UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ZHUHAI COSMX BATTERY CO., LTD.
Petitioner

v.

NINGDE AMPEREX TECHNOLOGY LIMITED,
Patent Owner

Case IPR2025-00389
U.S. Patent No. 11,923,498 B2

PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 11,923,498

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PETITIONER'S EXHIBIT LIST

Exhibit #	*Description*
1001	U.S. Patent No. 11,923,498 B2 to Tao ("the '498 patent")
1002	Prosecution File History of U.S. Patent No. 11,923,498 B2 ("'498 File History")
1003	Declaration of Ulrich von Sacken, Ph.D
1004	Curriculum Vitae of Ulrich von Sacken, Ph.D
1005	U.S. Patent Pub. No. 2011/0111276 to Sato *et al.*
1006	Japanese Patent Pub. No. 2000-67907 to Takemura *et al.*
1007	U.S. Patent Pub. No. 2011/0104539 to Oh *et al.*
1008	Japanese Patent Pub. No. 2010-55906 to Kobayashi *et al.*
1009	Japanese Patent Pub. No. 10-326629 to Maejima *et al*.
1010	Japanese Patent Pub. No. 11-26008 to Yamauchi *et al*.
1011	Japanese Patent Pub. No. 2000-285902 to Mizutani *et al.*
1012	Japanese Patent Pub. No. 2003-068271 to Nakamura *et al*.
1013	Japanese Patent Pub. No. 2007-165224 to Yoneda *et al*.
1014	U.S. Patent Pub. No. 2006-0051662 to Kwak *et al.*
1015	U.S. Patent Pub. No. 2007-0172736 to Fujikawa *et al*.
1016	Japanese Patent Pub. No. 2008-171593 to Aoki *et al*.
1017	U.S. Patent Pub. No. 2010-0035144 to Oh *et al*.
1018	Korean Patent Pub. No. 2013-0085202 to Lee *et al.*
1019	Agubra *et al.*, "Lithium Ion Battery Anode Aging Mechanisms"
1020	Smart *et al.*, "Effects of Electrolyte Composition on Lithium Plating in Lithium-Ion Cells"
1021	Ratnakumar *et al.*, "Lithium Plating Behavior in Lithium-ion Cells"

Exhibit #	***Description***
1022	Eberman *et al.*, "Material and Design Options for Avoiding Lithium-Plating during Charging"
1023	Wen *et al*., "A Review on Lithium-Ion Battery Safety Issues: Existing Problems and Possible Solutions"
1024	Complaint and Exhibit N filed in *Ningde Amperex Technology Ltd. V. Zhuhai CosMX Battery Co., Ltd.*, Case No. 2:24-ccv-728 (E.D. Tex.)
1025	Unopposed Application for Extension of Time to Answer Complaint, Ningde Amperex Tech. Ltd. v. Zhuhai CosMX Battery Co., No. 2:24-cv-00728-JRG (E.D. Tex. Dec. 4, 2024), ECF 16

I. INTRODUCTION

Petitioner Zhuhai CosMX Battery Co., Ltd. ("Petitioner" or "CosMX") requests *inter partes* review ("IPR") and cancellation of claims 1-22 of U.S. Patent No. 11,923,498 ("the '498 patent") to Ningde Amperex Technology Ltd ("Patent Owner"). These claims are unpatentable under 35 U.S.C. § 103(a) in view of the prior art.

The '498 patent claims lithium-ion batteries found in cell phones, laptops, or motors. Like all lithium-ion batteries, the claimed batteries have an anode (negative electrode), cathode (positive electrode), and a separator in between. The '498 patent purports to improve energy density and safety performance by providing recesses in the electrodes' active material layers to connect the battery's leads to exposed portion of the electrodes' current collector. But this was well known in the prior art, as was covering recesses and lead connections with insulating layers.

The alleged invention stems from a common arrangement of insulating layers with known benefits—a first insulating layer on a top surface of the positive lead and a second insulating layer on the positive active material layer opposite the second recess of the negative electrode to prevent lithium plating.

Insulating positive active material from the negative electrode's lead connection and exposed metal was a well-known technique for preventing lithium

plating, as evidenced herein. EX1003, ¶¶108-113, 392-395. Thus, claims 1-22 would have been obvious to a skilled artisan. EX1003, ¶26.

II. GROUNDS FOR STANDING (37 C.F.R. § 42.104(A))

The '498 patent is available for IPR. Petitioner is not barred or estopped from requesting IPR.

III. PRECISE RELIEF REQUESTED (37 C.F.R. § 42.22(a) AND IDENTIFICATION OF CHALLENGE (37 C.F.R. § 42.104(b))

The Board should institute IPR under 35 U.S.C. §§ 311-319 and 37 C.F.R. §§ 42.1-.80 and 42.100-42.123, and find all claims of the '498 patent unpatentable under AIA 35 U.S.C. § 103(a) based on the following combinations:

Ground	Combination	Claims
1	Sato-Takemura	1-3, 6, 8, 17, 19
2	Sato-Takemura-Nakamura	4, 5, 7, 18
3	Sato-Takemura-Oh-539-Oh-144	20, 22
4	Sato-Takemura-Kobayashi	9-11, 14, 16
5	Sato-Takemura-Kobayashi-Nakamura	12, 13, 15
6	Sato-Takemura-Kobayashi-Oh-539-Oh-144	21
7	Takemura-Oh-539-Kobayashi	1-3, 9-11, 17
8	Takemura-Oh-539-Kobayashi-Oh-144	20-22

The '498 patent claims priority to CN 201420030319.4, filed January 17, 2014, its earliest possible priority date. All applied art qualifies under at least § 102(a)(1):

- **Sato, US 2011/0111276**, published May 12, 2011
- **Takemura, JP 2000/067907**, published March 3, 2000
- **Nakamura, JP 2003-068271**, published March 7, 2003
- **Kobayashi, JP 2010-055906**, published March 11, 2010
- **Oh-539, US 2011/0104539**, published May 5, 2011
- **Oh-144, US 2010/0035144**, published February 11, 2010.

This Petition is supported by the expert declaration of Ulrich von Sacken, Ph.D., P.E., an expert in the field of battery materials, construction, and operation; manufacture; testing; and reliability and safety. EX1003, ¶¶1-26.

IV. PERSON OF ORDINARY SKILL IN THE ART ("POSA")

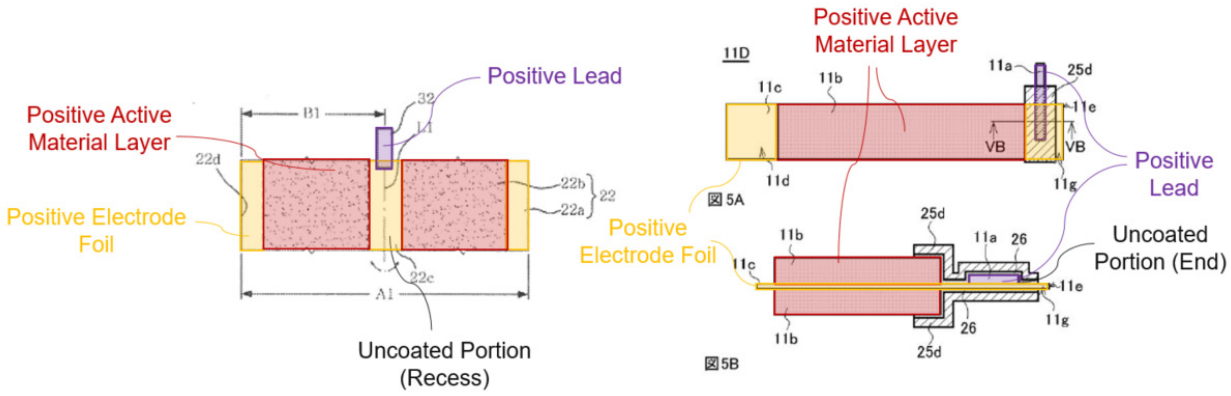
A POSA is presumed to be aware of all pertinent art. The POSA possesses the "understandings and knowledge reflected in the prior art" and thinks along conventional wisdom. *See Abbott Labs. v. Andrx Pharm., Inc.*, 452 F.3d 1331, 1336 (Fed. Cir. 2006).

For the '498 patent, a POSA at the time of the alleged invention would have had a Bachelor's Degree in Physics or an Engineering field relevant to battery technology (e.g., Electrical or Mechanical Engineering) and at least two years of industry experience in lithium-ion battery manufacturing and/or design. EX1003, ¶¶27-30.

V. BACKGROUND OF THE ART

Conventional lithium-ion batteries have a cathode and an anode, immersed in an electrolyte and separated by a separator. EX1003, ¶31.

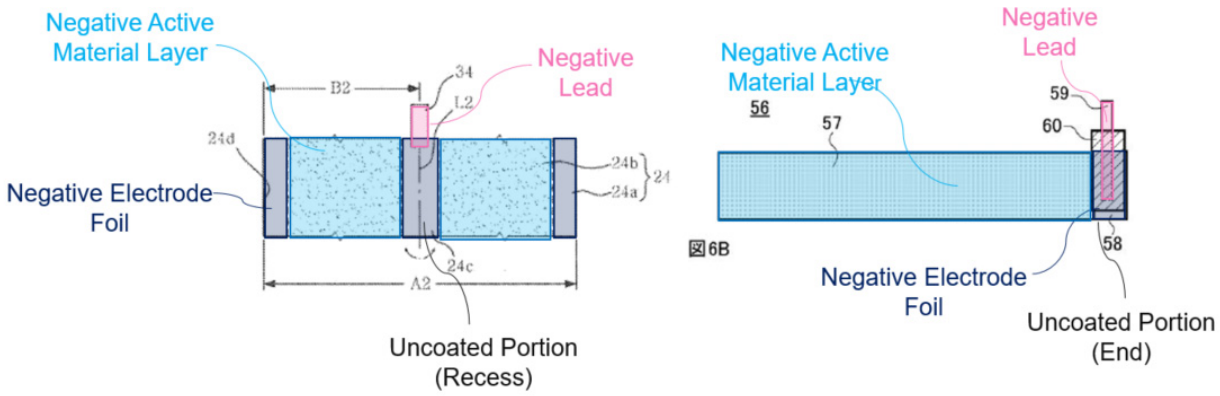
The cathode typically includes a positive electrode foil (positive electrode current collector) coated with a positive active material, such as lithium composite oxide. EX1003, ¶32. A positive electrode lead is attached to the positive electrode plate at a portion of the positive electrode that is not coated with active material (an "exposed" portion). *Id.* The positive electrode lead can be attached at an uncoated end or at an uncoated recess along the positive electrode. *Id.* Example conventional positive electrode constructions are below.



EX1007, FIG. 2 (annotated); EX1008, FIG. 5 (annotated).

The anode typically includes a negative electrode foil (negative electrode current collector) coated with a negative active material such as graphite. EX1003, ¶33. A negative electrode lead is attached to the negative electrode plate at a portion that is not coated with active material. *Id.* The negative electrode can be attached at

an uncoated end or at an uncoated recess along the negative electrode. *Id*. Example conventional negative electrode constructions are below.



EX1007, FIG. 3 (annotated); EX1008, FIG. 6B (annotated).

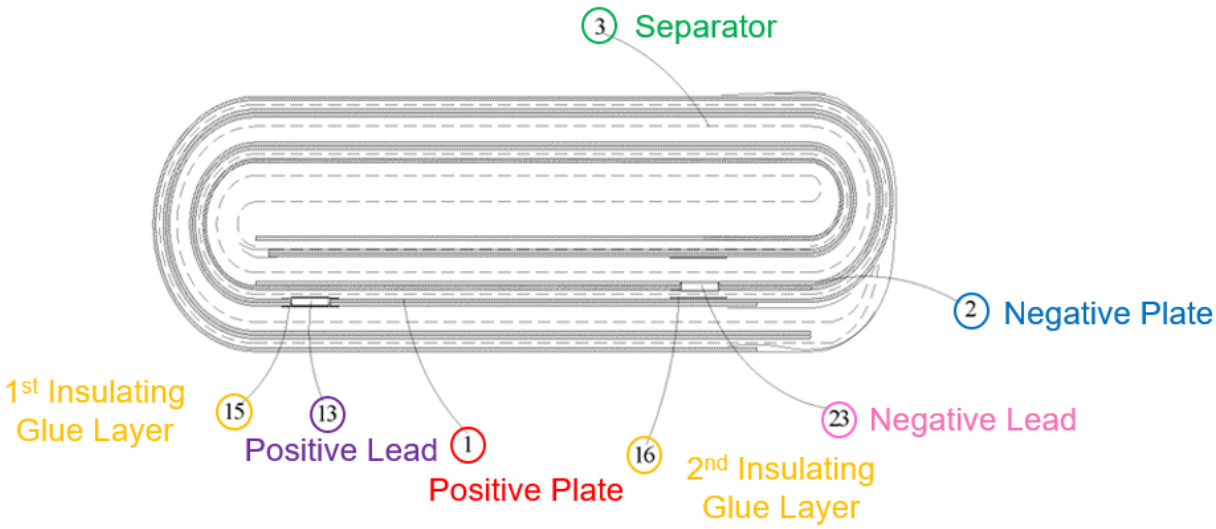
Lithium-ion batteries have a known risk of overheating or failing if internal components are not properly protected from adverse chemical and/or mechanical issues. EX1003, ¶¶35-38. For example, unintended lithium plating, deposition, and precipitation (collectively, "lithium plating") can cause short-circuiting between the cathode and anode. EX1009, ¶[0002]; EX1016, ¶[0010]; EX1019, 1318; EX1021, 242; EX1022, 47; EX1023, 201. So, internal battery protective layers are employed so that battery components, e.g., electrode leads and active materials, function as intended, even under extreme conditions. *See generally*, EX1006; EX1008-EX1018. Internal battery protective layers are located at various positions within wound lithium-ion batteries to solve safety and performance problems such as short-circuiting, lithium plating, and undesirable thermal expansion. EX1003, ¶¶39-73.

