweise zumindest 97 Gew.-% eingestellt. Die Messung der Konzentration erfolgt beispielsweise spektroskopisch.
- Alternativ oder zusätzlich wird ein Fortschrittsparameter erfasst, der den Fortschritt des Trocknens beschreibt, und das Trocknen wird beendet, wenn der
- 25 Fortschrittsparameter einen vorgegebenen Fortschrittsparameter-Schwellenwert erreicht. Der Fortschrittsparameter ist zu Beginn des Trocknens klein und wächst mit Fortschreiten des Trocknens. Äquivalent dazu ist der Fall, dass der Fortschrittsparameter zu Beginn des Trocknens groß ist und mit Fortschreiten des
- 30 Trocknens abnimmt.

Beispielsweise ist der Fortschrittsparameter die Konzentration an gasförmigem Elektrolyten im abgesaugten Gas. Es ist möglich, nicht aber notwendig, dass da-

zu die Konzentration an gasförmigem Elektrolyten, insbesondere organischen Karbonaten, direkt gemessen wird, beispielsweise per Spektroskopie, insbesondere Infrarot-Spektroskopie. Es ist alternativ oder zusätzlich möglich, dass der Fortschrittsparameter der Kondensat-Strom (gemessen beispielsweise in Volumen, Masse, Gewicht oder Stoffmenge pro Zeiteinheit) an kondensierten Gasbestandteilen in einem etwaig vorhandenen Kondensator ist. Wiederum alternativ ist der Fortschrittsparameter der Druck im Trocknungsbehälter oder der Gasstrom aus dem Trocknungsbehälter. Bei konstanter Pumpleistung hängt der Druck in guter Näherung nur von dem Trocknungsfortschritt und der Temperatur des Zerkleinerungsguts ab. Ist der Elektrolyt weitgehend verdampft, sinkt der Druck. Zudem sinkt der Gasstrom.

Gemäß einer bevorzugten Ausführungsform wird das Zerkleinerungsgut nach dem Trocknen direkt weiterverarbeitet. Insbesondere wird das Zerkleinerungsgut nach dem Trocknen nicht in einen Transportbehälter abgefüllt.. Insbesondere wird das Zerkleinerungsgut nach dem Trocknen mittels einem kontinuierlich oder diskontinuierlich förderndem Förderer zur weiteren Verarbeitung, beispielsweise einer Trennvorrichtung, transportiert. Insbesondere ist der Förderer staubdicht mit dem Trockner verbunden. Beispiele für kontinuierlich fördernde Förderer sind staubdichte Rohrkettenförderer, vorzugsweise mit zwei regelbaren Auslass-Schiebern, Förderbänder, Fördertröge, Förderschnecken, Becherförderer oder semi-kontinuierliche Förderer.

Bevorzugt ist ein Verfahren, bei dem das Trocknen des Zerkleinerungsguts erst beendet wird, wenn sich nach Beenden des Trocknens kein entzündliches oder explosives Gasgemisch über dem abgefüllten Zerkleinerungsgut mehr bilden kann und/oder wenn das Zerkleinerungsgut so trocken ist, dass sich im Transportbehälter oder während der Weiterverarbeitung ein entzündliches oder explosives Gasgemisch ergeben kann. Unter dem Merkmal, dass das Trocknen beendet wird, wenn sich nach Beenden des Trocknens kein entzündliches oder explosives Gasgemisch über dem abgefüllten Zerkleinerungsgut bilden kann, wird insbesondere verstanden, dass sich in einem Transportbehälter in Form eines 50-Literbehälter, der zur Hälfte (bezogen auf sein Volumen) mit dem Zerkleiner-

5 rungsgut gefüllt ist, innerhalb von einer Woche bei 50°C und 1013 hPa kein zündfähiges Gasgemisch bildet. Ob das Kriterium erfüllt ist, wird in Vorversuchen ermittelt. Bildet sich ein zündfähiges Gasgemisch, muss das Trocknen länger und/oder bei niedrigerem Druck durchgeführt werden. Die Vorversuche werden so lange wiederholt, bis eine Trocknungsdauer und/oder ein Trocknungsdruck ermittelt ist, bei der das Merkmal bei einem Testsatz von drei Transportbehälter für alle drei Transportbehälter erfüllt ist.

10 Vorzugsweise wird das Zerkleinerungsgut so lange getrocknet, bis ein Elektrolytgehalt im Zerkleinerungsgut so klein ist, dass eine elektrochemische Reaktion unmöglich ist. In anderen Worten ist der Elektrolytgehalt kleiner als ein Schwellenwert, wobei der Schwellenwert so gewählt ist, dass die Zellspannung bei Unterschreiten dieses Schwellenwerts auf höchstens ein Viertel abgesunken ist. Dieser Schwellenwert wird beispielsweise dadurch bestimmt, dass die Zellen-
15 spannung einer Batterie in Abhängigkeit vom Elektrolytgehalt bestimmt wird. Kurz vor dem Erreichen des Schwellenwerts bricht die Zellspannung zusammen, das heißt, dass sie um zumindest 75% absinkt. Ist der Schwellenwert unterschritten, enthält die Batterie so wenig Elektrolyt, dass in guter Näherung keine elektrochemische Reaktion mehr möglich ist.

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Vorzugsweise wird das Zerkleinerungsgut so lange getrocknet, dass eine Menge von 50 kg an Zerkleinerungsmaterial, das kompaktiert in einem 50 Liter-Fass enthalten ist, keine oder eine nur so geringe Wärmeentwicklung zeigt, dass ein thermisches Durchgehen, also eine thermisch induzierte Kettenreaktion, für zu-
25 mindest zwei Monate ausgeschlossen ist und dass eine etwaige Gasentwicklung zudem so gering ausgebildet ist, dass nach zwei Wochen kein Überdruck entsteht, wenn zu Beginn ein Unterdruck von 500 hPa herrscht.

Günstig ist es, wenn das Zerkleinerungsgut so lange getrocknet wird, bis der
30 Elektrolytgehalt an organischen Komponenten, die bei 50°C flüchtig sind, höchstens 3 Gew.-%, höchstens insbesondere 2 Gew.-%, besonders bevorzugt höchstens 1,5 Gew.-%, beträgt.

Vorzugsweise wird das Trocknen so lange durchgeführt, dass der akkumulierte Gehalt an organischen Karbonaten aus dem Elektrolyten, die bei 80°C flüchtig sind, in der Atmosphäre über dem Zerkleinerungsgut 3 Vol.-% unterschreitet.

- 5 Insbesondere wird das Trocknen so lange durchgeführt, bis der Gehalt an Kohlendisäuredimethylester 4 Vol.-%, insbesondere 3 Vol.-%, unterschreitet und/oder der Gehalt an Cyclohexylbenzol 1 Vol.-%, insbesondere 0,5 Vol.-%, unterschreitet.
- 10 Vorzugsweise erfolgt das Trocknen unmittelbar nach dem Zerkleinern. Hierunter wird insbesondere verstanden, dass zwischen dem Beginn des Zerkleinerns der Batterien und dem Zeitpunkt, zu dem zumindest ein Teil des dadurch entstandenen Zerkleinerungsguts anfängt zu Trocknen, höchstens fünf Minuten beträgt, insbesondere höchstens eine Minute. Durch die schnelle Trocknung nach dem
- 15 Zerkleinern wird die Masse an Material klein gehalten, die potentiell elektrochemisch reagieren könnte, zudem wird die elektrochemische Reaktionszeit potentieller exothermer Reaktionen klein gehalten. Das senkt das Risiko für die Anlage und die Umgebung.
- 20 Gemäß einer bevorzugten Ausführungsform wird das Zerkleinerungsgut in der Trockenvorrichtung, insbesondere beim Entnehmen aus der Trockenvorrichtung, mittels eines Rührwerks bewegt. Bei dem Rührwerk kann es sich um die Zerkleinerungseinheit handeln, das ist aber nicht notwendig. Das Rührwerk dient insbesondere zum Verhindern von Verstopfungen und/oder zum Eintrag von Wärme-
- 25 energie in das Zerkleinerungsgut und/oder der Trennung der geschichteten Folien, so dass die Elektrolytverdampfung nicht sterisch behindert wird. Zudem bewirkt der mechanische Energieeintrag eine zumindest teilweise Ablösung der Beschichtung von den Stromsammelrfolien. Dadurch entsteht weitere freie Oberfläche der Beschichtungsfragmente, welche die Trocknung begünstigt und die
- 30 folgende Trennung von Beschichtung und Folien erleichtert. Vorzugsweise hat das Rührwerk eine Leistung von zumindest 1 kW pro Kubikmeter Trocknervolumen. Günstig ist es, wenn das Rührwerk zumindest ein Rührblatt aufweist, das so angeordnet ist, dass es das Zerkleinerungsgut nach oben bewegt.

Vorzugsweise wird mittels des Rührwerks mehr als 35%, insbesondere zumindest 50%, einer zum Trocknen des Zerkleinerungsguts notwendigen Verdampfungswärme zugeführt. In anderen Worten ist im Idealfall eine zusätzliche
5 Heizung zum Beheizen des Zerkleinerungsguts entbehrlich. Ist eine solche Heizung vorhanden, ist ihre Leistung vorzugsweise kleiner als die Leistung des Rührwerks. Das Einbringen von Energie in das Zerkleinerungsgut per Rührwerk hat den Vorteil, dass es zu einem Trennen beispielsweise von Beschichtung und Trägerfolie und anderen Komponenten der Batterie kommt.

10

Das Rührwerk hat vorzugsweise eine Leistung von zumindest 1 Kilowatt pro Kubikmeter an Volumen der Trockenvorrichtung.

Vorzugsweise besitzt die Trockenvorrichtung eine Heizung, die welche die Wärme aus der Wärmeabfuhr der zumindest einen Vakuumpumpe und/oder des
15 Kondensators bezieht. Durch das Kondensieren des Elektrolyten im Kondensator entsteht Kondensationswärme. Im Kondensator kann daher eine Temperatur von zumindest 60°C herrschen. Die Wärme wird beispielsweise mittels eines Wärmeübertragungsfluids, insbesondere eines Gases oder einer Flüssigkeit,
20 übertragen. Beispielsweise wird das Wärmeübertragungsfluids zum Heizen einer Außenwand der Trockenvorrichtung verwendet.

Ein unabhängiger Gegenstand der vorliegenden Erfindung ist ein Verfahren zum Behandeln gebrauchter Lithium-Batterien mit den Schritten (a) Zerkleinern
25 der Batterien, sodass Zerkleinerungsgut erhalten wird, und (b) Trocknen des Zerkleinerungsguts, sodass Elektrolyt der Batterie verdampft, wobei (c) die zum Verdampfungswärme zu zumindest 50% mittels mechanischer Energie in das Zerkleinerungsgut eingebracht wird. Insbesondere wird die mechanische Energie mittels einer Zerkleinerungseinheit und/oder eines Rührwerks in das Zerkleinerungsgut eingebracht. Besonders günstig ist es, wenn das das Trocknen bei einem Druck von höchstens 300 hPa und höchstens 80 °C erfolgt, das ist aber
30 nicht notwendig. Die in der Beschreibung genannten bevorzugten Ausführungsformen beziehen sich auch auf diesen Aspekt der Erfindung.

Vorzugsweise wird das Zerkleinern und das Trocknen in nur einem Behälter, insbesondere der Zerkleinerungsvorrichtung, durchgeführt. In anderen Worten finden das Zerkleinern und das Trocknen im Unterdruck gleichzeitig in einem Behälter statt. Vorteilhaft hieran ist, dass die mechanische Energie, die zum Zerkleinern zugeführt wird und in Wärmeenergie umgewandelt wird, beim Verdampfen des Elektrolyten aufgenommen und so abgeführt wird. So wird einerseits eine übermäßige Erwärmung des Zerkleinerungsguts verhindert, andererseits ist eine Heizung zum Trocknen entbehrlich.

