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UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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*Ex parte* JIANG FAN and DENGGUO WU

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Appeal 2019-003938
Application 14/952,755
Technology Center 1700

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Before DONNA M. PRAISS, MICHELLE N. ANKENBRAND, and JEFFREY R. SNAY, *Administrative Patent Judges.*

PRAISS, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellant[1] appeals under 35 U.S.C. § 134(a) from the Examiner's decision rejecting claims 1–24. We have jurisdiction over the appeal under 35 U.S.C. § 6(b).

We AFFIRM.

[1] We use the word "Appellant" to refer to "applicant" as defined in 37 C.F.R. § 1.42. Appellant identifies American Lithium Energy Corporation as the real party in interest. Appeal Brief ("Appeal Br.") filed Nov. 9, 2018, 2.

## STATEMENT OF THE CASE[2]

The invention "relates to an internal current limiter or current interrupter used to protect a battery in the event of an internal short circuit or overcharge leads to thermal runaway." Spec. ¶ 2. The Specification discloses dangerous conditions can pose a safety hazard for high energy density rechargeable batteries, such as lithium-ion batteries, because the batteries may suffer thermal runaway, cell rupture, and even combustion if overcharged or overheated. *Id.* ¶¶ 4–5. In view of this, the Specification discloses a high energy density rechargeable metal-ion battery that includes, among other things, an interrupt layer that, upon exposure to a temperature at or above an upper temperature safety limit (i.e., activated), interrupts current within the battery before thermal runaway takes hold. *Id.* ¶¶ 15–16. When unactivated, the interrupt layer is laminated between a separator and a current collector. *Id.* ¶ 16. The interrupt layer can include a temperature sensitive decomposable component that, upon exposure to the temperature at or above the upper temperature safety limit, evolves a gas for delaminating the interrupt layer. *Id.*

Claim 1, reproduced below from the Claims Appendix to the Appeal Brief, is illustrative (disputed limitations are italicized).

1. A high energy density rechargeable metal-ion battery comprising:

an anode energy layer;

a cathode energy layer;

a separator for separating the anode energy layer from the

[2] Our Decision also refers to the Specification ("Spec.") filed Nov. 25, 2015, the Non-Final Office Action ("Non-Final Act.") dated June 14, 2018, the Examiner's Answer ("Ans.") dated Feb. 6, 2019, and the Reply Brief ("Reply Br.") filed Apr. 8, 2019.

cathode energy layer;

at least one current collector for transferring electrons to and from either the anode or cathode energy layer, the high energy density rechargeable metal-ion battery having an upper temperature safety limit for avoiding thermal runaway; and

an interrupt layer activatable for interrupting current through the high energy density rechargeable metal-ion battery upon exposure to a temperature at and/or above the upper temperature safety limit, the interrupt layer interposed between the separator and one of the current collectors, the interrupt layer, when unactivated, being laminated between the separator and the one of the current collectors for conducting current there through, the interrupt layer, when activated, being delaminated from the one of the current collectors for interrupting the current through the high energy density rechargeable metal-ion battery, *the interrupt layer including a ceramic powder that undergoes a chemical reaction upon exposure to the temperature at and/or above the upper temperature safety limit, the ceramic powder evolving a gas in response to the chemical reaction, the evolved gas delaminating the interrupt layer from the one of the current collectors, the delamination separating the interrupt layer from the one of the current collectors*, and the separation of the interrupt layer from the one of the current collectors interrupting the current through the high energy density metal-ion battery,

wherein the activation of the interrupt layer avoids thermal runaway by at least interrupting the current in the high energy density rechargeable metal-ion battery in response to being exposed to the temperature at and/or above the upper temperature safety limit.

Appeal Br. 25–26 (Claims Appendix).

Independent claim 23 recites "[a] method for interrupting current within a high energy density rechargeable metal-ion battery upon exposure to a temperature at and/or above an upper temperature safety limit for avoiding thermal runaway, the method comprising" exposing the battery to

the temperature at and/or above the upper temperature safety limit, wherein the battery includes, among other things, an interrupt layer similar to claim 1. Each remaining claim on appeal depends from claim 1.