VI. THE '498 PATENT

The '498 patent claims to have invented a lithium-ion battery that reduces the "occurrence of internal short circuit and lithium precipitation." EX1001, 3:57-65. The '498 patent employs a common technique—insulating a lead connection in a recess of the electrode's active material with an insulating layer—to address the well-known problems of lithium plating and short-circuiting. EX1001, 2:10-40; EX1003, ¶¶74-79. Many prior-art references addressed these common issues using the same solutions. EX1003, ¶78 (citing, e.g., EX1009, ¶¶[0007]-[0008], [0013]; EX1006, ¶[0008]; EX1011, ¶[0044]; EX1012, ¶¶[0052]-[0053]; EX1015, ¶¶[0017]-[0118]; EX1016, ¶[0028]; EX1008, ¶[0005]; EX1017, ¶¶[0037]-[0039]).

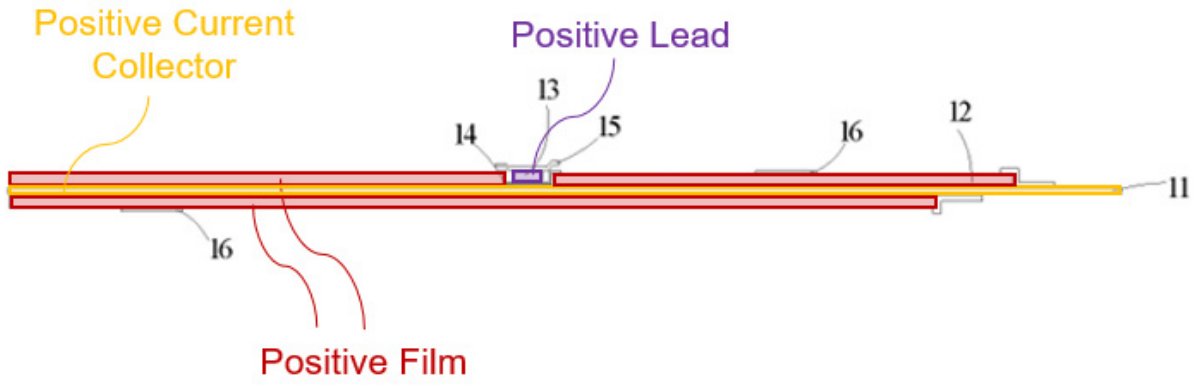
A. Specification

The '498 patent discloses a lithium-ion battery that "includes a positive plate 1, a negative plate 2, a separator 3 disposed between the positive plate 1 and the negative plate 2, and electrolyte." EX1001, 4:66-5:3; EX1003, ¶76.



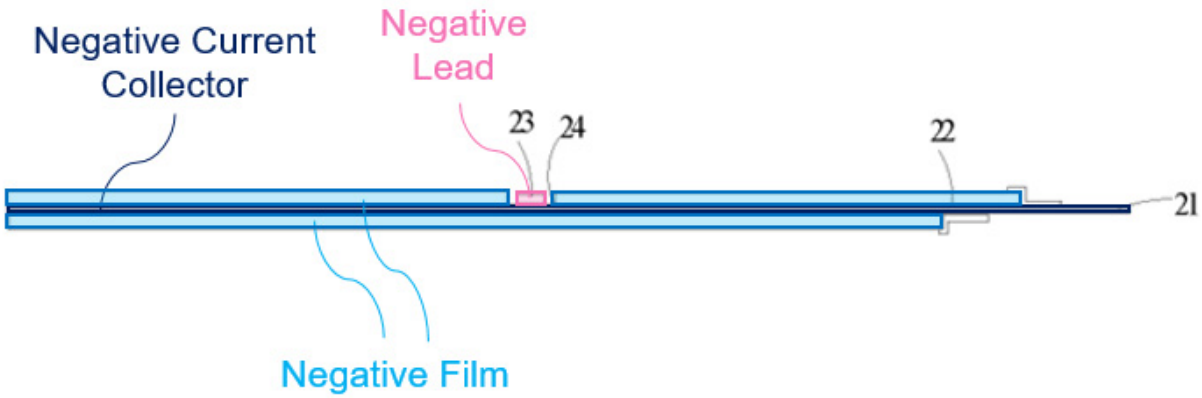
EX1001, FIG. 5 (annotated).

The "positive plate 1 includes a positive current collector 11, a positive film 12 provided on the positive current collector 11, and a positive lead 13," shown below. EX1001, 5:3-5. A portion of positive current collector 11 is exposed by "defin[ing] a first recess 14" in positive film 12, where positive lead 13 is "seated" on positive current collector 11. EX1001, 5:8-10; EX1003, ¶80.



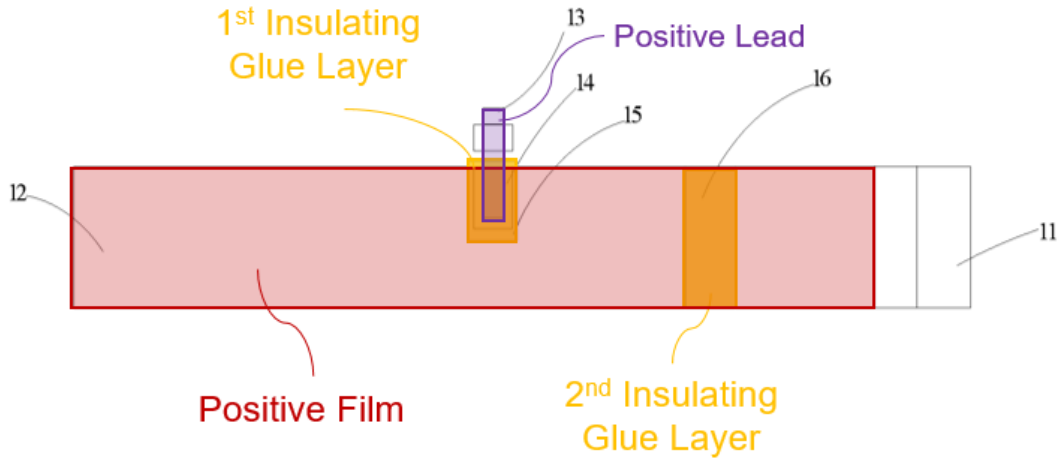
EX1001, FIG. 1 (annotated).

"[N]egative plate 2 includes a negative current collector 21, a negative film 22 provided on the negative current collector 21, and a negative lead 23," shown below. EX1001, 5:5-8. A portion of negative current collector 21 is also exposed by "defin[ing] a second recess 24" in negative film 22, where negative lead 23 is "seated" on negative current collector 21. EX1001, 5:8-10; EX1003, ¶81.



EX1001, FIG. 3 (annotated).

To prevent short-circuiting and lithium precipitation, the '498 patent describes pasting a first insulating layer 15 on the upper and lower surfaces of positive lead 13 and a second insulating layer 16 on the surface of positive film 12. EX1001, 3:57-65, 5:12-23. Second insulating layer 16 is applied opposite second recess 24 of negative plate 2 such that second insulating layer 16 is interposed between negative lead connection 23 and positive film 12, shown in Figure 5. EX1001, 5:12-23; EX1003, ¶¶78-83.



EX1001, FIG. 2 (annotated).

This technique of insulating the lead connections and exposed current collectors' exposed portions in lithium-ion batteries to prevent lithium precipitation/short-circuiting was well known. EX1003, ¶¶39-73.

B. Prosecution History

The application that issued as the '498 patent was filed as a Track 1 application on May 17, 2022. EX1002, 0051-53.

The Office issued three Office Actions before ultimately allowing the claims. EX1002, 0082-98, 0179-200, 0297-321. In its initial responses, Applicant replaced original claims 1-19 with new claims 20-39, and amended independent claims 20, 29, and 37 to recite "a surface of the positive electrode active material layer opposite to the second recess across the separator in a thickness direction of the positive plate and the negative plate is pasted with a second insulating glue layer." EX1002, 0167-75, 0271-83.

In the last Office Action, the Office applied JP 2007/165224 ("Atsuo") to address the added location of the recited "second insulating glue layer." EX1002, 0297-321. To overcome the rejection, Applicant filed a response, accompanied by a declaration from inventor Tao, arguing that Atsuo failed to disclose the recited location of the "second insulating glue layer." EX1002, 0380-405. Subsequently, the Office issued a Notice of Allowance, noting the cited art did not disclose "the insulating glue layer being applied to both active layers." EX1002, 0408-14; EX1003, ¶¶84-97.

VII. CLAIM CONSTRUCTION

In IPR, claims are "construed using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. 282(b)." 37 C.F.R. § 42.100(b). Claim terms must be given their ordinary and customary meaning as understood by a POSA at the time of the invention, in light of the specification and prosecution history. *Id.*; *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312-1313 (Fed. Cir. 2005) (*en banc*); 83 Fed. Reg. 51,340 (Oct. 11, 2018).

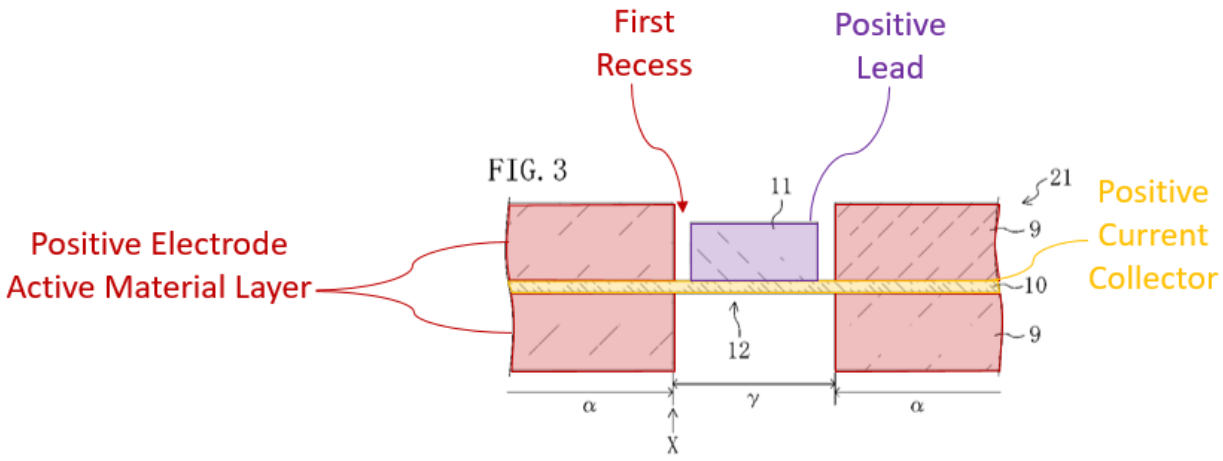
Without waiver, Petitioner does not believe any claim terms require specific construction and thus should receive their plain and ordinary meaning, in the context

of the '498 patent specification, under *Phillips*.[1] Under any reasonable construction, the challenged claims are unpatentable. EX1003, ¶¶20-21.

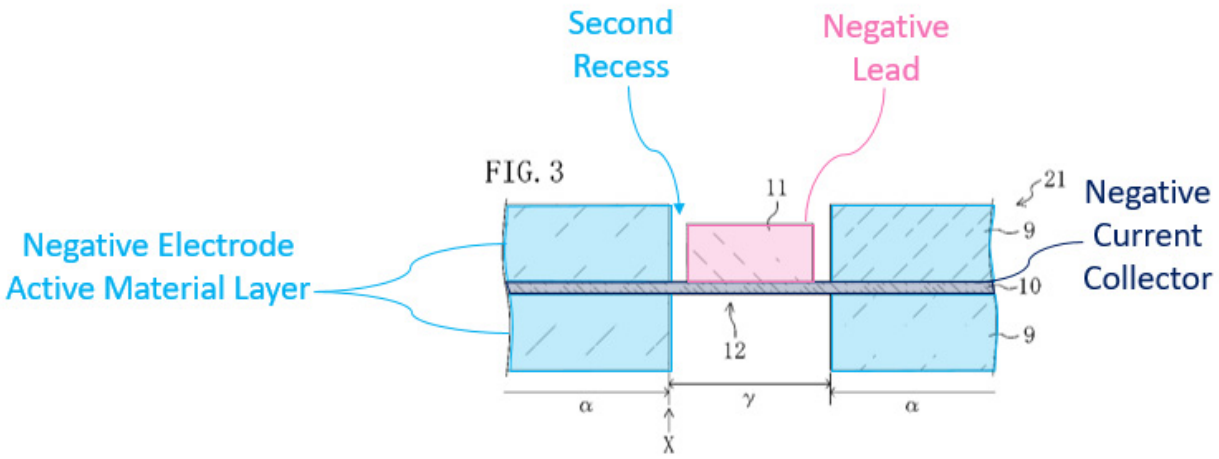
VIII. APPLIED REFERENCES

A. Sato

Sato discloses a lithium-ion battery containing similar materials, wound structure, and electric lead connections, as recited in the '498 patent claims. EX1005, ¶¶[0027]-[0034]. As shown below, Sato's positive and negative active layers (mixture layers 9 on the positive and negative current collectors 10, respectively) define a recess (exposed portion 12) to connect a lead (lead 11) to the current collector. EX1005, ¶¶[0035]-[0044].