10

Besonders günstig ist es, wenn das Vakuum von einem Absolutdruck von höchstens 300 hPa mittels einer Strahlpumpe erzeugt wird. Strahlpumpen sind, insbesondere bei geeigneter Wahl des Strahlmediums, weitgehend unempfindlich gegen aggressive abzapfende Gase. Günstig ist es, wenn das Strahlmedium, das eine Flüssigkeit ist, einen pH-Wert von zumindest 8, insbesondere von zumindest 9, beispielsweise zumindest 12, hat. In diesem Fall können sich unerwünschte Bestandteile des Gases, das abgepumpt wird, zersetzen oder zu weniger schädlichen Substanzen reagieren. So kann beispielsweise Kohlensäuredimethylester und/oder Kohlensäureethylmethylester durch eine Verseifungsreaktion abgebaut werden. Etwaig im Strahlmedium enthaltener Fluorwasserstoff kann im basischen Milieu in einer Säure-Base-Reaktion zu einem ungefährlichen Salz umgesetzt werden.

Vorzugsweise enthält das Strahlmedium eine Fluor fällende Substanz. Beispielsweise kann das Strahlmedium Natriumkarbonat, Kaliumkarbonat oder Calciumkarbonat enthalten. Die bei der Reaktion mit einer Fluorverbindung, insbesondere Fluorwasserstoff, entstehenden Salze werden vorzugsweise abgetrennt, insbesondere abgefiltert oder aussedimentiert. Auf diese Weise wird zumindest weitgehend verhindert, dass Fluorwasserstoff oder andere giftige fluorhaltige Verbindungen in die Umgebung abgegeben werden können.

Vorzugsweise erfolgt das Trocknen bei einer Temperatur von höchstens 80°C. In diesem Fall entsteht kaum Fluorwasserstoff. Das erhöht die Lebensdauer der

Batterie-Verarbeitungsanlage und verringert die Umweltgefährdung.

Gemäß einer bevorzugten Ausführungsform umfasst das Verfahren die Schritte des Kondensierens von Bestandteilen des Elektrolyten durch Abkühlen und/oder Druckerhöhen, sodass ein Elektrolytkondensat entsteht. Beispielsweise wird das Kondensieren an einer Stelle durchgeführt, die bezüglich des Gasflusses zwischen dem Trockner und der Vakuumpumpe liegt. Vom Trockner kommende Gase müssen daher in diesem Fall zunächst einen Kondensator passieren, bevor sie zur Vakuumpumpe gelangen können. Das führt dazu, dass gasförmiger Elektrolyt, der in dem Gas vorliegt, das beim Trocknen entsteht, zumindest zu einem überwiegenden Teil im Kondensator abgeschieden wird, bevor das verbleibende Gas zur Pumpe gelangt. So kann Elektrolyt zurückgewonnen werden. Zudem verringert sich der Gasstrom durch die Vakuumpumpe, was deren Lebensdauer verlängert und deren Energieverbrauch reduziert.

15
Gemäß einer bevorzugten Ausführungsform umfasst das Verfahren alternativ den Schritt der Gasreinigung durch Adsorption der flüchtigen organischen Bestandteile an einem Aktivkohlefilter vor oder nach der Verdichtereinheit.

20
Vorzugsweise umfasst das erfindungsgemäße Verfahren alternativ oder zusätzlich den Schritt eines Reinigens des Gases, das beim Trocknen entsteht, bevor dieses die Vakuumpumpe erreicht. Das kann beispielsweise auch dadurch erfolgen, dass das Gas einen Aktivkohlefilter und/oder einen Filter passiert, in dem mit Fluorwasserstoff reagierende Substanzen enthalten sind, beispielsweise ein

25
Calziumsalz wie Calziumkarbonat oder ein Kaliumsalz wie Kaliumkarbonat.

Vorzugsweise wird das Hochtemperatur-Trocknen, bei dem sich der Binder zersetzt, so durchgeführt, dass die entstehenden Zersetzungsgase sich nicht mit den Gasen mischen, die beim Niedrigtemperatur-Trocknen entstehen. Es ist

30
möglich, dass das Hochtemperatur-Trocknen und das Niedertemperatur-Trocknen bei unterschiedlichen Drücken erfolgt. Beispielsweise kann das Hochtemperatur-Trocknen bei Normaldruck erfolgen.

Unter dem Aktivmaterial wird der Stoff verstanden, der beim Betrieb der Batterien elektrochemisch reagiert. Unter dem Träger für das Aktivmaterial wird insbesondere eine Trägerfolie verstanden, auf der das Aktivmaterial in Form von Partikeln aufgebracht ist. Beispielsweise handelt es sich bei der Trägerfolie um eine Folie aus Aluminium oder eine Aluminiumlegierung. Der Binder ist der Stoff, der das Aktivmaterial mit dem Träger verbindet, beispielsweise enthält der Binder Polyvinylidenfluorid.

Günstig ist es, wenn beim Zerkleinern der Batterien flüssiger Stickstoff zugegeben wird. Das kühlt die Zerkleinerungsmaschine und das Zerkleinerungsgut und verdrängt zudem Sauerstoff und Wasserdampf aus der Atmosphäre.

Günstig ist es, wenn das Zerkleinern bei dem Taupunkt - 40 °C und/oder einem Sauerstoff-Partialdruck von höchstens 40 hPa, insbesondere höchstens 15 hPa erfolgt.

Gemäß einer bevorzugten Ausführungsform umfasst das Verfahren die Schritte eines Abtrennens von Hartteilen und/oder eines Separierens von Aktivmaterial vom Träger, insbesondere durch eine zweite Zerkleinerungsstufe und/oder Luftstrahlsieben, sodass eine Aktivmaterialfraktion und eine Trägerfraktion entstehen, und eines getrennten Verpackens von Aktivmaterialfraktion und Trägerfraktion in jeweilige Transportbehältnisse. Günstig ist es, wenn diese Transportbehältnisse luftdicht ausgebildet sind. Durch das Trennen von Aktivmaterialfraktion und Trägerfraktion ist ein Transport in der Regel ohne Genehmigungen möglich. Ein weiterer Vorteil ist, dass derartig getrennte Fraktionen nur eine geringe Gefährdung darstellen.

Das Entnehmen des Zerkleinerungsguts aus dem Transportbehälter erfolgt vorzugsweise unter Vakuum und/oder unter Schutzgas.

Es ist möglich, nicht aber notwendig, dass das Zerkleinerungsgut unter Vakuum in den Transportbehälter abgefüllt wird. Günstig ist es, wenn der Transportbehälter ein Vakuumbehälter ist, insbesondere ein evakuierter Vakuum-

behälter, sodass im Transportbehälter nach dem Verschließen ein Unterdruck oder Vakuum herrscht. Alternativ kann der Transportbehälter mit einem Inertgas gefüllt werden.

- 5 Gemäß einer bevorzugten Ausführungsform wird das Verfahren so durchgeführt, dass ein Druck von 100 hPa für zumindest eine Minute unterschritten wird.

10 In einer bevorzugten Batterie-Verarbeitungsanlage sind die Trennungseinheit und die Trockenvorrichtung in einem gemeinsamen Standard-Container angeordnet. Das hat den Vorteil, dass die Batterie-Verarbeitungsanlage besonders einfach transportiert werden kann.

15 Die Trockenvorrichtung ist eingerichtet zum Trocknen des Zerkleinerungsguts für eine so lange Zeit, bis ein Elektrolytgehalt so klein ist, dass eine elektrochemische Reaktion unmöglich ist. Wird die Trockenvorrichtung im Chargenbetrieb betrieben, was eine mögliche Ausführungsform darstellt, so wird das Trocknen beispielsweise für eine vorgegebene Zeitspanne durchgeführt. Alternativ oder zusätzlich wird der Gehalt an organischen Substanzen, beispielsweise an organischen Carbonaten, in der Atmosphäre in der Trockenvorrichtung kontinuierlich gemessen und das Trocknen beendet, wenn eine vorgegebene Schwellen-Konzentration unterschritten wird.

25 Gemäß einer bevorzugten Ausführungsform umfasst die Batterie-Verarbeitungsanlage, insbesondere die Vakuumanlage, einen Kondensator, der eingerichtet ist zum Kondensieren von organischen Bestandteilen der Atmosphäre im Trockner, insbesondere von organischen Carbonaten, beispielsweise von Dimethylcarbonat, Ethylmethylcarbonat und/oder Ethylencarbonat. Der Kondensator kann auch als Kondensiervorrichtung oder als Verflüssiger bezeichnet werden. Vorzugsweise ist der Kondensator in Materialflussrichtung hinter einer Vakuumpumpe angeordnet, mittels der der Trockner evakuiert wird. Günstig ist es, wenn der Kondensator gekühlt ist, vorzugsweise auf eine Temperatur von höchstens 90°C, vorzugsweise höchstens 80°C, insbesondere höchstens 70°C. Um den Kühlaufwand klein zu halten wird der Kondensator, sofern er gekühlt wird, auf

eine Temperatur von zumindest -10°C, insbesondere zumindest 10 °C, gekühlt.

Günstig ist es, wenn die Trockenvorrichtung ein Rührwerk aufweist, beispielsweise einen Ankerrührer oder einen Stabrührer, dessen Rührstäbe quer zu einer
5 Rührwelle angebracht sein können. Alternativ oder zusätzlich ist das Rührwerk ein externes Rührwerk, das den Trockner als Ganzes bewegt.

Die Batterie-Verarbeitungsanlage besitzt eine Vakuumanlage, die mit der Trockenvorrichtung zum Erzeugen eines Vakuums in der Trockenvorrichtung verbunden ist. Besonders günstig ist es, wenn auch die Vakuumanlage im Standard-Container angeordnet ist. Bei dem Standard-Container handelt es sich vorzugsweise um einen Container nach ISO-Norm 668, vorzugsweise um einen 40-Fuß-Container oder einen 20-Fuß-Container.

15 Beispielweise umfasst die Vakuumanlage eine Strahlpumpe, bei der ein Strahlmedium zum Erzeugen des Unterdrucks verwendet wird.

Günstig ist es, wenn die Zerkleinerungseinheit in der Trockenvorrichtung angeordnet ist. Es existiert in anderen Worten in diesem Fall ein Behälter, in dem die
20 Batterien sowohl zerkleinert werden und in dem das Zerkleinerungsgut getrocknet wird. Beide Prozesse laufen simultan und unter Vakuum ab. In diesem Fall ist ein Rührwerk entbehrlich.

Vorzugsweise umfasst die Batterie-Verarbeitungsanlage eine Hartmetallabtrennvorrichtung und/oder eine Leichtfraktionabtrennvorrichtung, eine Separiervorrichtung, insbesondere eine Klassiervorrichtung, zum Separieren von Aktivmaterial vom Träger, insbesondere durch eine zweite Zerkleinerungsstufe und/oder Luftstrahlsieben, sodass eine Aktivmaterialfraktion und eine Trägerfraktion entsteht, und vorzugsweise eine zweite Abfüllvorrichtung zum getrennten Abfüllen von Aktivmaterialfraktion und Trägerfraktion. Günstig ist es, wenn diese Abfüllvorrichtung zum Abfüllen unter Unterdruck und/oder unter Inertgas mindestens jedoch
30 staubdicht ausgebildet ist.