## ANALYSIS

We review the appealed rejections for error based upon the issues Appellant identifies and in light of the arguments and evidence produced thereon. *Ex parte Frye*, 94 USPQ2d 1072, 1075 (BPAI 2010) (precedential) (*cited with approval in In re Jung*, 637 F.3d 1356, 1365 (Fed. Cir. 2011) ("[I]t has long been the Board's practice to require an applicant to identify the alleged error in the examiner's rejections.")). After considering the argued claims in light of the case law presented in this Appeal and each of Appellant's arguments, we are not persuaded of reversible error in the Examiner's rejections.

The Examiner rejects claims 1–24 under 35 U.S.C. § 103 as unpatentable over Andersen[3] in view of Xie.[4] Non-Final Act. 2–5; Ans. 3–6.

Appellant argues the claims together. Appeal Br. 11–23. Therefore, we confine our discussion to claim 1, which we select as representative. Claims 2–24 stand or fall with claim 1. *See* 37 C.F.R. § 41.37(c)(1)(iv).

The Examiner finds Andersen discloses a lithium ion battery including, among other things, a primer layer between a current collector and an energy layer. Ans. 3–4. The Examiner finds Andersen's primer layer includes a blowing agent for decomposing to a gas when the

[3] Andersen, WO 2004/049494 A1, published June 10, 2004 ("Andersen").
[4] Xie, US 2008/0292939 A1, published Nov. 27, 2008 ("Xie").

temperature of the battery rises to or above a runaway temperature. *Id.* at 4. The Examiner finds the gas causes the energy layer to expand, causes an increase in resistance, and interrupts current flowing through the battery, which avoids thermal runaway. *Id.* The Examiner finds Andersen's current interruption and similar structure to Appellant's interrupt layer demonstrate that Andersen's gas generation causes delamination. *Id.*

The Examiner finds Andersen does not disclose ceramic powder as a blowing agent, but "Xie teaches that ceramics were common blowing agents for this use." *Id.* The Examiner concludes it would have been obvious for one of ordinary skill in the art to have modified Andersen in view of Xie to use a ceramic blowing agent because this would have been the use of a known material for its intended purpose. *Id.*

Appellant contends Andersen increases the primer layer's porosity to interrupt current flow through a battery, which is a "different mechanism than an interrupt layer separating into constituent layers to cause the interruption of current flowing through the battery cell." Appeal Br. 15. Appellant argues one of ordinary skill in the art would have appreciated that these mechanisms are not analogous and asserts the Examiner ignores the plain meaning of "delamination" (i.e., "separation into constituent layers"), which "requires an interrupt layer to separate into multiple layers and detach from the current collector coupled to the interrupt layer." *Id.* at 15–16 (citing the Merriam-Webster dictionary). According to Appellant, "Andersen is merely increasing the quantity of empty space within the primer layer and not separating the primer layer into multiple constituent layers." *Id.* at 16 (emphasis omitted). Appellant contends the Examiner erred in finding Andersen's primer layer would necessarily lead to at least a

degree of delamination because Andersen's increase in porosity merely "corresponds to an increase in the quantity of empty space within the primer layer." *Id.* at 16–17.

Appellant's arguments are unpersuasive of error because the preponderance of the evidence in this appeal record supports the Examiner's findings.

Andersen's "invention relates to the protection of electrochemical cells against the effects of excessive heat" due to an external source or the generation of excessive internal heat. Andersen 1:3–4, 1:20–23. Andersen teaches blowing agents are known that are capable of evolving gas upon exposure to an elevated temperature. *Id.* at 4:15–19. Andersen discloses an electrochemical cell including a negative electrode, a positive electrode, and an electrolyte wherein at least one of the electrodes includes a blowing agent, which may be dispersed within the material of the electrode or included in a primer layer interposed between the electrode and a current collector. *Id.* at 4:32–5:2, 5:11–13.

Andersen also teaches gas evolved from the blowing agent "has the effect of making the electrode more porous and possibly even of disrupting the electrode," increases the thickness of the electrode, increases "the impedance of the cell and the discharge current is thereby limited," and "[t]he cell is thus effectively deactivated on overheating." *Id.* at 5:13–19. Thus, Anderson discloses dispersing blowing agent specifically in a primer layer, which, once activated at an elevated temperature to evolve gas, effectively separates the interrupt layer from the current collector, as claim 1 requires. Although Andersen does not explicitly describe the result of the primer layer's activation as "being delaminated" as claim 1 recites, these

disclosures support the Examiner's finding that Andersen's primer layer, once activated at an elevated temperature to evolve gas, delaminates an interrupt layer from a current collector, thus separating the interrupt layer from the current collector, as claim 1 recites.