[1] Petitioner reserves the right to challenge the claims under 35 U.S.C. § 112 in other forums.

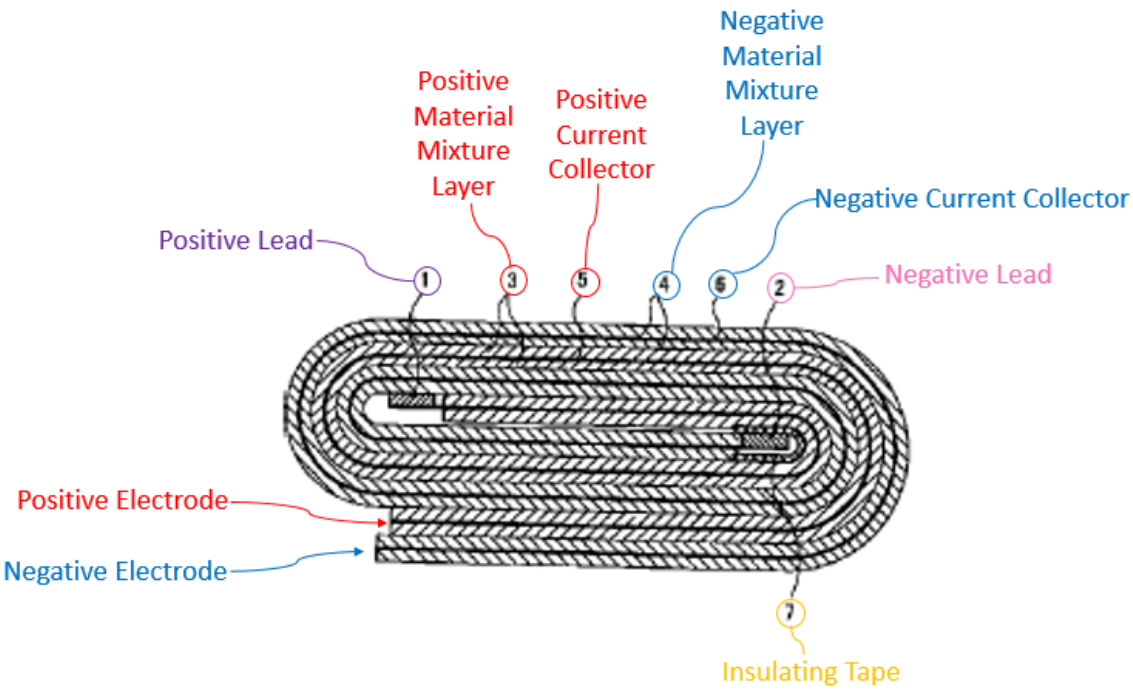


EX1005, FIG. 3 (annotated).

A top surface of Sato's positive lead is provided with an insulating layer (polypropylene adhesive tape). EX1005, ¶[0113]. Sato places an additional insulating tape on "the positive electrode surface facing the negative electrode lead…in order to prevent lithium deposition." EX1005, ¶[0137]. Sato's additional insulating tape is attached to a portion of the positive electrode's active material. EX1005, ¶[0148]; EX1003, ¶¶98-103.

B. Takemura

Takemura discloses similar fabrication attributes as Sato and the '498 patent, and places an insulating tape 7 on the positive active material 3 adjacent to a negative electrode current collecting lead 2 and bare portion of the negative current collector 6. EX1006, ¶[0003], FIG. 9.

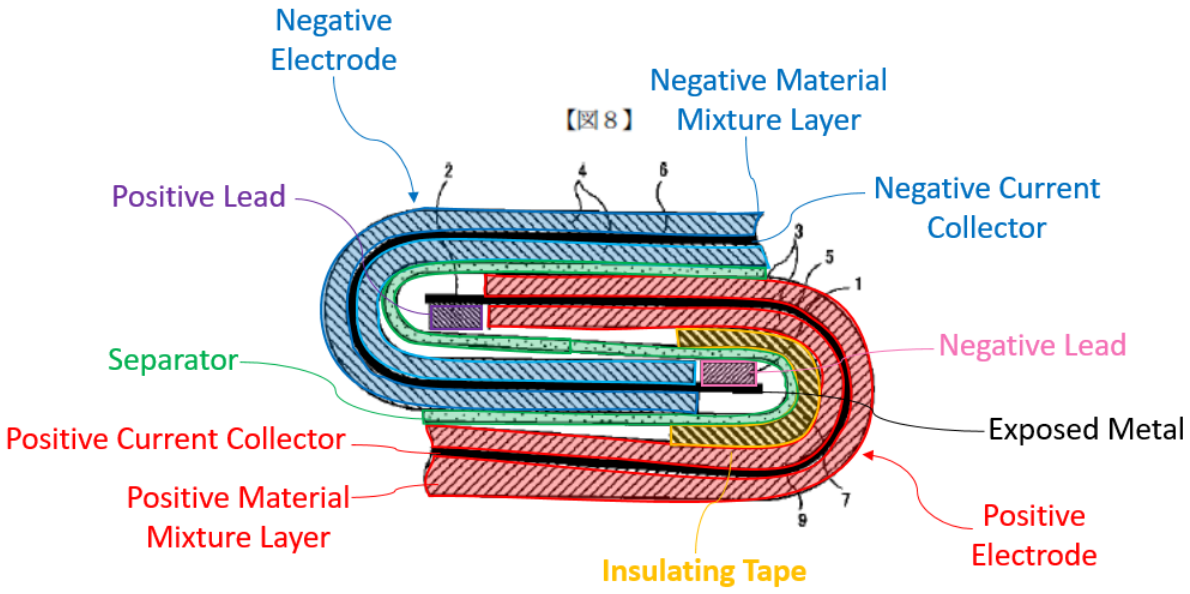


EX1006, FIG. 9 (annotated).

Locating insulating tape 7 around the negative lead 2 prevents short-circuiting caused by lithium plating on the negative current collector's exposed metal. EX1006, ¶[0008]. Takemura's Figure 8 (below) shows an enlarged view of the structure in Figure 9, with a separator (green) located between the positive electrode and the negative electrode.[2] The insulating tape 7 is sized to overlap all the exposed

[2] Takemura mislabels the positive lead 1 and negative lead 2 in Figure 8. The lead labeled "1" should be "2" and the lead labeled "2" should be "1." EX1006, ¶[0003].

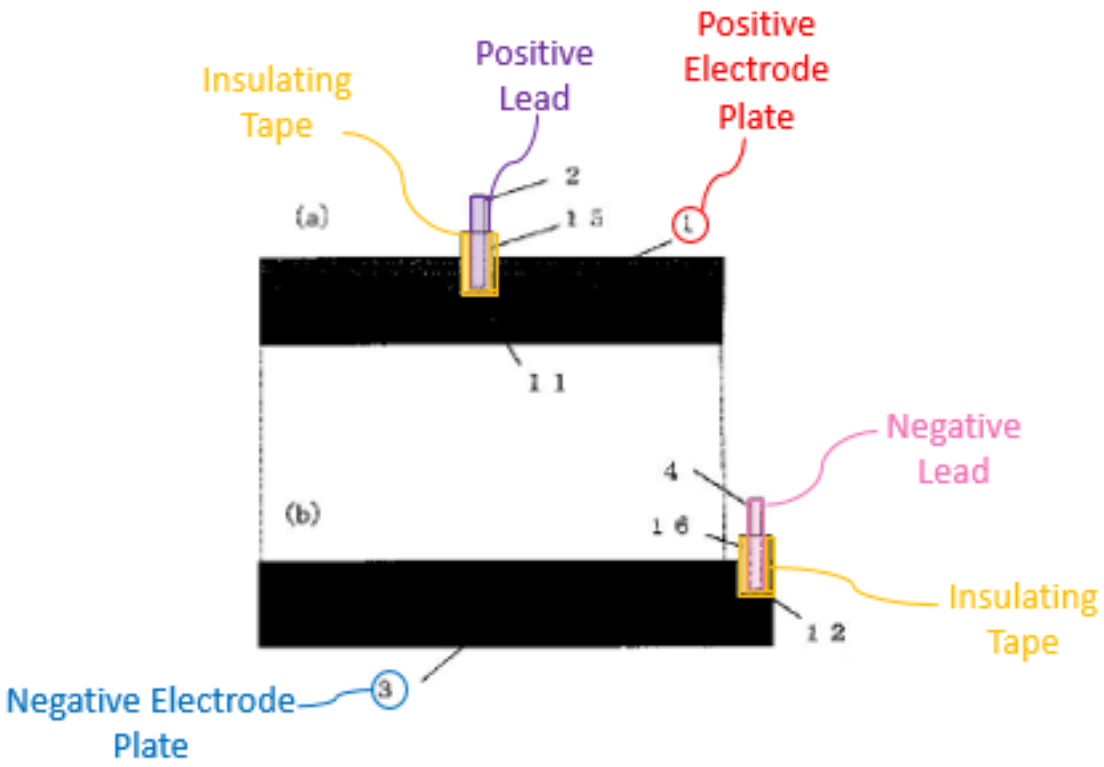
metal on the negative current collector 6 and the edge of the negative active material 4 above and below the negative lead 2. EX1003, ¶¶104-107.



EX1006, FIG. 8 (annotated).

C. Nakamura

Nakamura discloses a "lithium secondary battery" similar to Sato, Takemura, and the '498 patent. EX1012, ¶[0007]. A positive electrode plate 1 is formed by a positive electrode current collector and a positive active material applied to the positive current collector's surfaces. EX1012, ¶[0012]. Likewise, negative electrode plate 3 is formed by a negative electrode current collector and a negative active material applied to the negative current collector's surfaces. EX1012, ¶[0029]. A positive electrode lead 2 is connected to positive electrode plate 1 and a negative electrode lead 4 is connected to negative electrode plate 3. EX1012, ¶¶[0026]-[0027], [0034]; EX1003, ¶¶185-187.

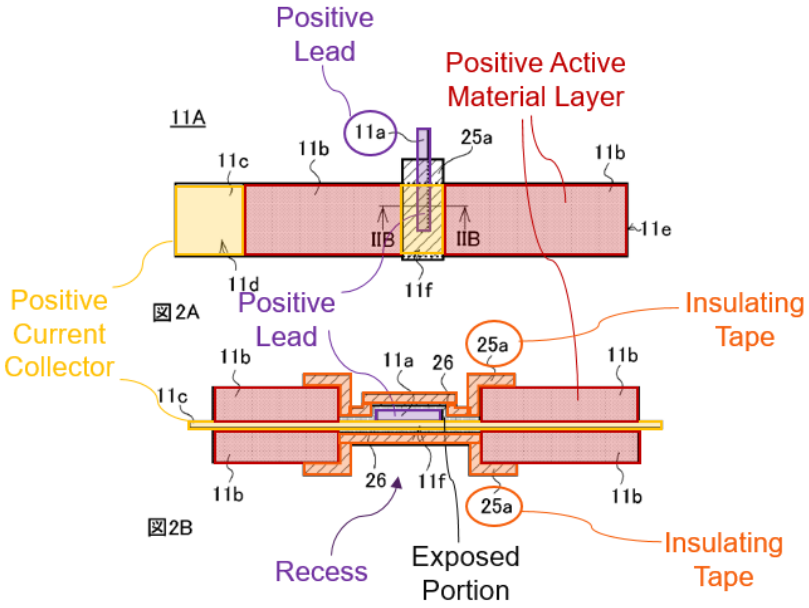


EX1012, FIG. 1 (annotated).

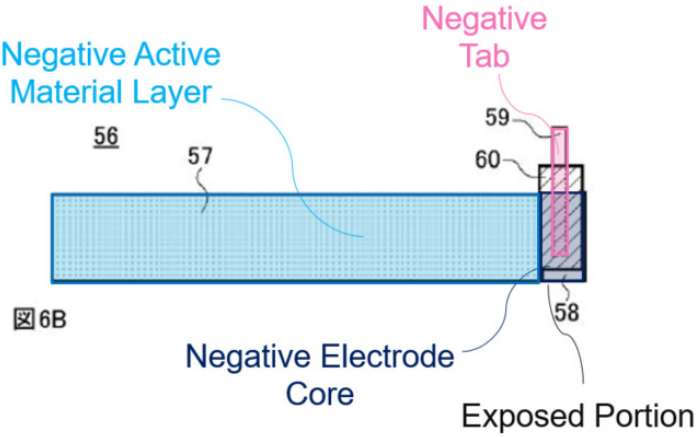
D. Kobayashi

Kobayashi discloses a lithium-ion, non-aqueous electrolyte secondary battery similar to Sato, Takemura, Nakamura, and the '498 patent. EX1008, ¶[0013]. Kobayashi's battery has a positive electrode plate 11A with positive electrode core 11c and a positive active material 11b; a negative electrode plate 56 with a negative electrode core 58 and a negative active material 57; and a separator 13 disposed between the plates. EX1008, ¶[0007], [0013], [0028], [0034]-[0035], FIGs. 2A-2B, 6B. The positive electrode plate 11A has an exposed portion 11f of metal foil and a positive current collecting tab 11a attached to exposed portion 11f. EX1008, ¶¶[0013], [0034]. Similarly, negative electrode plate 56 has an exposed portion 53

of metal foil and a negative current collecting tab 54 attached to exposed portion 53 of the metal foil. EX1008, ¶¶[0007], [0013].



EX1008, FIGs. 2A-2B (annotated).