Unter einer Hartmetallabtrennvorrichtung wird insbesondere eine Vorrichtung zur Abtrennung von Fragmenten peripherer Bestandteile des Betriebssystems, der Batteriezellhülle und der Strom-Kontakte verstanden. Beispielsweise umfasst die Hartmetallabtrennvorrichtung eine Magnetseparationsvorrichtung und/oder einen
5 Sieb, insbesondere einen Querstromsieb und/oder einen Zickzack-Sieb. Unter der Separiervorrichtung wird insbesondere eine Vorrichtung zum zur Abtrennen der Separatorfolie verstanden.

Die Leichtfraktionabtrennvorrichtung umfasst vorzugsweise einen Zickzack-
10 Sieb und/oder einen Lufttrenner, wobei es günstig ist, wenn die Luft im Kreislauf geführt wird. Das reduziert die Staubexposition der Umwelt mit gesundheitsschädlichem Staub.

Vorzugsweise sind die zweite Abfüllvorrichtung und die Separiervorrichtungen in
15 einem gemeinsamen Standard-Container angeordnet, beispielsweise im oben beschriebenen ersten Standard-Container, oder einem zweiten Standard-Container. Günstig ist es, wenn der Container staubdicht gekapselt ist.

Vorzugsweise umfasst die Batterie-Verarbeitungsanlage eine Schleuse zwischen
20 der Zerkleinerungseinheit und der Inaktivierungsvorrichtung, insbesondere der Trocknungsvorrichtung. Beispielsweise handelt es sich um eine Zellenradschleuse oder einen Flachschieber. Durch die Schleuse wird der Gaseintrag in die Inaktivierungsvorrichtung, insbesondere die Trocknungsvorrichtung, vermindert. Die Schleuse ist vorzugsweise als Dosierschleuse ausgebildet. So kann die In-
25 aktivierungseinheit während des Betriebes der Zerkleinerungseinheit evakuiert werden.

Wenn das Zerkleinern und das Trocknen in unterschiedlichen Behältern durchgeführt werden, besitzt die Batterie-Verarbeitungsanlage vorzugsweise eine
30 staubdichte, insbesondere eine gasdichte, Fördervorrichtung, die die Zerkleinerungsvorrichtung und die Trockenvorrichtung miteinander verbindet. Als staubdicht wird eine Fördervorrichtung insbesondere dann betrachtet, wenn höchstens 5 Gew.-% aller Partikel mit einem Durchmesser von zumindest 0,1 Mikro-

meter die Fördervorrichtung in die Umgebung verlassen.

Um die Trockenzeit zwischen Beginn und Ende des Trocknens zu verringern, ist es günstig, wenn die Trockenvorrichtung eine Heizung umfasst. Es kann sich bei
5 der Heizung um eine konduktive oder eine konvektive Heizung handeln, welche vorzugsweise die Kompressionswärme der Pumpen und die Kondensationswärme in den Trockner einbringt.

Es hat sich herausgestellt, dass die Qualität des zurückgewonnenen Elektrolyten
10 besonders hoch ist, wenn die Trockenvorrichtung zumindest eine trockenlaufende Vakuumpumpe, vorzugsweise ausschließlich trockenlaufende Vakuumpumpen, aufweist.

Die Pumpleistung der Vakuumanlage beträgt bei 300 hPa zumindest das Fünffache des Volumens des Innenraums der Trockenvorrichtung pro Stunde. Auf
15 diese Weise kann die Trockenzeit klein gehalten werden.

Die Trockenzeit lässt sich zudem vermindern, wenn – wie gemäß einer bevorzugten Ausführungsform vorgesehen – die Trockenvorrichtung zumindest zwei
20 Vakuumpumpen aufweist, die sich in ihrem Volumenstrom bei 400 hPa und ihrem maximal erreichbaren Minimaldruck unterscheiden. So hat eine der beiden Vakuumpumpen vorzugsweise eine hohe Volumenstromleistung (gemessen in Litern pro Sekunde bei 400 hPa), aber einen geringeren Minimaldruck. Der maximal erreichbare Minimaldruck ist der kleinste Druck, der mit der Pumpe er-
25 reichbar ist. Es ist dann möglich, die Pumpen in ihren optimalen Arbeitsbereichen einzusetzen. Die in Materialflussrichtung ersten Pumpen gewährleisten einen hohen Volumenstrom bei niedrigen Drücken, während nachgelagerte Pumpen kleinere Volumenströme gegen Umgebungsdruck verdichten.

30 Beispielsweise besitzt die Vakuumanlage zumindest eine trocken laufende Wälzkolbenpumpe und/oder zumindest eine trocken laufende Schraubenvakuumpumpe.

Die Zerkleinerungseinheit besitzt vorzugsweise ein Bodensieb zum Begrenzen der maximalen Größe des Zerkleinerungsguts. Das erleichtert die Weiterverarbeitung des Zerkleinerungsguts und vermindert die Gefahr einer Nachträglichen Erhitzung und Selbstentzündung des Zerkleinerungsgutes durch Kurzschlüsse von Batteriefragmenten. Vorzugsweise hat das Bodensieb eine Maschenweite von höchstens 35 mm.

Zum Zuführen von Inertgas zur Trockenvorrichtung besitzt diese vorzugsweise ein Zulassventil, das mit einer Inertgas-Versorgungsvorrichtung zum Zuführen von Inertgas in einen Innenraum der Trockenvorrichtung verbunden ist. Insbesondere wird verflüssigtes, also bei 22°C und 1013 hPa gasförmigem, Inertgas mit einer Temperatur von höchstens -30°C zugeführt. Zum gleichen Zweck besitzt die Zerkleinerungsvorrichtung alternativ oder zusätzlich ein Zuführventil, das mit einer Inertgas-Versorgungsvorrichtung zum Zuführen von Inertgas in einen Innenraum der Zerkleinerungsvorrichtung verbunden ist. Die Inertgas-Versorgungsvorrichtung ist vorzugsweise zum Bereitstellen von verflüssigtem Inertgas.

Zum Messen einer Sauerstoffkonzentration, insbesondere zum Ermitteln, ob eine Explosionsgrenze überschritten ist, besitzt die Zerkleinerungseinheit eine Sauerstoff-Erfassungsvorrichtung zum Erfassen einer Sauerstoffkonzentration in der Zerkleinerungseinheit.

Die Batterie-Verarbeitungsanlage kann eine Verbrennungsvorrichtung zur thermischen oder katalytischen Verbrennung von gasförmigen Bestandteilen des Elektrolyten besitzen. Diese ist vorzugsweise in Materialflussrichtung hinter dem Kondensator und/oder vor einer Abgasöffnung angeordnet. So werden keine Bestandteile des Elektrolyten durch die Abgasöffnung in die Umgebung entlassen.

Vorzugsweise besitzt die Batterie-Verarbeitungsanlage eine Partikel-Entfernvorrichtung zum Entfernen von Partikeln aus dem aus der Trockenvorrichtung abgezogenen Gasstrom. Die Partikel-Entfernvorrichtung kann zum Beispiel einen Zyklon und/oder einen Filter und/oder Aktivkohle umfassen.

Im Folgenden wird die Erfindung anhand der beigefügten Zeichnungen näher erläutert. Dabei zeigt

- 5 Figur 1 ein Ablaufdiagramm eines erfindungsgemäßen Verfahrens,
 Figur 2 einen Querschnitt durch eine erfindungsgemäße Batterie-
 Verarbeitungsanlage und
10 Figur 3 einen Querschnitt durch weitere, optionale Bestandteile einer erfindungsgemäßen Batterie-Verarbeitungsanlage.
 Figur 4 zeigt ein Ablaufdiagramm eines erfindungsgemäßen Verfahrens gemäß einer zweiten Ausführungsform.

15

Figur 1 zeigt das Ablaufdiagramm eines erfindungsgemäßen Verfahrens. Zunächst werden Batterien 10.1, 10.2, ..., insbesondere Batteriesysteme bestehend aus mehreren Batteriemodulen oder Batteriestacks, welche wiederum aus mehreren Batteriezellen bestehen, in einer Entladeeinheit 12 entladen. Danach
20 folgt an einer Demontagestation 14 die Demontage der Batterien 10, wenn diese erforderlich ist, weil die Batteriesysteme ansonsten aus geometrischen oder gravimetrischen Gründen nicht in die Zerkleinerungseinheit befördert werden können. Dazu werden die Batteriesysteme geöffnet und soweit demontiert, dass die Module/Stacks einzeln entfernt werden können. Gegebenenfalls können auch
25 die Zellen von der Ansteuerelektronik getrennt werden. Die entstehenden Untereinheiten (Module/Stacks) und/oder Zellen 16.1, 16.2, ... werden einer Zerkleinerungseinheit 18 zugeführt, die beispielsweise eine Rotorschere mit einem Rotor und einen Zerkleinerer mit Statoren oder mehreren Rotoren, oder eine Schneidmühle mit einem Rotor und mehreren Rotoren umfasst.

30

Die Zerkleinerungseinheit 18 zerkleinert die Batterien 10 unter Schutzgas 20, das beispielsweise einer Schutzgasflasche entnommen wird. Alternativ oder zusätzlich kann flüssiger Stickstoff aus einer Flüssigstickstoffquelle 19 zugeführt werden. Bei dem Schutzgas kann es sich beispielsweise um Stickstoff, ein Edel-

gas, Kohlendioxid, Lachgas oder ein sonstiges, vorzugweise nicht giftiges Gas handeln.

5 Beim Zerkleinern entsteht Zerkleinerungsgut 24, das einer Inaktivierungsvorrichtung in Form einer Trockenvorrichtung 26 zugeführt wird. Zwischen der Zerkleinerungseinheit 18 und der Trockenvorrichtung 26 ist eine Schleuse 28 angeordnet, die soweit gasdicht ist, dass die Druckvorrichtung 26 in guter Näherung von der Zerkleinerungseinheit 18 gasdicht getrennt ist.

10 Die Trockenvorrichtung 26 ist mit einer Vakuumanlage 29 verbunden, die eine Vakuumpumpe 30 aufweist und ein Vakuum erzeugt. In der Trockenvorrichtung 26 herrscht ein Druck p_{26} von $p_{26} \approx 100$ hPa, zeitweise unter 50 hPa. Es sei darauf hingewiesen, dass im Rahmen der vorliegenden Beschreibung unter einer Vakuumpumpe insbesondere ganz allgemein eine Vorrichtung verstanden wird,
15 die ein Vakuum erzeugt. Es ist dabei möglich und bevorzugt, nicht aber notwendig, dass die Vakuumpumpe gleichzeitig als Verdichter wirkt, so dass von ihr Gas unter einem Druck abgegeben wird, der größer ist als der Umgebungsdruck.

In dem in Figur 1 gezeigten Fall handelt es sich bei der Vakuumpumpe um einen
20 Verdichter, der Gas 31, das in der Trockenvorrichtung 26 vorliegt, ansaugt und verdichtet. Alternativ oder zusätzlich kann die Vakuumanlage 29 eine Strahlpumpe aufweisen, bei der ein Strahlmedium in Form einer Flüssigkeit mit hoher Geschwindigkeit durch Venturi-Düse geleitet wird. Das Strahlmedium ist alkalisch und hat einen pH-Wert von zumindest pH 13 und ist beispielsweise eine
25 10%ige Kaliumhydroxidlösung.