Appellant asserts that "'delamination' refers to a type of structural failure in which a material separates into multiple constituent layers" (Appeal Br. 12), but does not sufficiently explain why a blowing agent dispersed and activated in Andersen's primer layer specifically would not separate that layer from the adjacent layers in Andersen's structure. Even accepting Appellant's definition of delamination, Appellant does not explain adequately why Andersen's increase in porosity of the primer layer is not capable of accomplishing to any degree or extent the delamination and separation structural effect claim 1 requires. As noted above, Appellant argues that Andersen's blowing agent increases the quantity of empty space *within* the primer layer. The Examiner explains in the Answer that Andersen's blowing agent would be located at the surface of the primer layer, which would be at the boundary between the primer layer and the current collector, and gas from the blowing agent at the boundary would meet Appellant's definition for delamination. Ans. 7. Appellant's arguments do not adequately address this reasoning or otherwise identify a reversible error in the Examiner's rejection.

Appellant further asserts that the combination of Andersen and Xie does not disclose or suggest the use of a ceramic powder to form claim 1's interrupt layer because Andersen does not disclose or suggest using a ceramic powder in its primer layer and, although "Xie describes using ceramic powder to form powders to form porous hydrophilic structures atop

its current collectors," "Xie is silent on adding ceramic powder to an interrupt layer to cause the interrupt layer to delaminate in response to excessive heat." Appeal Br. 18 (emphases omitted). In addition, Appellant contends: (1) there would have been a lack of reason to combine because the proposed combination would have required substantial modification, (2) one of ordinary skill in the art would not have considered Xie when contemplating modifications to Andersen, (3) the resulting combination would have been inoperable as it would have resulted in ceramic powder that was already sacrificed before use, and (4) the rejection fails to address the fact that Andersen and Xie do not disclose or suggest an interrupt layer with a ceramic powder that causes the interrupt layer to delaminate into multiple constituent layers and interrupt the current flow of a battery. *Id.* at 18–23; Reply Br. 2–3.

Appellant's arguments are not persuasive because they do not consider what the combined teachings of Andersen and Xie would have suggested to one of ordinary skill in the art. The test for obviousness is not that the claimed invention be expressly suggested in any one or all of the references, but what the combined teachings of the references would have suggested to one of ordinary skill in the art. *In re Keller*, 642 F.2d 413, 425 (CCPA 1981).

Andersen discloses a number of factors (e.g., reaction temperature and compatibility with other materials, manufacturing processes, and storage practices) influence the choice of blowing agent in a particular case and such a choice "will generally be made from amongst the materials already known for use as blowing agents in the plastics industry." Andersen 5:21–27, 6:16–

18. As a result, Andersen generally discloses known blowing agents may be used in its primer layer.

As noted above, the Examiner concludes the proposed modification of Andersen in view of Xie would have been the obvious use of a known material for its intended purpose. Ans. 4, 8 (citing MPEP § 2144.07). *In re Leshin* also describes this principle. 277 F.2d 197, 199 (CCPA 1960) ("Mere selection of known plastics to make a container-dispenser of a type made of plastics prior to the invention, the selection of the plastics being on the basis of suitability for the intended use, would be entirely obvious"). Appellant does not dispute the Examiner's finding that Xie discloses a ceramic blowing agent. Xie also teaches that its blowing agents can be used to create porous structures, including structures made from a polymer. Xie ¶¶ 11, 13. As a result, the record supports the Examiner's rationale that using Xie's blowing agent in Andersen's primer layer would have been an obvious use of a known material for its intended use (i.e., to function as a blowing agent that evolves gas to create a porous structure, such as Andersen's primer layer after activation of the blowing agent).

For these reasons and those the Examiner provides, we uphold the Examiner's rejection of claims 1–24 under 35 U.S.C. § 103 as obvious over Andersen and Xie.

## DECISION

Upon consideration of the record, and for the reasons given above, in the Non-Final Office Action, and in the Examiner's Answer, the decision of the Examiner rejecting claims 1–24 under 35 U.S.C. § 103 as obvious over Andersen in view of Xie is *affirmed*.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1).

## DECISION SUMMARY

In summary:

| Claims Rejected | 35 U.S.C. § | References/Basis | Affirmed | Reversed |
|---|---|---|---|---|
| 1–24 | 103 | Andersen, Xie | 1–24 | |
| **Overall Outcome** | | | 1–24 | |

AFFIRMED