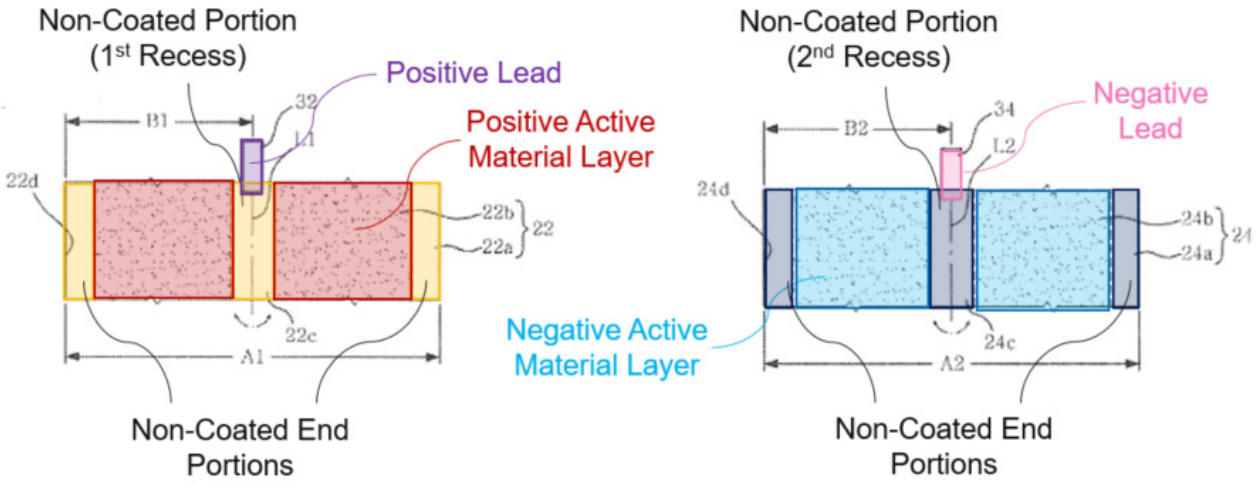


EX1008, FIG. 6B (annotated).

To protect exposed portion 11f from short-circuiting, Kobayashi places tapes 25a on the top and bottom surface of exposed portion 11f of positive electrode plate 11A. EX1008, ¶¶[0034]-[0035], FIGs. 2A-2B; EX1003, ¶¶259-262.

E. **Oh-539**

Oh-539 discloses a lithium-ion battery similar to Sato, Takemura, Nakamura, Kobayashi, and the '498 patent. EX1007, ¶[0092]; EX1003, ¶¶224-227. Oh-539's battery includes a positive electrode (cathode) 22, a negative electrode (anode) 24, and a separator 12. EX1007, ¶[0039], FIG. 1. Oh-539's positive electrode 22 includes a positive lead (cathode tab 32) attached to positive electrode 22 within a first recess (non-coated portion 22c) formed in the positive active material (cathode active material 22b) on positive electrode 22. EX1007, ¶¶[0039]-[0046], FIG. 2. Similarly, Oh-539's negative electrode includes a negative lead (anode tab 34) attached to negative electrode 24 within a second recess (non-coated portion 24c) formed in the negative active material (anode active material 24b) on negative electrode 24. EX1007, ¶¶[0056]-[0059], FIG. 3.

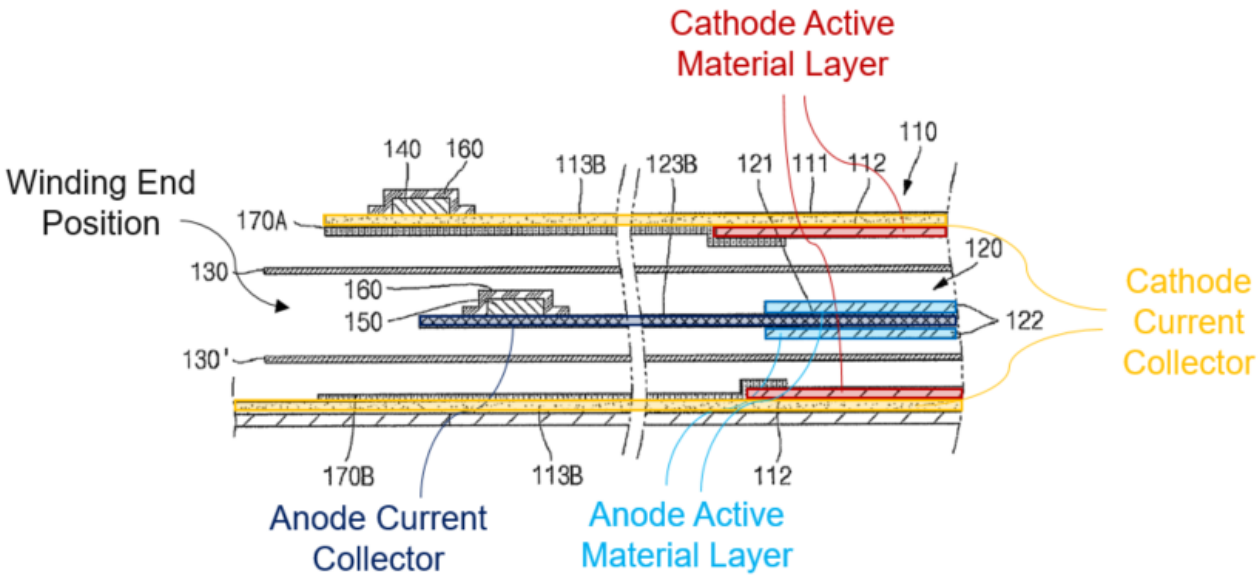


EX1007, FIGs. 2, 3 (annotated).

The center of Oh-539's first and second recesses (non-coated portions 22c, 24c) is located at distance that is 40% to 60% of the total length of Oh-539's positive electrode 22 and negative electrode 24, respectively. EX1007, ¶¶[0050]-[0051], [0061]-[0062]; EX1003, ¶¶225-228.

F. Oh-144

Oh-144 discloses a lithium-ion battery similar to Sato, Takemura, Nakamura, Kobayashi, Oh-539, and the '498 patent. Oh-144's battery includes a positive electrode (cathode) plate 110, a negative electrode (anode) plate 120, and a separator 130 wound between cathode plate 110 and anode plate 120. EX1017, ¶[0025], FIGs. 3-4. Oh-144's cathode plate 110 includes a cathode collector 111, a cathode active material 112, and uncoated cathode portions 113. EX1017, ¶[0026]. Oh-144's anode plate 120 includes an anode collector 121, an anode active material 122, and uncoated cathode portions 123. EX1017, ¶[0027].



EX1017, FIG. 4 (annotated).

Oh-144 also discloses placing tapes—tapes 160, 170A/170B, 180—at various locations on the positive and negative electrode plates 110, 120 to prevent short-circuiting within a battery coil. EX1017, ¶¶[0037]-[0039], [0041]-[0042]; EX1003, ¶¶2298-230.

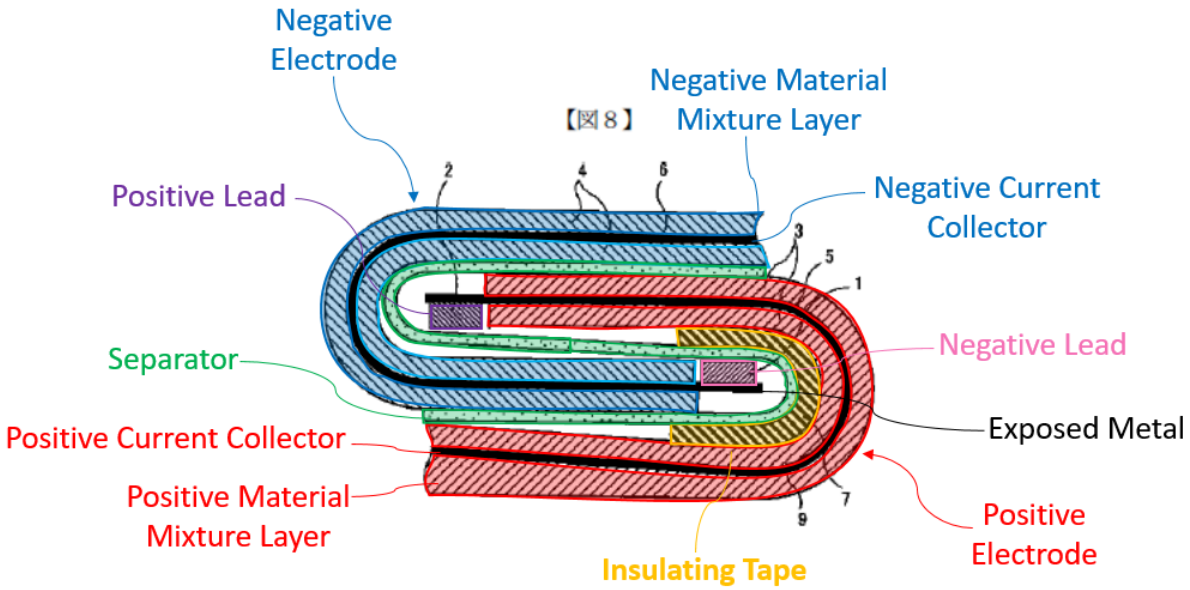
IX. GROUND 1: CLAIMS 1-3, 6, 8, 17, AND 19 WOULD HAVE BEEN OBVIOUS IN VIEW OF SATO AND TAKEMURA.

A. Motivation to Combine Sato and Takemura

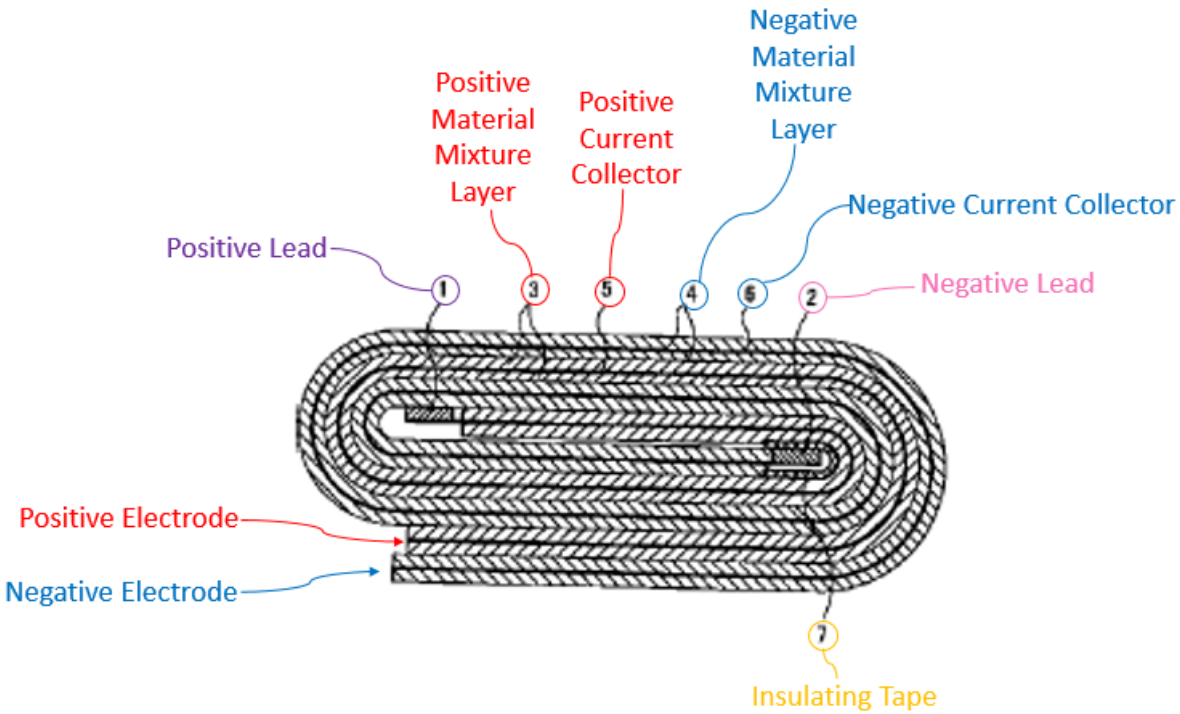
In view of Takemura, a POSA would have been motivated to locate Sato's additional polypropylene adhesive tape on its positive active material opposite to the negative lead connection, to prevent lithium plating on the negative electrode, thereby reducing short-circuiting and improving reliability. EX1003, ¶¶108-114; EX1006, ¶[0008].

Sato and Takemura are analogous art—lithium-ion batteries. EX1005, ¶¶[0010], [0113]; EX1006, ¶[0006]; EX1003, ¶108. To prevent lithium plating—a well-known problem for lithium-ion batteries—Sato and Takemura place insulating tape on the positive active material across the battery's separator opposite the negative lead and exposed metal on the negative current collector. EX1003, ¶¶110-111; EX1005, ¶[0137]; EX1006, ¶¶[0008].

To the extent Sato does not explicitly disclose attaching the additional tape on the positive active material "opposite to the second recess across the separator in a thickness direction of the positive plate," Takemura discloses this known positioning. EX1003, ¶112. As shown in Figures 8 and 9, Takemura attaches an insulating tape 7 to a positive active material 3 of a positive electrode that is opposite to an exposed portion of a negative electrode current collector 6 where the negative lead 2 is attached. EX1006, ¶[0008]. This prevents "short circuiting caused by lithium metal deposition." *Id.*



EX1006, FIG. 8 (annotated).



EX1006, FIG. 9 (annotated).