Die Vakuumanlage 29 umfasst eine Gasreinigungsvorrichtung 32, die zwischen der Trockenvorrichtung 26 und der Vakuumpumpe 30 angeordnet ist und die im vorliegenden Fall einen Kondensator 34 und/oder einen Aktivkohlefilter 36 um-
30 fasst. Der Kondensator wird bei einer Temperatur von -10 °C betrieben, so dass Kohlensäuredimethylester und Kohlensäureethylmethylester kondensieren und in einen Kondensatbehälter 38 abgegeben werden können. Zudem wird etwaig vorhandenes Wasser ausgefroren. Ein Steuerventil 40 ist ausgebildet zum Öff-

nen, wenn der Druck p_{26} zu groß wird und zum Zufahren, wenn Pumpenkreislauf und Trocknungsbehälter entkoppelt werden sollen.

Vorzugsweise ist das Trocknungsgut während der Trocknung bewegt. Dies kann
5 beispielsweise durch Rühren mit einem Rührwerk 41, wie einem Ankerrührer oder einem Stabrührer mit senkrecht zur Rührwelle angebrachten Stäben passieren. Alternativ durch einen bewegten Trocknungsbehälter.

Durch das Trocknen des Zerkleinerungsguts entsteht inaktiviertes Zerkleinerungsgut 42, das einer Abfüllvorrichtung 44 zugeführt wird. Dort wird das inaktivierte Zerkleinerungsgut 42 unter Vakuum und/oder unter Schutzgas in einen
10 Transportbehälter 46 abgefüllt. Der Transportbehälter 46 ist vorzugsweise gasdicht. Es ist möglich, nicht aber notwendig, dass der Transportbehälter 46 vor dem Abtransport mit Inertgas aufgefüllt wird, so dass er unter Normaldruck steht.
15 Alternativ ist es auch möglich, dass der Transportbehälter unter Vakuum verschlossen und transportiert wird. Es ist möglich, dass alternativ zum Transportbehälter eine vakuumverschweißte Folie, beispielsweise eine Aluminiumverbundfolie, gewählt wird.

20 Über eine Spülleitung 48 wird der Zerkleinerungseinheit 18 Schutzgas 20 von der Vakuumpumpe 30 zugeführt. Arbeitet die Vakuumpumpe 30 wie im vorliegenden Fall, der eine bevorzugte Ausführungsform darstellt, zudem als Kompressor, kann das Schutzgas auf eine Druckgasflasche 50 gezogen werden. Alternativ oder zusätzlich kann das Schutzgas 20, gegebenenfalls nach zusätzlicher
25 Reinigung, in die Umgebung abgegeben werden.

Figur 2 zeigt schematisch einen Querschnitt durch eine erfindungsgemäße Batterie-Verarbeitungsanlage 52 (vgl. Figur 1), die einen Standard-Container 54 aufweist, in dem die Zerkleinerungseinheit 18, die Trockenvorrichtung 26 und die
30 Abfüllvorrichtung 44 angeordnet sind. Hinter der Zerkleinerungseinheit 18 ist ein erster gasdichter Förderer 56 angeordnet, der beispielsweise eine Förderschnecken oder einen Rohrkettenförderer umfasst. Der erste Förderer 56 fördert das Zerkleinerungsgut 24 zur Trockenvorrichtung 26, die mit der in Figur 2 nicht

sichtbaren Vakuum-Erzeugungsvorrichtung verbunden ist. In Materialstromrichtung hinter der Trockenvorrichtung 26 ist ein zweiter Förderer 58 angeordnet, der vorzugsweise ebenfalls gasdicht ausgebildet ist und eine Förderschnecke oder einen Rohrkettentransporter enthalten kann. Der zweite Förderer fördert das
5 inaktivierte Zerkleinerungsgut 42 zur Abfüllvorrichtung 44.

Figur 3 zeigt optionale, in der vorliegenden Ausführungsform vorhandene Einheiten der erfindungsgemäßen Batterie-Verarbeitungsanlage 52 (vgl. Figur 1), die einen Aufschlusszerkleinerer 60 sowie einen Sieb 62 umfasst. Der Auf-
10 schlusszerkleinerer 60 enthält eine Transportbehälter-Entleervorrichtung 64, mittels der aus dem Transportbehälter 46 inaktiviertes Zerkleinerungsgut 42 entnommen werden kann. Der Aufschlusszerkleinerer 60 erzeugt Aufschlussmaterial 66, das dem Sieb 62 zugeführt wird. Es kann sich bei dem Sieb beispielsweise um einen Zickzack-Sieb handeln.

15 Vorzugsweise umfasst die Batterie-Verarbeitungsanlage 52 einen Zerkleinerer, der vorzugsweise im Materialfluss vor der Klassiervorrichtung 74 steht und ein schnell laufendes Zerkleinerungswerkzeug enthält, wobei eine Rotorumfangsgeschwindigkeit größer ist als 1 m/s, vorzugsweise größer als 10 m/s. Dieser
20 Zerkleinerer zerkleinert das Zerkleinerungsmaterial und beansprucht es mechanisch so, dass sich die elektrochemisch aktive Beschichtung mindestens teilweise vom Träger löst. Das Vorhandensein eines solchen Zerkleinerers ist ein allgemeines bevorzugtes Merkmal einer erfindungsgemäßen Batterie-Verarbeitungsanlage.

25 Im Sieb entstehen eine Leichtfraktion mit Separatorfolie und feinem Beschichtungsmaterial und eine Schwergutfraktion mit Trägerfolien (Aluminium- und Kupfer) mit größerem leicht anhaftender Beschichtung. Beide Fraktionen werden auf jeweils ein Sieb zur weiteren Trennung in Beschichtung und Separatorfolie beziehungsweise Beschichtung und Metallfolien gegeben. Die entstehenden Fraktionen werden getrennt weiter verarbeitet.
30

Das Aufschlussmaterial 66 wird dem Sieb 62 mittels einem dritten Förderer 68

zugeführt. Ein vierter Förderer 70 führt gesichtetes Material 72, insbesondere das Material der Leichtfraktion und das Material der Schwerfraktion, das den Siebter 62 verlässt, einer oder zwei Klassiervorrichtungen 74 zu. Die Klassiervorrichtung 74 umfasst vorzugsweise ein Luftstrahlsieb, das gleichzeitig als

5 Trennvorrichtung im Falle der Schwerfraktion zum Trennen des Aktivmaterials von dem Träger fungiert. Im Falle der Leichtfraktion wird das Aktivmaterial vom Separator getrennt. Durch das Trennen entsteht eine Aktivmaterialfraktion 76, die in ein Transportbehältnis 78 abgefüllt wird.

10 Es entsteht zudem eine Trägerfraktion (Schwergut) 80 und eine Separatorfraktion (Leichtgut), die in der vorliegenden Ausführungsform mit einem fünften Förderer 82 einer Abfülleinheit 84 zugeführt wird, die die Trägerfraktion 80 in einen Behälter 86 füllt. Die Abfülleinheit 84 ist zusammen mit einer zweiten Abfülleinheit 88 Teil einer zweiten Abfüllvorrichtung.

15

Figur 4 zeigt ein Flussdiagramm einer zweiten erfindungsgemäßen Batterie-Verarbeitungsanlage 52, die zwei Trockenvorrichtungen 26.1, 26.2 aufweist. Jede der Trockenvorrichtungen 26.1, 26.2 besitzt jeweils ein Rührwerk 41.1 bzw. 41.2. In Materialflussrichtung vor der Zerkleinerungseinheit 18 befindet sich die

20 Schleuse 27, die im vorliegenden Fall als Dosierschleuse ausgebildet ist und mit welcher die Zerkleinerungseinheit 18 befüllt werden kann, ohne dass die Gasatmosphäre im Zerkleinerer mit Umgebungsluft vermischt wird. In Materialflussrichtung hinter der Zerkleinerungseinheit 18 befindet sich die Schleuse 28, die im vorliegenden Fall als Dosierschleuse ausgebildet ist und mittels der die Trockenvorrichtungen 26.1, 26.2 einzeln oder simultan beschickt werden können.

25

Jedes der Rührwerke 41.1, 41.2 besitzt eine Leistung von zumindest 4 kW, im vorliegenden Fall 5 kW pro Kubikmeter Trockenvolumen. Die eingebrachte mechanische Energie wird auf das in der jeweiligen Trockenvorrichtung 26.1, 26.2

30 enthaltene Zerkleinerungsgut 24 übertragen. Ein Teil der mechanischen Energie führt zur Trennung von Bestandteilen des Zerkleinerungsguts, beispielsweise zu einer Trennung von Beschichtungsmaterial von der Trägerfolie. Der überwiegende Teil der mechanischen Leistung wird jedoch in Wärmeenergie umgewandelt.

Diese Wärmeenergie wird von dem verdampfenden Elektrolyten, der noch Bestandteil des Zerkleinerungsguts 24 ist, aufgenommen.

Die in den Trockenvorrichtungen 26.i ($i = 1, 2$) entstehenden Gase werden zunächst mittels einer Partikel-Entfernvorrichtung 90 von mitgerissenen Partikeln gereinigt. Die Partikel werden in einem Behälter 92 aufgefangen oder direkt weiterverarbeitet. Bei der Partikelentfernvorrichtung 90 kann es sich beispielsweise um einen Filter und/oder einen Zyklon handeln.

10 In Strömungsrichtung hinter der Partikelentfernvorrichtung 90 ist die Vakuumpumpe 30 angeordnet. Günstig ist es, wenn in Gas-Strömungsrichtung hinter der Vakuumpumpe 30 oder parallel dazu mindestens eine zweite Pumpe anderer Bauart angeordnet ist.

15 Hinter der Vakuumpumpe 30 ist der Kondensator 34 angeordnet, in dem ein Druck p_{34} herrscht. Der Druck p_{34} entspricht im Wesentlichen dem Umgebungsdruck, das heißt, dass er beispielsweise um höchstens 100 hPa vom Umgebungsdruck abweicht. Da der Druck p_{34} deutlich größer ist als der Druck p_{26} in den Trockenvorrichtungen 26.1, 26.2, kondensieren insbesondere die Carbonsäureester, insbesondere Dimethylcarbonat, Propylencarbonat, Diethylcarbonat, Ethylencarbonat und Ethylmethylcarbonat, aus. Die entstehende Kondensationswärme wird durch Kühlung abgeführt. Dabei ist es möglich, dass der Kondensator auf eine Temperatur T_{34} gekühlt wird, die sich um weniger als 20 Kelvin von der Umgebungstemperatur $T_{Um\ g}$ unterscheidet. Das hat den Vorteil, dass der Energieaufwand für das Trocknen des Zerkleinerungsgutes 24 vergleichsweise gering ist und gleichzeitig viel Elektrolyt zurückgewonnen werden kann.

30 In Materialflussrichtung hinter dem Kondensator 34 kann ein Aktivkohlefilter 36 angeordnet sein, das ist aber nicht notwendig. Es ist zudem möglich, dass in Strömungsrichtung hinter dem Kondensator 34 eine Oxidationsvorrichtung 94 angeordnet ist, mittels der verbleibenden Reste oxidierbaren Materials, insbesondere von organischen Bestandteilen des Elektrolyten, katalytisch oder ther-

misch oxidiert werden, sodass das aus der Oxidationsvorrichtung 94 austretende Gas gefahrlos in die Umgebung abgegeben werden kann.

Es ist möglich, dass die Batterieverarbeitungsanlage 52 eine Abfüllvorrichtung 44 aufweist, mittels der das getrocknete Zerkleinerungsgut 24 in Form des inaktiven Zerkleinerungsgutes 42 in einen Transportbehälter 46 abgefüllt werden kann. Es ist aber auch möglich, dass die Batterieverarbeitungsanlage 52 keine solche Abfüllvorrichtung 44 aufweist.