A POSA would have understood that the exposed surface of the negative electrode current collector is susceptible to lithium plating because lithium ions

flowing across the separator will precipitate on the negative current collector's exposed surface during battery charging. EX1003, ¶110; EX1009, ¶[0003]; EX1016, ¶¶[0008], [0012]. Significant precipitation of lithium ion results in dendritic lithium formation, needle-like structures capable of puncturing the separator and short-circuiting the electrodes. EX1023, 201.

Because lithium plating "is one of the most common and important factors leading to internal short circuits of lithium-ion battery," *id.*, a POSA would have been motivated to apply Takemura's known technique of placing insulating tape on the positive active material opposite the lead connection of the negative electrode to prevent lithium plating in Sato's battery. EX1003, ¶111. Takemura's insulating tape would prevent lithium ion precipitation on Sato's exposed negative current collector, even when Sato's battery is exposed to lithium plating conditions, e.g., rapid charging. EX1003, ¶112; EX1009, ¶[0017]. Thus, combining the placement of Takemura's insulating tape with Sato would have provided the predictable result of inhibiting lithium plating, prolonging Sato's battery's operability. EX1003, ¶112.

A POSA would have also had a reasonable expectation of success combining Takemura's teachings with Sato. EX1003, ¶113. Positioning Sato's additional insulating tape according to Takemura's disclosed arrangement would insulate exposed metal from chemical interactions producing lithium plating. *Id.* Furthermore, locating the second insulating tape on the portion of Sato's positive

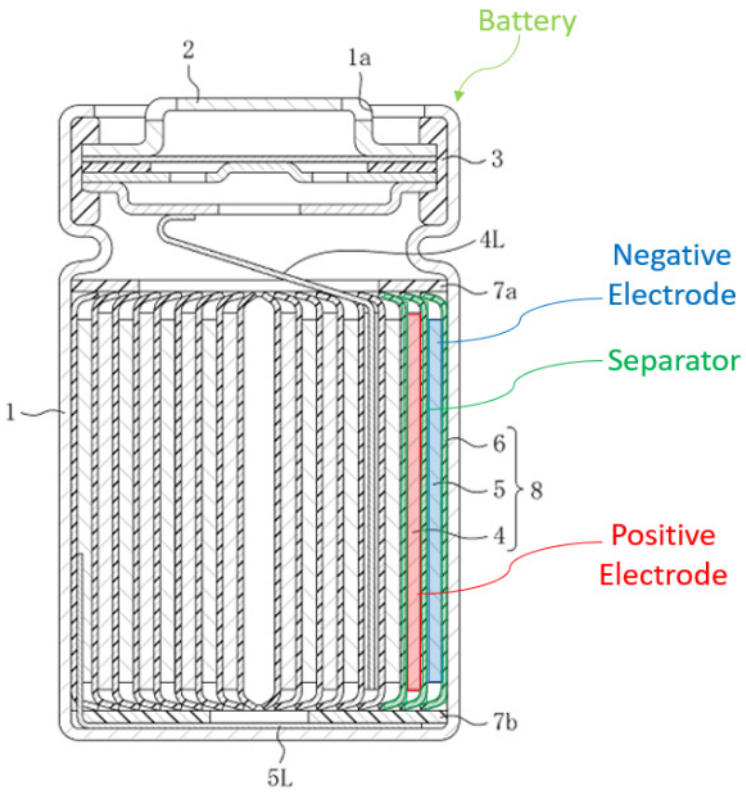
active material opposite the negative lead connection would not obstruct the remaining majority of Sato's positive active material from exchanging lithium ions during charging/discharging cycles. *Id.* Thus, this modification would have simply been combining known elements (Sato's positive electrode and Takemura's insulating tape) according to known methods (adhering insulating tape to the positive active material surface opposite the negative lead connection) for a known benefit (prevent lithium plating). *KSR Int'l. Co. v. Teleflex Inc.*, 550 U.S. 398, 416-417 (2007); EX1003, ¶113. Moreover, this would have simply been applying a known technique (locating insulating tape on the positive active material surface opposite the negative lead connection) to a known device (Sato's battery) to prevent lithium plating. EX1003, ¶113; *KSR*, 550 U.S. at 417.

B. Independent Claims 1 and 17

1. [1.P]/[17.P]

Sato discloses a lithium-ion battery.[3] EX1005, ¶[0027]; EX1003, ¶¶115, 174.

[3] Whether or not the preambles are limiting, the prior art discloses them.



EX1005, FIG. 1 (annotated).

2. [1.A]/[17.A]

Sato's positive electrode plate 4 discloses the recited "positive electrode." EX1005, ¶[0030]. Sato discloses the recited "positive current collector" and "positive electrode active material layer" as a positive electrode current collector 4A/10 and electrode material mixture layer 4B/9, respectively.[4] EX1005, ¶¶[0033],

[4] A POSA would have understood that current collector 10 (Figure 3) is representative of positive electrode current collector 4A and negative electrode current collector 5A (Figure 2). EX1003, ¶102. A POSA would have also understood that electrode material mixture layer 9 is representative of positive

[0039]. Sato's "electrode material mixture layer 4B is provided on each surface of the positive electrode current collector 4A" and "contains a positive electrode active material (e.g., lithium composite oxide)." EX1005, ¶¶[0033], [0051] ("Examples…include $LiCoO_2$."); EX1003, ¶¶116-119, 175.

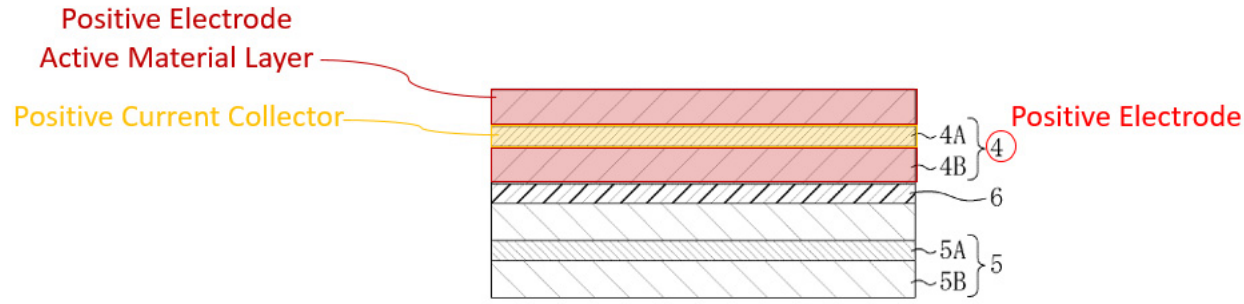
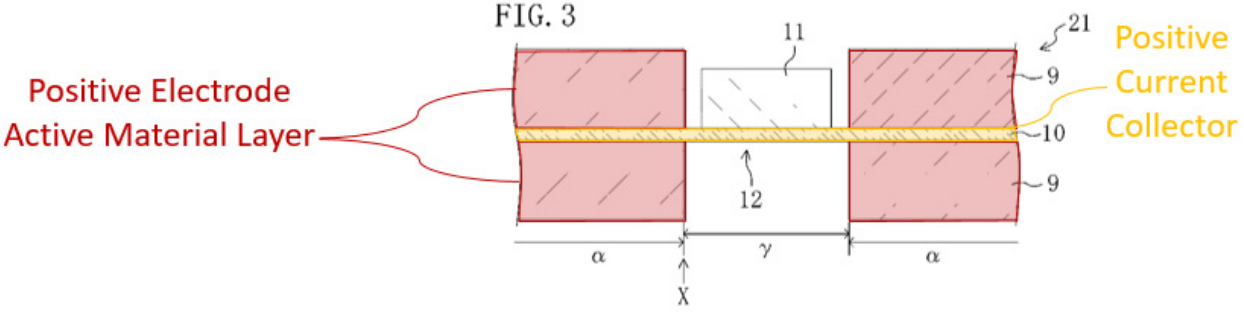
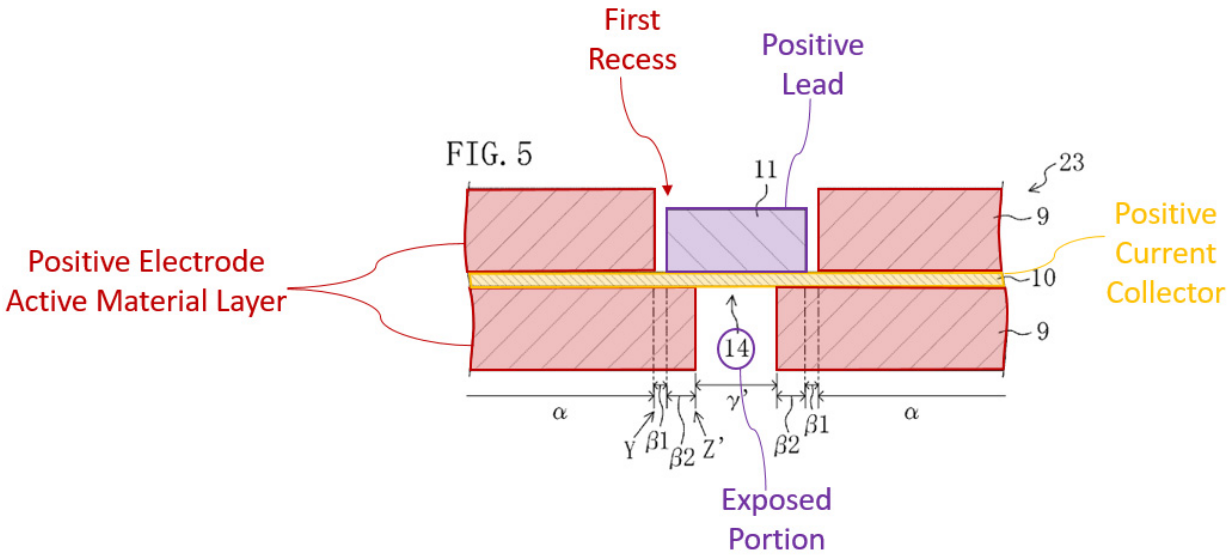


FIG. 3



electrode material mixture layer 4A and negative electrode material mixture layer 4B. EX1003, ¶102.

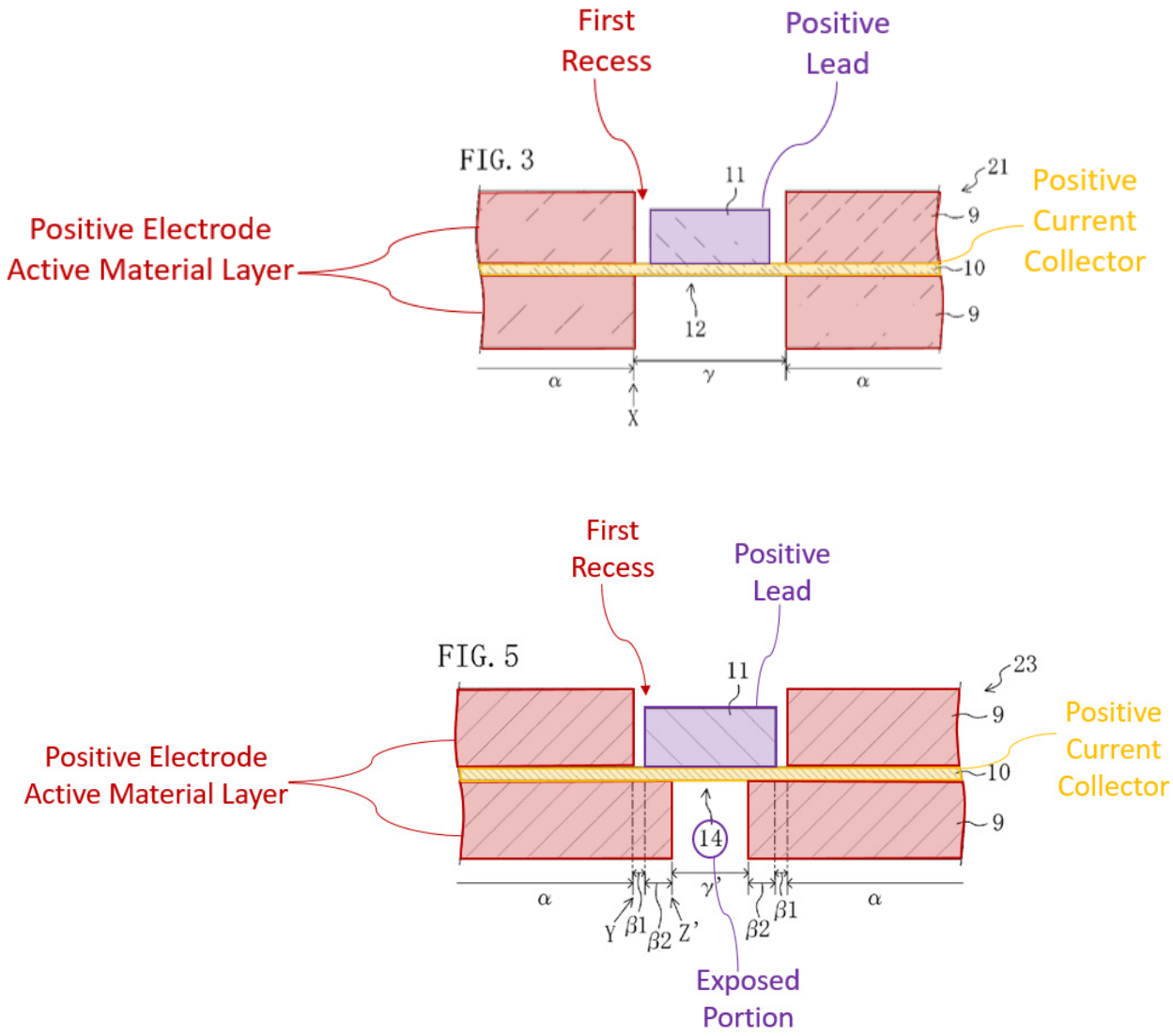


EX1005, FIGs. 2, 3, 5 (annotated).