10 Die Trockenvorrichtung 26.1, 26.2 (es ist auch möglich, dass die Batterieverarbeitungsanlage in dieser Ausführungsform lediglich eine Trockenvorrichtung 26 aufweist) besitzen jeweils eine Ausgangs-Schleuse 96.1, 96.2 in Form einer Dosier- und Umlenkschleuse. Das inaktive Zerkleinerungsgut 42 wird beispielsweise in einem Silo 98 zwischengelagert oder direkt einem Schwergutabscheider 15 100 zugeführt. Der Schwergutabscheider 100 ist ausgebildet zum Abscheiden von Material mit einer Dichte von zumindest 2,6 Gramm pro Kubikzentimeter, insbesondere Aluminium- und/oder Eisenbestandteile.

Nachfolgend wird das verbleibende Material in einem Zerkleinerer 102 weiter 20 zerkleinert und danach in einem Sieb 62 klassiert in Leichtgut 108 (Separator und Beschichtungsmaterial) und in Schwergut 110 (Trägerfolien und Beschichtungsmaterial). Beide Fraktionen werden gesiebt 74.1, 74.2. Es entstehen die wiederverwertbaren Aluminium- und Kupferfolien in Behälter 88.3, eine Separatorfraktion in Behälter 88.1, sowie reines Beschichtungsmaterial in Behälter 88.4 25 und 88.2, welches auf Grund seiner großen Reinheit in folgenden metallurgischen Prozessschritten weiterverarbeitet werden kann.

Bezugsleistenliste

10	Batterie	60	Aufschlusszerkleinerer
12	Entladeeinheit	62	Sichter
14	Demotagesstation	64	Transportbehälter- Entleervorrichtung
16	Zelle	66	Aufschlussmaterial
18	Zerkleinerungseinheit	68	dritter Förderer
19	Flüssigstickstoffquelle		
20	Schutzgas	70	vierter Förderer
22	Schutzgasflasche	72	gesichtetes Material
24	Zerkleinerungsgut	74	Klassiervorrichtung
26	Trockenvorrichtung	76	Aktivmaterialfraktion
27	Schleuse vor Zerkleinerer	78	Transportbehältnis
28	Schleuse		
29	Vakuumanlage	80	Trägerfraktion
30	Vakuumpumpe	82	fünfter Förderer
31	Gas	84	Abfülleinheit
32	Gasreinigungsvorrichtung	86	Behälter
34	Kondensator	88	weitere Abfülleinheit
36	Aktivkohlefilter	90	Partikelentfernvorrichtung
38	Kondensatbehälter	92	Behälter
40	Steuerventil	94	Oxidationsvorrichtung
41	Rührwerk	96	Ausgangsschleuse
42	inaktives Zerkleinerungsgut	98	Silo
44	Abfüllvorrichtung	100	Schwergutabscheider
46	Transportbehälter	102	Zerkleinerer
48	Spülleitung	108	Leichtgut
50	Druckgasflasche	110	Schwergut
52	Batterie-Verarbeitungsanlage	p	Druck
54	Standard-Container		
56	erster Förderer		
58	zweiter Förderer		

Patentansprüche

1. Verfahren zum Behandeln gebrauchter Lithium-Batterien (10) mit den Schritten:
 - 5 (a) Zerkleinern der Batterien (10), sodass Zerkleinerungsgut (24) erhalten wird, und
 - (b) Inaktivieren des Zerkleinerungsguts (24) durch Trocknen, sodass ein inaktiviertes Zerkleinerungsgut (42) erhalten wird, dadurch gekennzeichnet, dass
 - 10 (c) das Trocknen bei einem Druck von höchstens 300 hPa und höchstens 80 °C erfolgt und
 - (d) das inaktivierte Zerkleinerungsgut (42) nach dem Trocknen nicht in einen Transportbehälter abgefüllt und/oder direkt weiterverarbeitet wird.
- 15 2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, dass
 - die Batterie bei einer Temperatur getrocknet wird, die unterhalb einer Zersetzungstemperatur eines Binders der Batterie liegt und
 - das Zerkleinerungsgut (24) durch das Trocknen inaktiviert wird, sodass eine elektrochemische Reaktion unmöglich ist, und.
- 20 3. Verfahren nach einem der vorstehenden Ansprüche, gekennzeichnet durch den Schritt: Kondensieren der beim Trocknen der entstandenen Gase, insbesondere bei Umgebungsdruck und/oder bei einer Temperatur von mehr als 0°C und höchstens 50°C.
- 25 4. Verfahren nach einem der vorstehenden Ansprüche, gekennzeichnet durch die Schritte:
 - beim Trocknen kontinuierliches Überwachen einer Konzentration an organischen Karbonaten in der Atmosphäre der Trockenvorrichtung, und
 - 30 - Beenden des Trocknens erst dann, wenn eine untere Explosionsgrenze unterschritten ist.

5. Verfahren nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, dass
- das Trocknen während zumindest 50% der Trockenzeit bei einem Druck von höchstens 30 hPa erfolgt und /oder
 - 5 - ein Minimaldruck beim Trocknen höchstens 50 hPa beträgt.
6. Verfahren nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, dass
- das Zerkleinerungsgut (24, 42) in der Trockenvorrichtung, insbesondere
 - 10 beim Entnehmen aus der Trockenvorrichtung, mittels eines Rührwerks bewegt wird und
 - mittels des Rührwerks zumindest 50%, insbesondere zumindest 80%, einer zum Trocknen des Zerkleinerungsguts (24) notwendigen Verdampfungswärme zugeführt wird.
 - 15
7. Verfahren nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, dass
- beim Trocknen entstehende Gase abgesaugt werden und/oder
 - das Bewegen mittels des Rührwerks so durchgeführt wird, dass zumin-
 - 20 dest 50 Gew.-% des Beschichtungsmaterials des Zerkleinerungsguts (42) abgesaugt werden.
8. Verfahren nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, dass das Zerkleinern und das Trocknen in nur einem Behälter durchgeführt wird.
- 25

9. Batterie-Verarbeitungsanlage zum Behandeln von Batterien, insbesondere gebrauchten Lithium-Batterien, mit:
- (a) einer Zerkleinerungseinheit (18) zum Zerkleinern der Batterien (10), sodass Zerkleinerungsgut (24) erhalten wird, und
 - 5 (b) einer Inaktivierungsvorrichtung in Form einer Trockenvorrichtung (26) zum Inaktivieren des Zerkleinerungsguts (24),
dadurch gekennzeichnet, dass
 - (c) eine Vakuumanlage mit der Trockenvorrichtung (26) zum Erzeugen eines Vakuums in der Trockenvorrichtung (26) von zumindest 300 hPa
10 verbunden ist und
 - (d) die Trockenvorrichtung (26) zum Trocknen bei einer Temperatur von höchstens 80 °C, insbesondere unter 80°C, ausgebildet ist.
10. Batterie-Verarbeitungsanlage nach Anspruch 9, dadurch gekennzeichnet,
15 dass die Zerkleinerungseinheit (18) in der Trockenvorrichtung angeordnet ist.
11. Batterie-Verarbeitungsanlage nach einem der Ansprüche 9 bis 10, gekennzeichnet durch
20 einen Kondensator zum Kondensieren von aus dem Trockner abgesaugtem gasförmigem Elektrolyten,
wobei in Materialflussrichtung zwischen der Trockenvorrichtung und dem Kondensator und/oder der zumindest einen Pumpe ein Partikelabscheider
angeordnet ist.
- 25 12. Batterie-Verarbeitungsanlage nach einem der Ansprüche 9 bis 11, gekennzeichnet durch
eine gasdichte und/oder staubdichte Fördervorrichtung, die die Zerkleinerungsvorrichtung und die Trockenvorrichtung (26) miteinander verbindet.
- 30

13. Batterie-Verarbeitungsanlage nach einem der Ansprüche 9 bis 12, gekennzeichnet durch
- eine Schleuse, die vor der Zerkleinerungseinheit (18) zum Zuführen der Batterien (10) angeordnet ist, und/oder
 - 5 - einen Partikelabscheider, der in Materialflussrichtung zwischen der Trockenvorrichtung und dem Kondensator angeordnet ist.
14. Batterie-Verarbeitungsanlage nach einem der Ansprüche 9 bis 13, dadurch gekennzeichnet, dass die Trockenvorrichtung eine Heizung umfasst, welche die Wärme vorzugsweise aus der Wärmeabfuhr der Vakuumpumpen und/oder des Kondensators bezieht.
- 10 15. Batterie-Verarbeitungsanlage nach einem der Ansprüche 9 bis 14, dadurch gekennzeichnet, dass die Trockenvorrichtung
- 15 zumindest eine trockenlaufende Vakuumpumpe aufweist, insbesondere zumindest zwei Vakuumpumpen aufweist, die sich in ihrem Volumenstrom bei 400 hPa und ihrem maximal erreichbaren Minimaldruck unterscheiden.
- 20 16. Batterie-Verarbeitungsanlage nach einem der Ansprüche 9 bis 15, dadurch gekennzeichnet, dass die Zerkleinerungseinheit ein Bodensieb zum Begrenzen der maximalen Größe des Zerkleinerungsguts aufweist.