3. [1.B]/[17.B]

Sato provides the positive active material layer (4B/9) with a first recess with an exposed portion 12/14 defined where "the mixture layer 9 is not formed on each of both surfaces of the current collector 10." EX1005, ¶[0039]. Sato's positive lead is coupled to positive electrode 4 by an extension lead 11/4L "connected to one of the surfaces of the exposed portion 12" of current collector 10.[5] EX1005, ¶¶[0039], [0093], [0111]- [0113]; EX1003, ¶¶120-122, 176.

[5] A POSA would have understood that Sato's extension lead 11 (Figure 3) is representative of a positive lead and a negative lead. EX1003, ¶120; EX1005, ¶[0093] ("A lead is connected in order to take current and Voltage from the positive electrode plate 4 and the negative electrode plate 5. In this connection, a portion of



EX1005, FIGs. 3, 5 (annotated).

4. [1.C]/[17.C]

Sato's negative electrode plate 5 discloses the recited "negative electrode." EX1005, ¶[0030]. Sato discloses the recited "negative current collector" and

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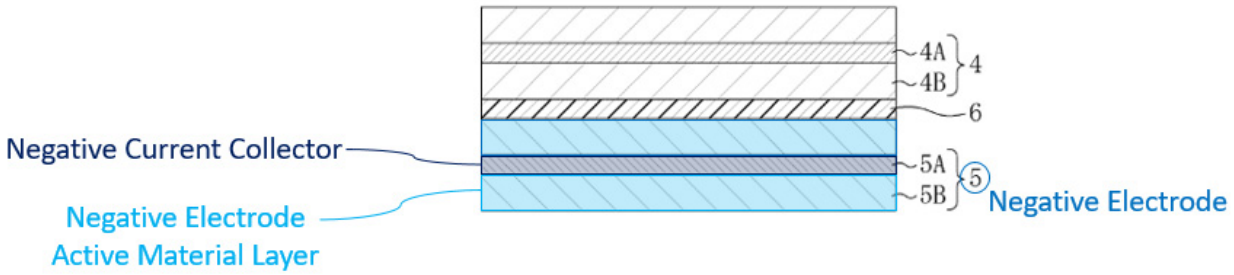
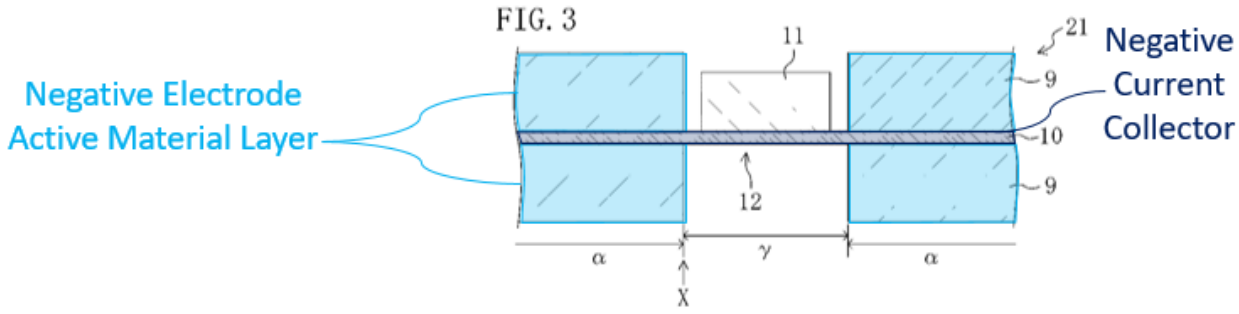
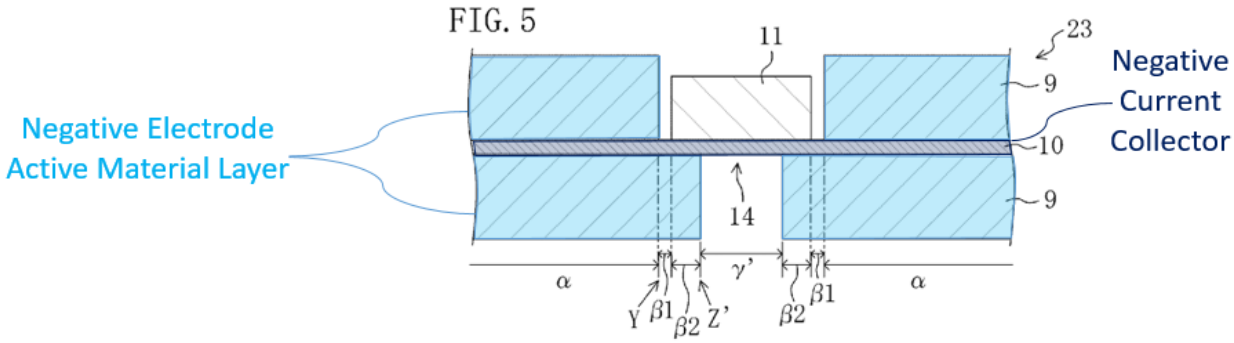
the current collector to which the lead is attached needs to be exposed beforehand.").

"negative electrode active material layer" as a negative electrode current collector 5A/10 and a negative electrode material mixture layer 5B/9, respectively. EX1005, ¶¶[0034], [0039]. Sato's "negative electrode material mixture layer 5B is provided on each surface of the negative electrode current collector 5A" and "contains a negative electrode active material." EX1005, ¶¶[0034], [0066] ("[N]egative electrode active material include[s]…a carbon material [and]…silicon compound … ."); EX1003, ¶¶123-126, 177.



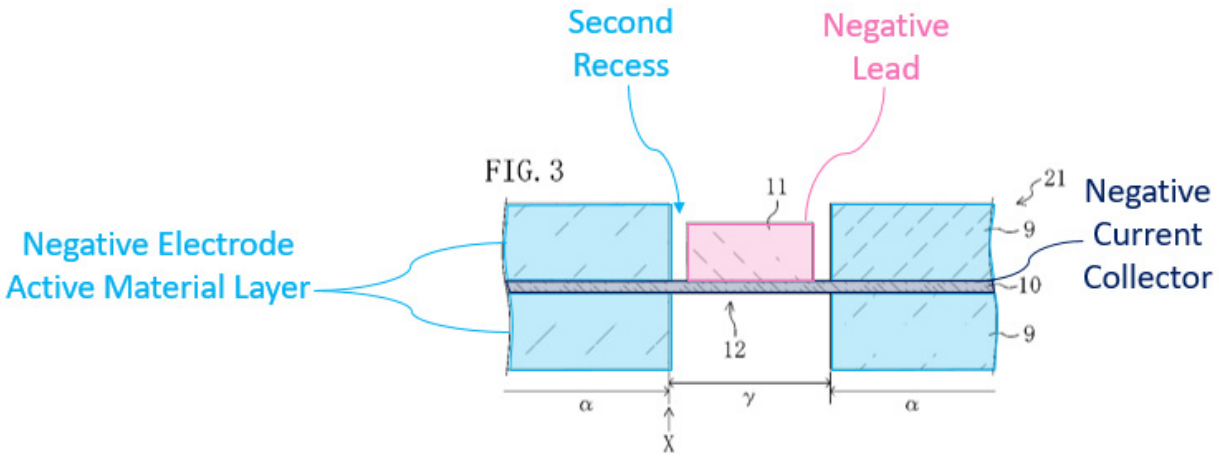




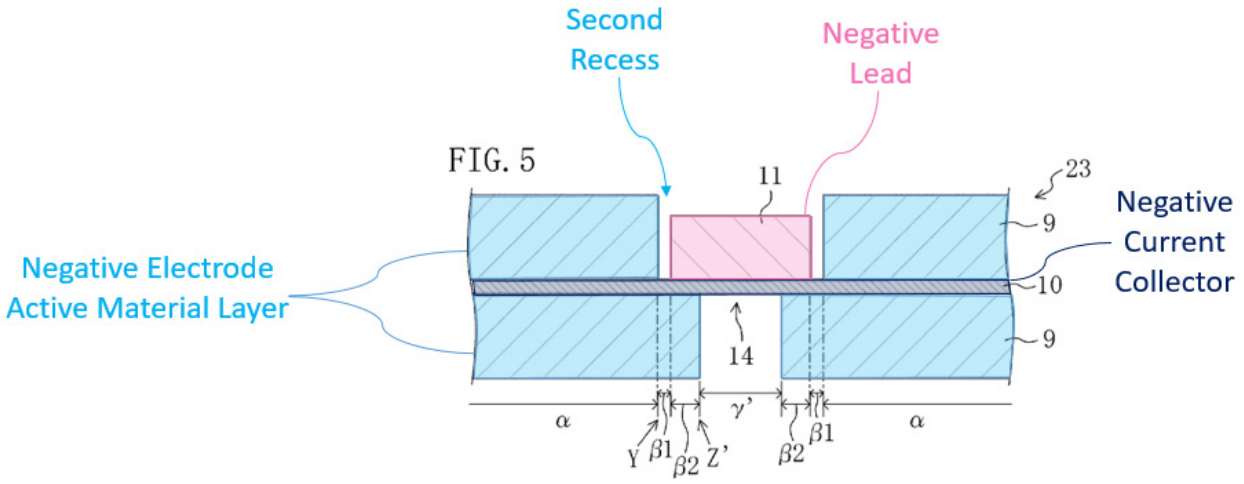
EX1005, FIGs. 2, 3, 5 (annotated).

5. [1.D]/[17.D]

Sato provides the negative active material layer (5B/9) with a second recess with exposed portion 12 defined where "the mixture layer 9 is not formed on each of both surfaces of the current collector 10." EX1005, ¶[0039]. Sato's negative lead is coupled to negative electrode 5 by an extension lead 11/5L "connected to one of the surfaces of the exposed portion 12" of current collector 10. EX1005, ¶¶[0039], [0093]; EX1003, ¶¶127-129, 178.



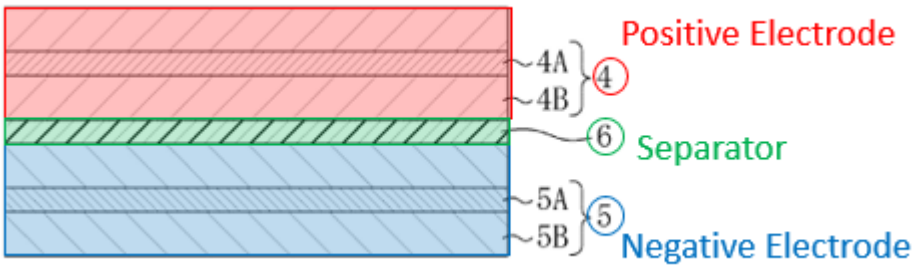
EX1005, FIG. 3 (annotated).

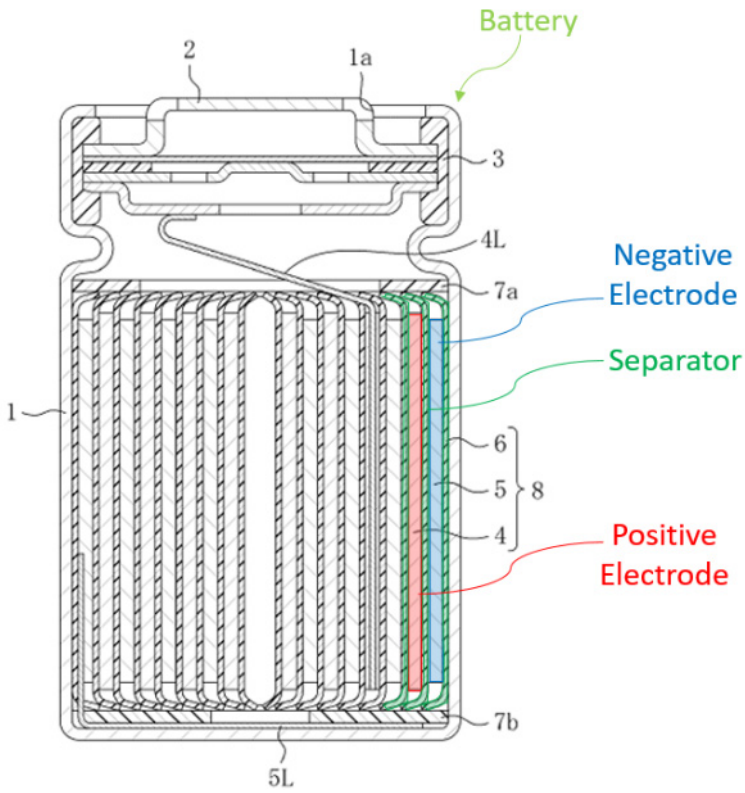


EX1005, FIG. 5 (annotated).

6. [1.E]/[17.E]

Sato discloses a "separator" as "a porous insulating layer (i.e., a separator) 6" interposed between positive electrode plate 4 and negative electrode plate 5. EX1005, ¶¶[0030], [0035], [0044], [0071], [0113]; EX1003, ¶¶130-131, 179.





EX1005, FIGs. 1, 2 (annotated).

7. [1.F]/[17.F]

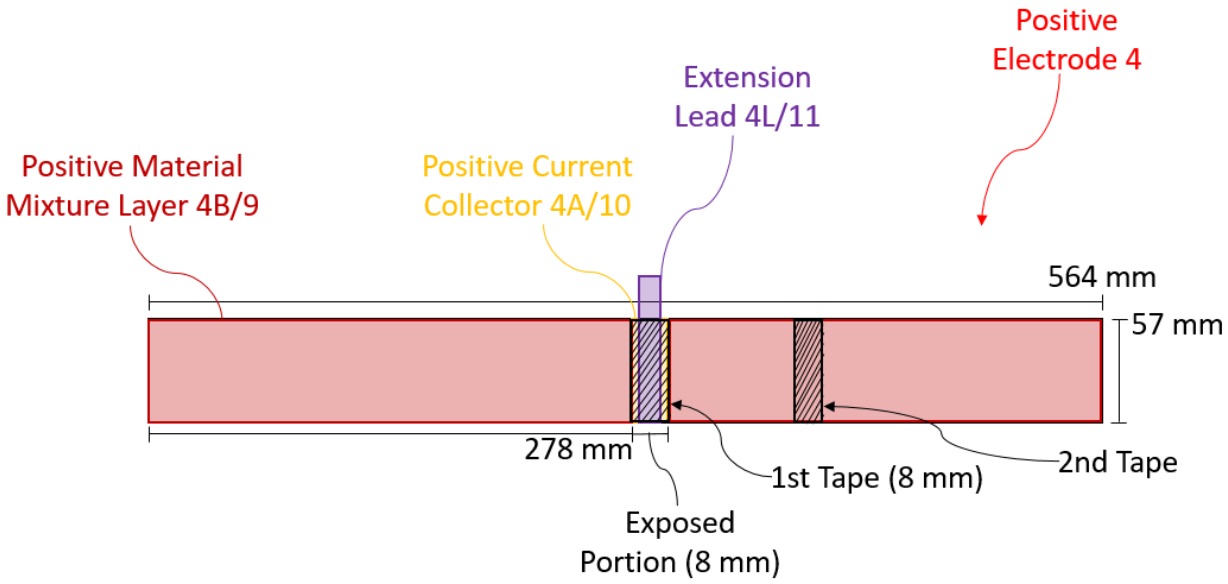
Sato discloses the recited "electrolyte" as a "nonaqueous electrolyte," e.g., "a gelled nonaqueous electrolyte, or a solid nonaqueous electrolyte." EX1005, ¶¶[0028], [0044], [0074]-[0084]; EX1003, ¶¶132-133, 180.

8. [1.G]/[17.G]

Sato attaches a polypropylene adhesive tape on the top surface of extension lead 11. EX1005, ¶[0113] ("[L]eads…protected and insulated by a polypropylene adhesive tape with a width of 8 mm in the positive electrode plate and by a polyethylene adhesive tape in the negative electrode plate."). In the related district court complaint, Patent Owner equates adhesive tape to an insulating glue layer.

EX1024, 8, 27, 28. Under Patent Owner's position, Sato's polypropylene adhesive tape is an insulating glue layer. A POSA would have understood that Sato's polypropylene adhesive tape is located on top of the positive lead 4L/11 to "protect[] and insulate[]" all the exposed portions of positive lead 4L/11 from the negative electrode. EX1003, ¶¶134-136, 181.

Given the disclosed locations of the exposed portion and lead connection of Sato's positive electrode, for example, according to Sato's example Battery 1, EX1005, ¶¶[0104], [0111]-[0113], a POSA would have understood that Sato's polypropylene adhesive tape (1st tape) is located on Sato's positive lead 4L/11, shown in Dr. von Sacken's illustration. EX1003, ¶¶134-136, 181.



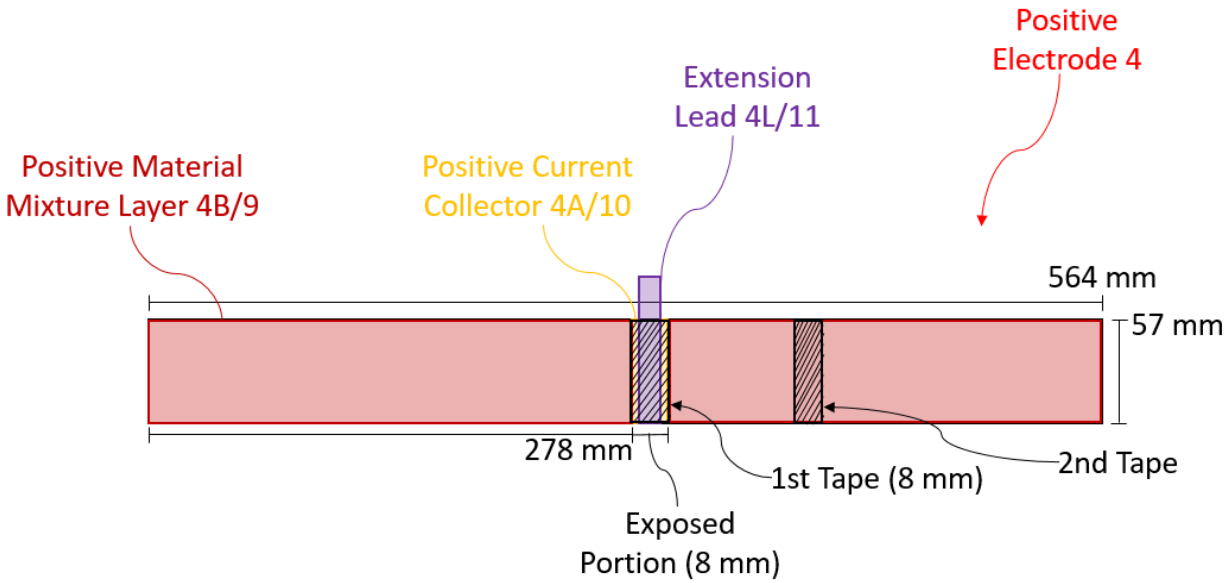
Sato's Positive Electrode, EX1003, ¶136.

9. [1.H]/[17.H]

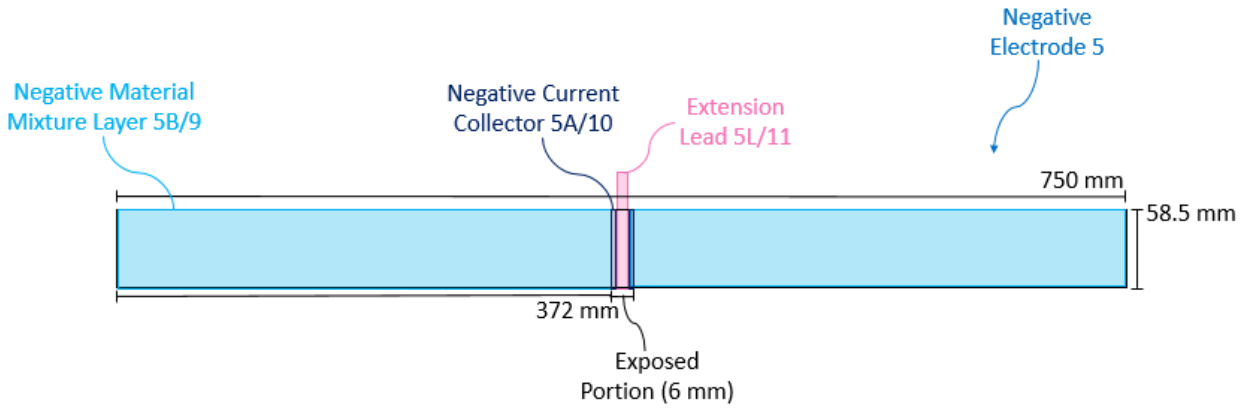
(a) Sato

Sato's "positive electrode surface facing the negative electrode lead position [is] insulated by a polypropylene adhesive tape in order to prevent lithium deposition." EX1005, ¶[0137]. Under Patent Owner's position, Sato's additional polypropylene adhesive tape is a second insulating glue layer. EX1024, 8, 27, 28. Sato's additional polypropylene adhesive tape covers a portion of the positive active layer (4B/9). EX1005, ¶[0148]; EX1003, ¶138. For Sato's additional tape to prevent lithium deposition, EX1005, ¶¶[0107], [0112], [0137], a POSA would have understood that Sato's additional polypropylene adhesive tape is located on Sato's positive active material (4B/9) in a position that overlaps the exposed portion 12 (recess) where Sato's negative lead 11 is located, as shown below in Dr. von Sacken's illustrations. EX1003, ¶¶139-140.

The only logical place for Sato's additional polypropylene adhesive tape on the positive active material to prevent lithium plating is opposite the recess in the negative active material across the separator. EX1003, ¶141. Indeed, this section is most susceptible to lithium plating during the battery's charging cycle. EX1003, ¶¶138-142.



Sato's Positive Electrode, EX1003, ¶138.

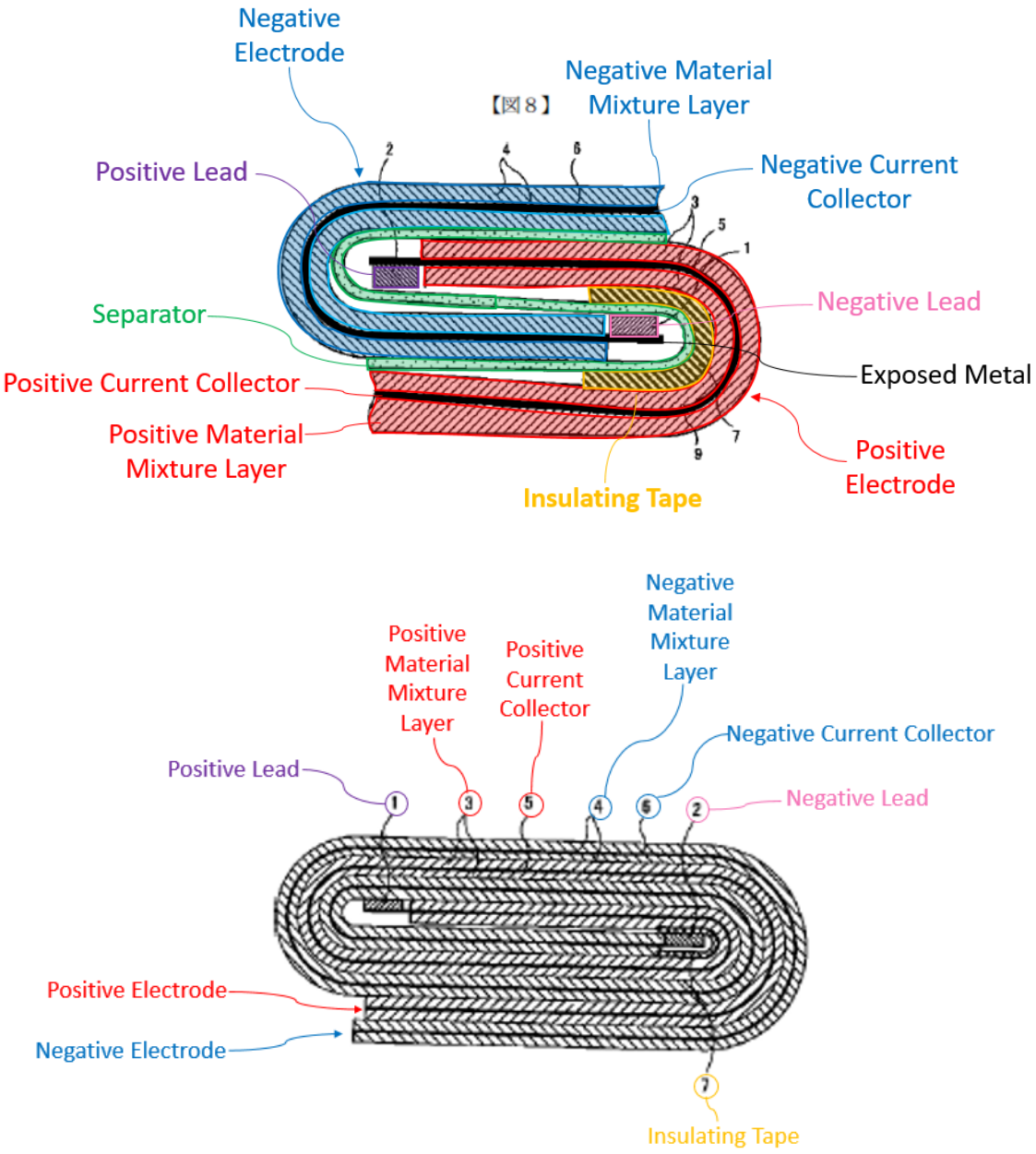


Sato's Negative Electrode, EX1003, ¶138.

(b) Takemura

To the extent Sato does not explicitly disclose locating the additional adhesive tape "opposite to the second recess across the separator in a thickness direction of the positive plate," Takemura discloses this. Specifically, Takemura locates an insulating tape 7 on the positive electrode's active material 3 across a separator 8 opposite a negative lead 2. EX1006, ¶[0003], FIGs. 8-9. In Figures 8-9, Takemura's

insulating tape 7 is attached to positive active material 3 adjacent to separator 8 and across from a bare negative electrode current collector 6 where negative lead 1 is attached. Thus, the location of Takemura's insulating tape corresponds to the recited position of the "second insulating tape." EX1003, ¶¶143-144, 182.



EX1006, FIGs. 8, 9 (annotated).

(c) Sato-Takemura Combination

As discussed in Section IX.A, it would have been obvious to apply Sato's additional polypropylene adhesive tape to "a surface of the positive electrode active material layer opposite to the second recess across the separator in a thickness direction of the positive plate and the negative plate," as recited by [1.H]/[17.H]. EX1003, ¶145. This modification would have simply been applying a known technique (Takemura's placement of insulating tape) to a known device (Sato's battery) to prevent lithium plating. EX1003, ¶¶145-148, 182.