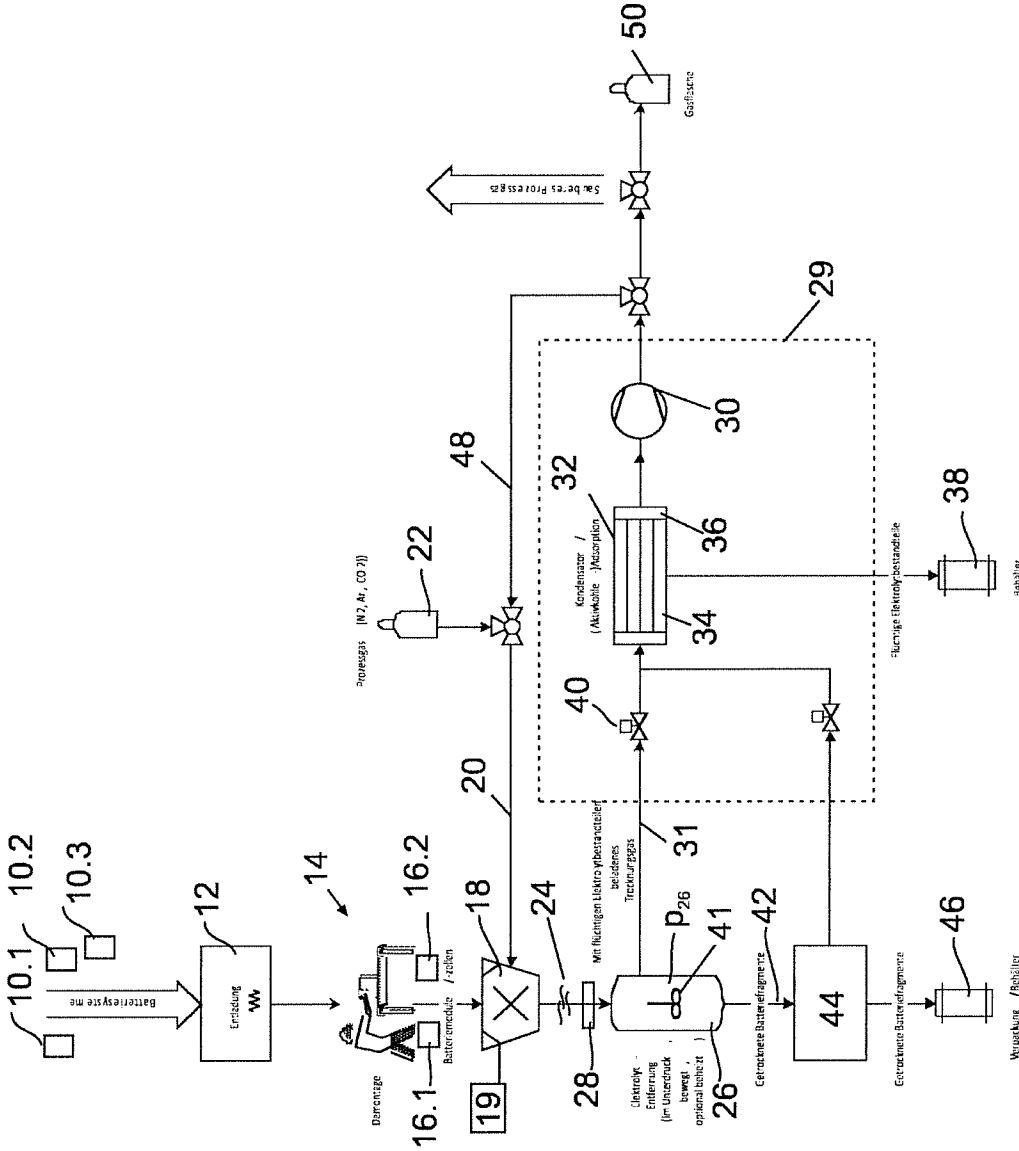


Fig. 1

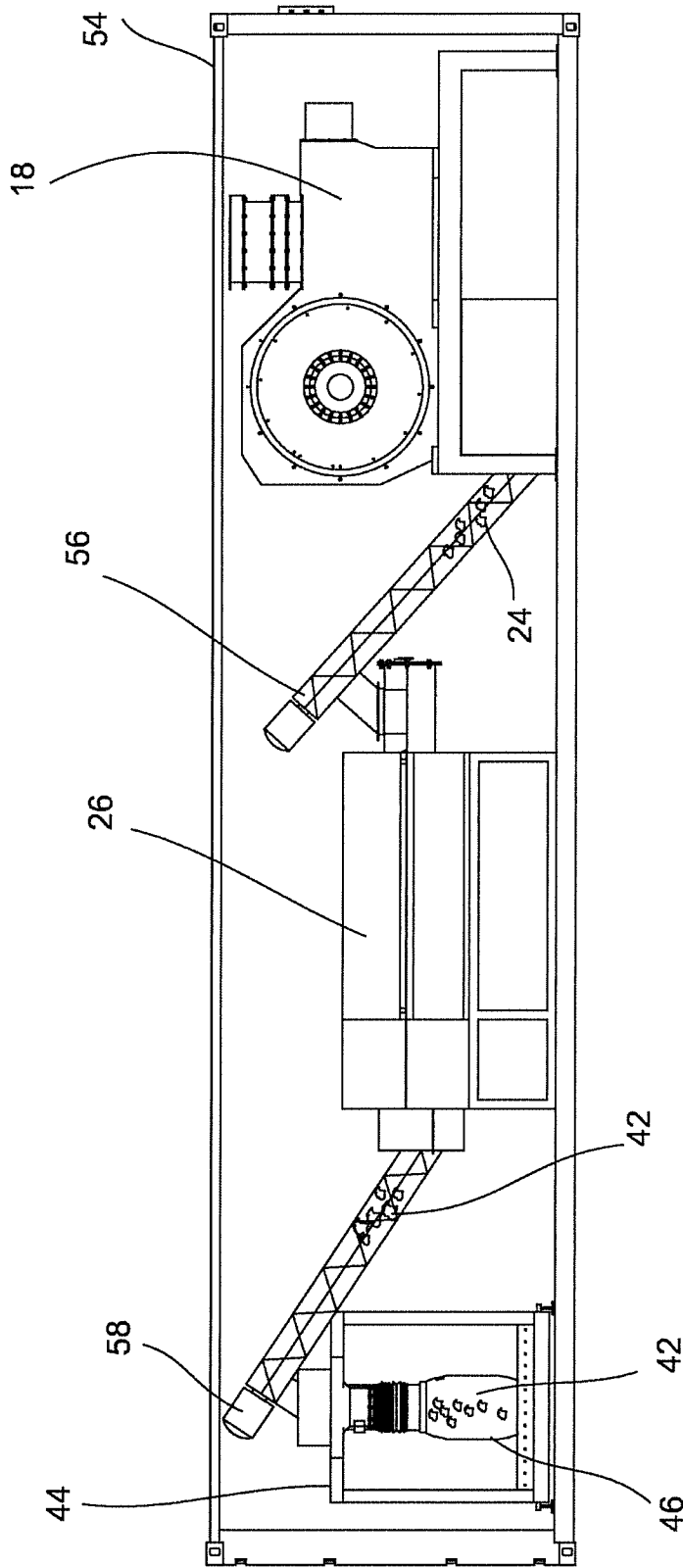


Fig. 2

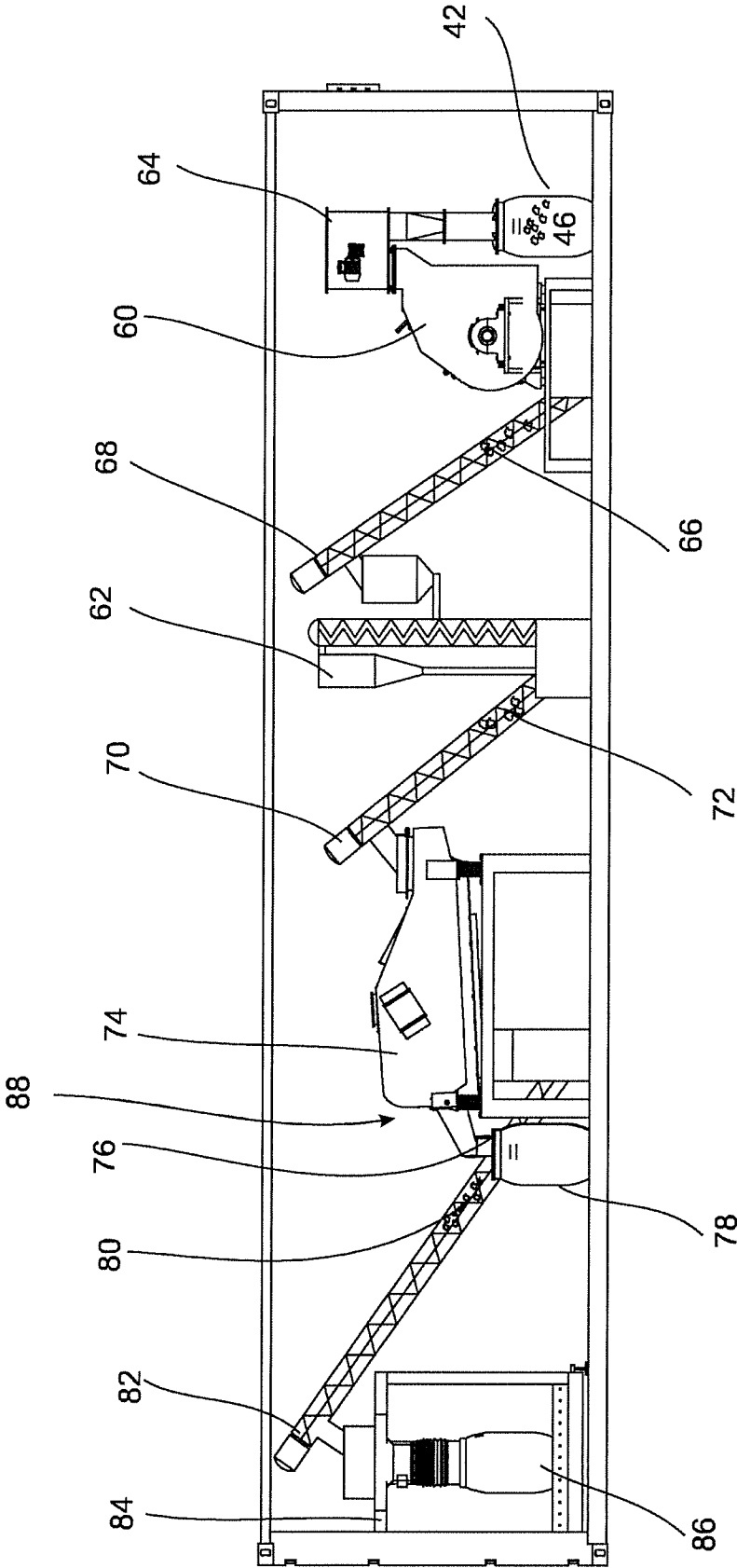


Fig. 3

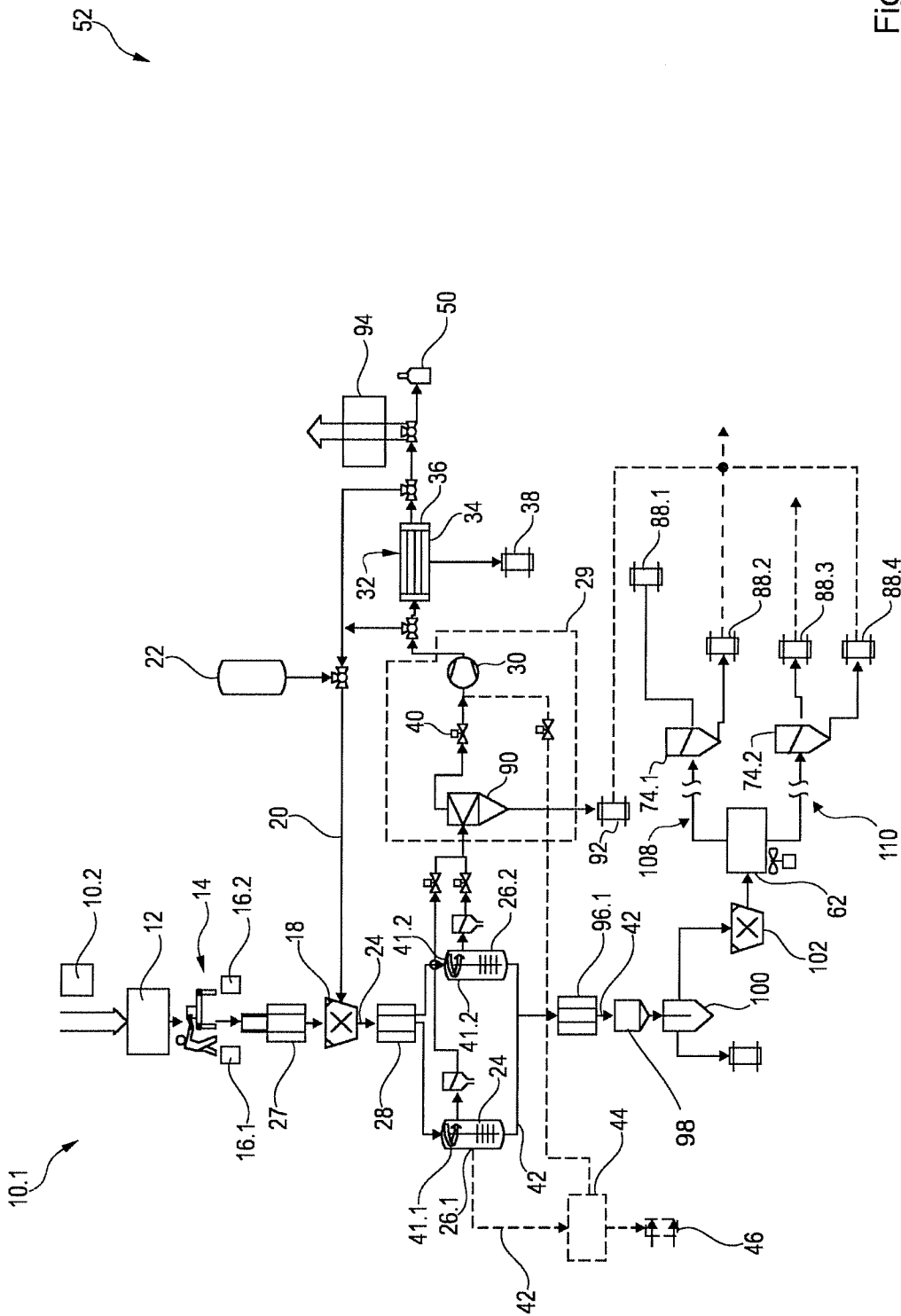


Fig. 4

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter I of the Patent Cooperation Treaty)

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International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237		
Applicant DUESENFELD GMBH		

1.	This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 bis.1(a).																								
2.	This REPORT consists of a total of 8 sheets, including this cover sheet. In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.																								
3.	<p>This report contains indications relating to the following items:</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 5%; text-align: center;">☒</td> <td style="width: 25%;">Box No. I</td> <td style="width: 70%;">Basis of the report</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. II</td> <td>Priority</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. III</td> <td>Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. IV</td> <td>Lack of unity of invention</td> </tr> <tr> <td style="text-align: center;">☒</td> <td>Box No. V</td> <td>Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</td> </tr> <tr> <td style="text-align: center;">☒</td> <td>Box No. VI</td> <td>Certain documents cited</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. VII</td> <td>Certain defects in the international application</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. VIII</td> <td>Certain observations on the international application</td> </tr> </table>	☒	Box No. I	Basis of the report	☐	Box No. II	Priority	☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability	☐	Box No. IV	Lack of unity of invention	☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement	☒	Box No. VI	Certain documents cited	☐	Box No. VII	Certain defects in the international application	☐	Box No. VIII	Certain observations on the international application
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4.	The International Bureau will communicate this report to designated Offices in accordance with Rules 44bis.3(c) and 93bis.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44bis .2).																								

<p style="text-align: center;">The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland</p> <p>Facsimile No. +41 22 338 82 70</p>	<p>Date of issuance of this report 23 April 2019 (23.04.2019)</p> <p>Authorized officer Nora Lindner</p> <p>e-mail: pct.team5@wipo.int</p>
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Form PCT/IB/373 (January 2004)

VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS

Absender: INTERNATIONALE RECHERCHENBEHÖRDE

An:

siehe Formular PCT/ISA/220

PCT

SCHRIFTLICHER BESCHIED DER INTERNATIONALEN RECHERCHENBEHÖRDE (Regel 43bis.1 PCT)

Absendedatum
(Tag/Monat/Jahr)
210 (Blatt 2)

siehe Formular PCT/ISA/
210

Aktenzeichen des Anmelders oder Anwalts
siehe Formular PCT/ISA/220

WEITERES VORGEHEN
siehe Punkt 2 unten

Internationales Aktenzeichen
PCT/EP2017/076113

Internationales Anmeldedatum (Tag/Monat/Jahr)
12.10.2017

Prioritätsdatum (Tag/Monat/Jahr)
20.10.2016

Internationale Patentklassifikation (IPC) oder nationale Klassifikation und IPC
INV. H01M6/52 C22B7/00 C22B15/00 C22B21/00 H01M10/54

Anmelder
DUESENFELD GMBH

1. Dieser Bescheid enthält Angaben zu folgenden Punkten:

- ☒ Feld Nr. I Grundlage des Bescheids
- ☐ Feld Nr. II Priorität
- ☐ Feld Nr. III Keine Erstellung eines Gutachtens über Neuheit, erfinderische Tätigkeit und gewerbliche Anwendbarkeit
- ☐ Feld Nr. IV Mangelnde Einheitlichkeit der Erfindung
- ☒ Feld Nr. V Begründete Feststellung nach Regel 43bis.1 a) i) hinsichtlich der Neuheit, der erfinderischen Tätigkeit und der gewerblichen Anwendbarkeit; Unterlagen und Erklärungen zur Stützung dieser Feststellung
- ☒ Feld Nr. VI Bestimmte angeführte Unterlagen
- ☐ Feld Nr. VII Bestimmte Mängel der internationalen Anmeldung
- ☐ Feld Nr. VIII Bestimmte Bemerkungen zur internationalen Anmeldung

2. WEITERES VORGEHEN

Wird ein Antrag auf internationale vorläufige Prüfung gestellt, so gilt dieser Bescheid als schriftlicher Bescheid der mit der internationalen vorläufigen Prüfung beauftragten Behörde ("IPEA"); dies trifft nicht zu, wenn der Anmelder eine andere Behörde als diese als IPEA wählt und die gewählte IPEA dem Internationale Büro nach Regel 66.1 bis b) mitgeteilt hat, dass schriftliche Bescheide dieser Internationalen Recherchenbehörde nicht anerkannt werden.

Wenn dieser Bescheid wie oben vorgesehen als schriftlicher Bescheid der IPEA gilt, so ist der Anmelder aufgefordert, bei der IPEA vor Ablauf von 3 Monaten ab dem Tag, an dem das Formblatt PCT/ISA/220 abgesandt wurde oder vor Ablauf von 22 Monaten ab dem Prioritätsdatum, je nachdem, welche Frist später abläuft, eine schriftliche Stellungnahme und, wo dies angebracht ist, Änderungen einzureichen.

Weitere Optionen siehe Formblatt PCT/ISA/220.

Name und Postanschrift der
Internationalen Recherchenbehörde

 Europäisches Patentamt
D-80298 München
Tel. +49 89 2399 - 0
Fax: +49 89 2399 - 4465

Datum der Fertigstellung
dieses Bescheids

siehe Formular
PCT/ISA/210

Bevollmächtigter Bediensteter

Wiedemann, Eric
Tel. +49 89 2399-0



Feld Nr. I Grundlage des Bescheids

1. Hinsichtlich der **Sprache** beruht der Bescheid auf
 - ☒ der internationalen Anmeldung in der Sprache, in der sie eingereicht wurde.
 - ☐ einer Übersetzung der internationalen Anmeldung in die folgende Sprache , bei der es sich um die Sprache der Übersetzung handelt, die für die Zwecke der internationalen Recherche eingereicht worden ist (Regeln 12.3 a) und 23.1 b)).
2. ☐ Dieser Bescheid wurde erstellt unter Berücksichtigung der **Berichtigung eines offensichtlichen Fehlers**, die nach Regel 91 von dieser Behörde genehmigt wurde bzw. dieser Behörde mitgeteilt wurde (Regel 43*bis*.1 a)).
3. ☐ Hinsichtlich der **Nucleotid- und/oder Aminosäuresequenz**, die in der internationalen Anmeldung offenbart wurde, ist der Bescheid auf der Grundlage eines Sequenzprotokolls erstellt worden, das
 - a) ☐ im Anmeldezeitpunkt Bestandteil der internationalen Anmeldung war und
 - ☐ in Form einer Textdatei gemäß Anhang C/ST.25 vorlag.
 - ☐ in Papierform oder in Form einer Bilddatei vorlag.
 - b) ☐ zusammen mit der internationalen Anmeldung gemäß Regel 13*ter*.1 a) PCT nur für die Zwecke der internationalen Recherche in Form einer Textdatei gemäß Anhang C/ST.25 eingereicht wurde.
 - c) ☐ nach dem internationalen Anmeldedatum nur für die Zwecke der internationalen Recherche eingereicht wurde, und zwar
 - ☐ in Form einer Textdatei gemäß Anhang C/ST.25 (Regel 13*ter*.1 a)).
 - ☐ in Papierform oder in Form einer Bilddatei (Regel 13*ter*.1 b) und Abschnitt 713 der Verwaltungsvorschriften).
4. ☐ In dem Fall, dass mehr als eine Version oder Kopie eines Sequenzprotokolls eingereicht wurde, wurden zusätzlich die erforderlichen Erklärungen eingereicht, dass die Informationen in den nachgereichten oder zusätzlichen Kopien denen entsprechen, die im Anmeldezeitpunkt Bestandteil der Anmeldung waren, bzw. dass sie nicht über den Offenbarungsgehalt der Anmeldung im Anmeldezeitpunkt hinausgehen.
5. Zusätzliche Bemerkungen:

**Feld Nr. V Begründete Feststellung nach Regel 43bis.1 a) i) hinsichtlich der Neuheit, der
erfinderischen Tätigkeit und der gewerblichen Anwendbarkeit; Unterlagen und Erklärungen zur
Stützung dieser Feststellung**

1. Feststellung

Neuheit	Ja: Ansprüche Nein: Ansprüche <u>1-16</u>
Erfinderische Tätigkeit	Ja: Ansprüche Nein: Ansprüche <u>1-16</u>
Gewerbliche Anwendbarkeit	Ja: Ansprüche: <u>1-16</u> Nein: Ansprüche:

2. Unterlagen und Erklärungen:

siehe Beiblatt

Feld Nr. VI Bestimmte angeführte Unterlagen

- Bestimmte veröffentlichte Unterlagen (Regeln 43bis.1 und 70.10)
und / oder
- Nicht-schriftliche Offenbarungen (Regeln 43bis.1 und 70.9)

siehe Formular 210

Zu Punkt V

Begründete Feststellung hinsichtlich der Neuheit, der erfinderischen Tätigkeit und der gewerblichen Anwendbarkeit; Unterlagen und Erklärungen zur Stützung dieser Feststellung

Es wird auf die folgenden Dokumente verwiesen:

- D1 DE 10 2011 110083 A1 (TECH UNI BRAUNSCHWEIG CAROLO WILHELMINA [DE]) 14. Februar 2013 (2013-02-14) in der Anmeldung erwähnt
- D2 WO 2010/102377 A1 (STEVENS WAYNE C [CA]) 16. September 2010 (2010-09-16)
- D3 DE 10 2012 024876 A1 (ELECTROCYCLING GMBH [DE]; VOLKSWAGEN AG [DE]) 26. Juni 2014 (2014-06-26) in der Anmeldung erwähnt
- D4 WO 2016/174156 A1 (LION ENG GMBH [DE]) 3. November 2016 (2016-11-03)

1. Neuheit

Die vorliegende Anmeldung erfüllt nicht die Erfordernisse des Artikels 33 (1) PCT, weil der Gegenstand der Ansprüche 1-16 nicht neu im Sinne des Artikels 33 (2) PCT ist.

a) Der vorliegende Anspruchssatz beinhaltet einen unabhängigen Anspruch bezogen auf ein Verfahren zum Behandeln gebrauchter Lithium Batterien (Anspruch 1) und einen unabhängigen Anspruch bezogen auf eine Batterie Verarbeitungsanlage (Anspruch 9) zur Durchführung des Verfahrens.

b) D1 wurde bereits vom Anmelder als Stand der Technik zitiert. Dokument D1 offenbart jedoch alle Merkmale der vorliegenden Ansprüche und wird somit als neuheitsschädlich betrachtet.

Dokument D1 offenbart in Absätzen 21, 22, 34-39 und Abbildung 1 ein Verfahren zum Behandeln gebrauchter Batterien (Lithium-Batterien) , mit den Schritten:

- (a) Zerkleinern der Batterien (Referenzzeichen 12 in Abbildung 1),
- (b) Inaktivieren des Zerkleinerungsguts durch Trocknen (80°C) des Zerkleinerungsguts unter Vakuum (Absätze 21, 22) zum Entfernen des Elektrolyts,
- (c) Abfüllen des inaktivierten Zerkleinerungsguts in einen Transportbehälter
- (d) Abtrennen von Hartteilen und oder Separieren von Aktivmaterial vom Träger, sodass eine Aktivmaterialfraktion und eine Trägerfraktion entsteht (Absatz 39).

Da 300mbar als kein besonders spezifisches oder tiefes Vakuum angesehen wird, wird davon ausgegangen, dass das Verfahren der D1 diese Drücke erzielt.

Zudem offenbart Dokument D1 in der Beschreibung und in Abbildung 1 eine Batterie-Verarbeitungsanlage zum Behandeln gebrauchter Batterien mit:

- (a) einer Zerkleinerungseinheit zum Zerkleinern der Batterien (Referenzzeichen 12 in Abbildung 1)
- (b) einer Inaktivierungsvorrichtung zum Inaktivieren des Zerkleinerungsguts (28) wobei die Inaktivierungsvorrichtung eine Trockenvorrichtung (28) umfasst
- (c) die Batterie-Verarbeitungsanlage eine Vakuumanlage (32), die mit der Trockenvorrichtung zum Erzeugen eines Vakuums in der Trockenvorrichtung verbunden ist, aufweist
- (d) einer Abfüllvorrichtung und eine
- (e) eine Hartmetallabtrennvorrichtung und eine Leichtfraktionsabtrennvorrichtung, sowie eine Separiervorrichtung zum Separieren von Aktivmaterial vom Träger durch Luftstrahlsieben (Absatz 39).

Des Weiteren wird angenommen, dass die Anlage so ausgelegt ist Vakuum bis 10mbar zu erzeugen, was ebenfalls im vorliegenden technischen Gebiet kein ungewöhnlich niedriges Vakuum ist.

2. Erfinderische Tätigkeit

Der Gegenstand der Ansprüche 1-16 beruht nicht auf einer erfinderischen Tätigkeit im Sinne des Artikels 33 (3) PCT.

a) Dokument D1 wird als nächstliegender Stand der Technik gesehen, siehe Punkt 1.

b) Das zu lösende technische Problem wird darin gesehen eine alternatives Verfahren sowie eine alternative Bearbeitungsanlage bereitzustellen, die Lithium Batterien sicher und einfach weiterverarbeitbar macht.

c) Dokument D2 offenbart in den Abbildungen 1 und 2 ein Verfahren und eine Batterie-Verarbeitungsanlage zum Behandeln gebrauchter Batterien, mit den folgenden Merkmalen:

(a) eine Zerkleinerungseinheit zum Zerkleinern der Batterien (Absatz 15)

(b) eine Inaktivierungsvorrichtung zum Inaktivieren des Zerkleinerungsguts (Absatz 16) mittels Trocknung unter Vakuum (Absatz 19 und Referenzzeichen 48 in Abbildung 1).

(c) Abfüllen des inaktivierten Zerkleinerungsguts in einen Transportbehälter

(d) Trennvorrichtung zum Abtrennen von Hartteilen und oder Separieren von Aktivmaterial vom Träger (Absatz 25).

d) Dokument D3 offenbart ein System und ein Verfahren zum Überführen transportkritischer Elektrolytzellen in einen transportfähigen Zustand.

(a) Dabei umfasst die Vorrichtung eine Zerkleinerungsvorrichtung (200) zum Zerkleinern der Elektrolytzellen.

(b) eine Inertgaszufuhrvorrichtung (300) im Zerkleinerungsraum und in der Materialaustragvorrichtung (400), eine Gasabsaugvorrichtung (240)

(c) die Materialaustragvorrichtung (400) besitzt eine Öffnung zur gasdichten Anbringung einer transportablen Auffangvorrichtung (500) zum Auffangen zerkleinerter Zellen umfasst.

d) Dokumente D2 und D3 offenbaren Verfahren und Vorrichtungen, die denen der vorliegenden Anmeldung gleichzusetzen sind. Einzelne Parameter sind jedoch nicht offenbart, liegen aber im Bereich der technischen Standards ohne aufwendiges Equipment oder der Notwendigkeit einer erfinderischen Tätigkeit.

Zu Punkt VI

Bestimmte angeführte Unterlagen

Bestimmte veröffentlichte Unterlagen

Anmeldenr. Patentnr.	Veröffentlic hungsdatum (Tag/Monat/ Jahr)	Anmeldedatum (Tag/Monat/ Jahr)	Prioritätsdatum (zu Recht beansprucht) (Tag/Monat/Jahr)
WO 2016/174156 A1	03.11.2003	28.04.2016	28.04.2015

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44bis)

Applicant's or agent's file reference 6110-004 PCT-1	FOR FURTHER ACTION	See item 4 below
International application No. PCT/EP2017/076113	International filing date (<i>day/month/year</i>) 12 October 2017 (12.10.2017)	Priority date (<i>day/month/year</i>) 20 October 2016 (20.10.2016)
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237		
Applicant DUESENFELD GMBH		

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2.	This REPORT consists of a total of 7 sheets, including this cover sheet.																								
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4.	The International Bureau will communicate this report to designated Offices in accordance with Rules 44bis.3(c) and 93bis.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44bis .2).																								

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. +41 22 338 82 70	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Date of issuance of this report 23 April 2019 (23.04.2019)</td> <td style="width: 50%;">Authorized officer</td> </tr> <tr> <td colspan="2" style="text-align: center; padding: 10px;">Nora Lindner</td> </tr> <tr> <td colspan="2">e-mail: pct.team5@wipo.int</td> </tr> </table>	Date of issuance of this report 23 April 2019 (23.04.2019)	Authorized officer	Nora Lindner		e-mail: pct.team5@wipo.int	
Date of issuance of this report 23 April 2019 (23.04.2019)	Authorized officer						
Nora Lindner							
e-mail: pct.team5@wipo.int							

Form PCT/IB/373 (January 2004)

From the INTERNATIONAL SEARCHING AUTHORITY

To:

PCTWRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY(PCT Rule 43*bis*.1)

Date of mailing

(day/month/year)

28 November 2017

Applicant's or agent's file reference

6110-004 PCT-1**FOR FURTHER ACTION**

See paragraph 2 below

International application No.

PCT/EP2017/076113

International filing date (day/month/year)

12 October 2017

Priority date (day/month/year)

20 October 2016

International Patent Classification (IPC) or both national classification and IPC

H01M 6/52(2006.01)i; C22B 7/00(2006.01)i; C22B 15/00(2006.01)i; C22B 21/00(2006.01)i;**H01M 10/54(2006.01)i**

Applicant

DUESENFELD GMBH

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- ☒ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/

Date of completion of this opinion

Authorized officer

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/EP2017/076113

Box No. V

Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step and industrial applicability;
citations and explanations supporting such statement

1. Statement

Novelty (N)

Claims _____ YES

Claims 1-16 NO

Inventive step (IS)

Claims _____ YES

Claims 1-16 NO

Industrial applicability (IA)

Claims 1-16 YES

Claims _____ NO

2. Citations and explanations :

See Supplemental Box

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/EP2017/076113

Box No. VI **Certain documents cited**1. Certain published documents (Rules 43*bis*.1 and 70.10)

Application No. Patent No.	Publication date (day/month/year)	Filing date (day/month/year)	Priority date (valid claim) (day/month/year)
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2. Non-written disclosures (Rules 43*bis*.1 and 70.9)

Kind of non-written disclosure	Date of non-written disclosure (day/month/year)	Date of written disclosure referring to non-written disclosure (day/month/year)
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**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/EP2017/076113**Supplemental Box**

In case the space in any of the preceding boxes is not sufficient.
Continuation of:

Box V**Reasoned statement with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement**

Reference is made to the following documents:

D1	DE 10 2011 110083 A1 (TECH UNI BRAUNSCHWEIG CAROLO WILHELMINA [DE]) 14 February 2013 (2013-02-14), cited in the application
D2	WO 2010/102377 A1 (STEVENS WAYNE C [CA]) 16 September 2010 (2010-09-16)
D3	DE 10 2012 024876 A1 (ELECTROCYCLING GMBH [DE]; VOLKSWAGEN AG [DE]) 26 June 2014 (2014-06-26), cited in the application
D4	WO 2016/174156 A1 (LION ENG GMBH [DE]) 3 November 2016 (2016-11-03)

1. Novelty

The present application fails to meet the requirements of PCT Article 33(1) because the subject matter of claims 1-16 is not novel (PCT Article 33(2)).

a) The present set of claims contains an independent claim relating to a method for treating used lithium batteries (claim 1) and an independent claim relating to the battery processing system (9) for performing the method.

b) D1 has already been cited by the applicant as the prior art. D1 discloses all the features of the present claims, however, and is therefore considered prejudicial to novelty.

D1, in paragraphs 21, 22 and 34-39 and figure 1, discloses a method for the handling of used batteries (lithium batteries), having the steps:

- (a) comminuting the batteries (reference sign 12 in figure 1),
- (b) deactivation of the comminuted material by drying in a vacuum (paragraphs 21 and 22) for the purposes of removing the electrolyte, and
- (c) adding the deactivated comminuted material to a transport container
- (d) separating hard parts and/or separating active material from the carrier, such that an active material fraction and a carrier fraction are formed (paragraph 39).

since 300 mbar is not considered a very specific or low vacuum, it is assumed that the method in D1 yields these pressures.

Moreover, the description in figure 1 in D1 discloses a battery processing system for handling used batteries with:

- (a) a comminution unit for comminuting the batteries (reference sign 12 in figure 1),
- (b) a deactivation device for deactivating the comminuted material (28), wherein the deactivation device comprises a drying device (28),
- (c) the battery processing system has a vacuum system (32) which is connected to the drying device for the purposes of generating a vacuum in the drying device

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/EP2017/076113**Supplemental Box**

- (d) a filling device, and
- (e) a hard-metal separating device and a light-fraction separating device,
as well as a separating device for separating active material from the carrier by an air jet sieve (paragraph 39).

Moreover it is assumed that the system is designed to generate a vacuum of 10 mbar which is also not an unusually low vacuum within the present technical field.

2. Inventive step

The subject matter of claims 1-16 does not involve an inventive step (PCT Article 33(3)).

- a) D1 is considered the closest prior art (see paragraph 1).
- b) The technical problem to be solved is considered that of providing an alternative method and an alternative processing system that makes lithium batteries safe and easy to process further.
- c) Figures 1 and 2 in D2 disclose a method and battery processing system for handling used batteries with the following features:
- (a) a comminution unit for comminuting the batteries (paragraph 15),
- (b) a deactivation device for deactivating the comminuted material (paragraph 16) by drying in a vacuum (paragraph 19 and reference sign 48 in figure 1).
- (c) adding the deactivated comminuted material to a transport container
- (d) a separating device for separating hard parts and/or separating active material from the carrier (paragraph 25).
- d) D3 discloses a system and a method for making electrolyte cells which are hazardous to transport transportable.
- (a) The device comprises a comminuting device (200) for comminuting the electrolyte cells.
- (b) an inert gas supply device (300) in the comminution chamber and the material discharge device (400), a gas suction device (240)
- (c) the material discharge device (400) possesses an opening for the gas-tight attachment of a transportable collection device (500) for collecting comminuted cells.
- d) D2 and D3 disclose methods and devices that are equivalent to those from the present application. Although some parameters are not disclosed, they fall under the technical standard without complex equipment or do not require an inventive step.

Box VI**Certain documents cited**

Certain published documents

Application no. Patent no.	Publication date (day/month/year)	Filing date (day/month/year)	Priority date (<i>valid claim</i>) (day/month/year)
WO 2016/174156 A1	03-11-2003	28-04-2016	28-04-2015