10. [1.I]/[17.I]

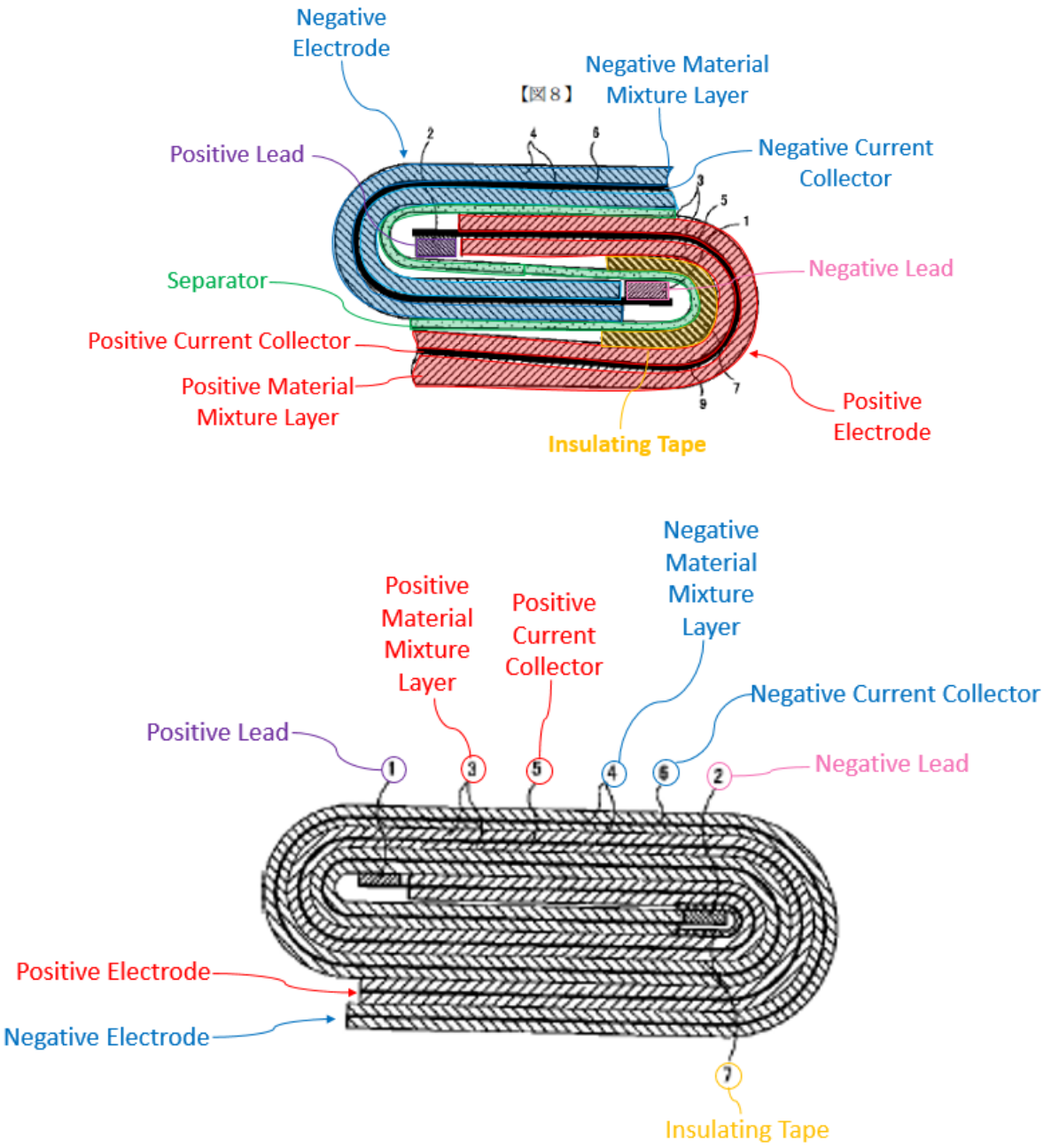
(a) Sato

As discussed for [1.H], Sato discloses an additional polypropylene adhesive tape. EX1005, ¶[0137]; EX1003, ¶149. Sato is silent about the adhesive tape having a width larger than a width of the second recess and a length larger than a length of the second recess. However, this insulating tape sizing was known, as Takemura disclosed. EX1003, ¶149.

(b) Takemura

In Figures 8-9, Takemura's insulating tape 7 is sized such that it overlaps (i) *all* the exposed metal on the negative current collector 6 and (ii) the edge of the negative active material 4 above and below the negative lead 2, to insulate exposed metal and prevent lithium plating. EX1006, ¶[0008]. Thus, Takemura's insulating tape has a width (measured along the length of the negative electrode cross-section

in Figures 8-9) larger than the exposed metal on the negative electrode current collector. EX1003, ¶¶150-151.



EX1006, FIGs. 8, 9 (annotated).

Although Takemura does not illustrate that the insulating tape has a length larger than the length of the exposed metal on the negative electrode current collector, a POSA would have done so (or at least found it obvious) to minimize exposing the negative electrode metal to lithium ions released from the positive active material. EX1003, ¶152; EX1022, 51. Furthermore, sizing Takemura's tape to be longer than the exposed metal would ensure metal is not exposed due to alignment variances. EX1022, 51; EX1003, ¶151. It would have been illogical to apply a tape smaller than the second recess to cover the exposed metal from the positive active material. EX1003, ¶152.

(c) Sato-Takemura Combination

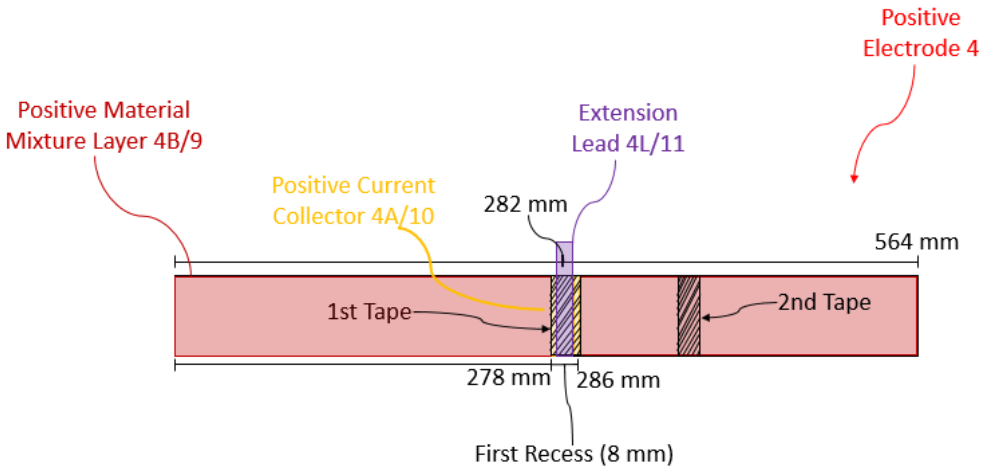
As discussed in Section IX.B.10.b, it would have been obvious to form Sato's additional polypropylene adhesive tape wider and longer than the width and length of the second recess formed in Sato's negative active material 5B/9—a well-known technique for covering exposed current collector surfaces. EX1003, ¶153, 183; EX1008, FIGs. 2A-2B; EX1012, ¶[0052]. This would have been the only logical sizing to avoid lithium plating. EX1003, ¶154. Additionally, merely changing the size of a component, such as Sato's second insulating tape, without any unexpected result does not give rise to a patentable invention. *Fox Factory, Inc. v. SRAM LLC*, 813 F. App'x 539, 542 (Fed. Cir. 2020) ("[A] mere change in proportion ... involve[s] no more than mechanical skill … ." (quoting *Powers-Kennedy*

Contracting Corp. v. Concrete Mixing & Conveying Co., 282 U.S. 175, 185 (1930))); *Iron Grip Barbell Co., Inc. v. USA Sports, Inc.*, 392 F.3d 1317, 1322 (Fed. Cir. 2004); *Gardner v. TEC Syst., Inc.*, 725 F.2d 1338, 1349 (Fed. Cir. 1984); EX1003, ¶¶153-155, 183.

C. Dependent Claims 2, 3, 6, 8, and 19

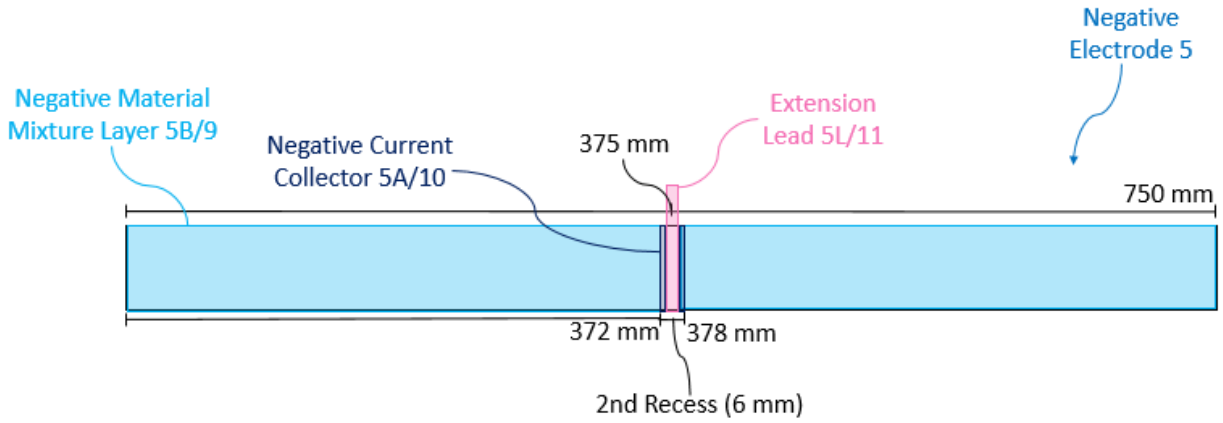
1. Claims 2/3

Sato discloses a distance between a center of the first recess (exposed portion 12/14 where the positive lead 11 is attached to plate 4) and one end of the positive active material (layer 4B/9) is half of a length of the positive active material (layer 4B/9)—falling within the recited ¼ to ¾ range of claim 2 and meeting the recited dimension of claim 3. EX1005, ¶¶[0104], [0111]-[0113] (positive electrode plate has "length of 564 mm" and distance from center of first recess to positive active material end is 282 mm); EX1003, ¶¶156-167. A POSA would have understood that the positive active material begins at the end of the electrode plate in view of Sato's positive electrode manufacturing process. EX1005, ¶[0104]; EX1003, ¶¶156-157, 164.



Sato's Positive Electrode, EX1003, ¶157.

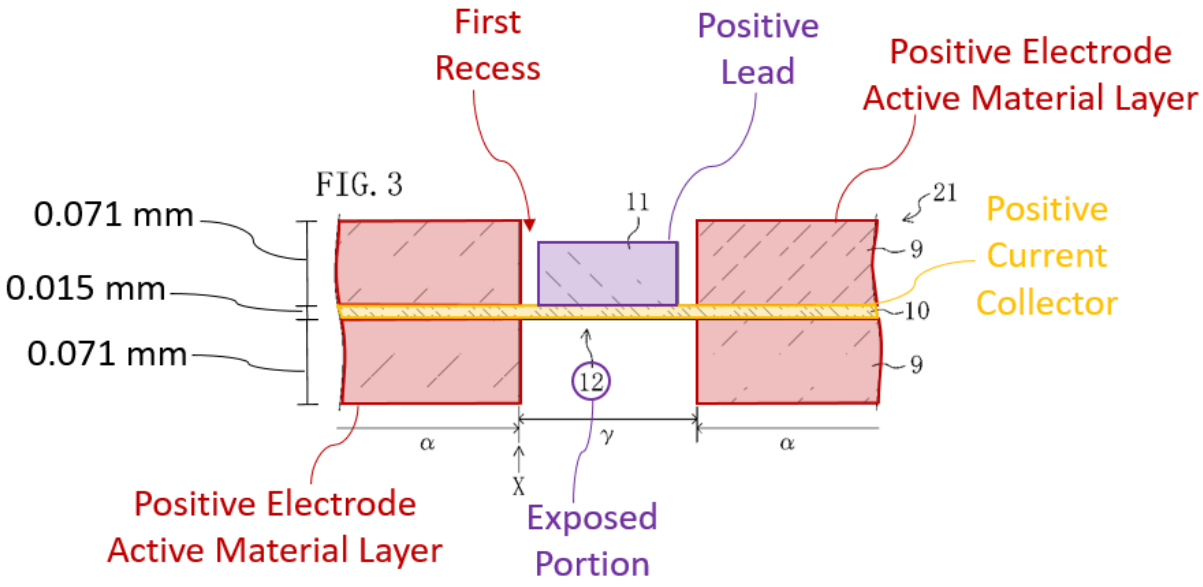
Similarly, Sato discloses that a distance between a center of the second recess (exposed portion 12/14 where the negative lead 11 is attached to plate 5) and one end of the negative active material (layer 5B/9) is half of a length of the negative active material—falling within the recited ¼ to ¾ range of claim 2 and meeting the recited dimension of claim 3. EX1005, ¶¶[0094], [0104], [0136], [0137] (negative electrode plate has "length of 750 mm" and distance from center of second recess to negative active material end is 375 mm). A POSA would have understood that the negative active material begins at the end of the electrode plate in view of Sato's negative electrode manufacturing process. EX1005, ¶[0137]; EX1003, ¶¶158-159, 165.

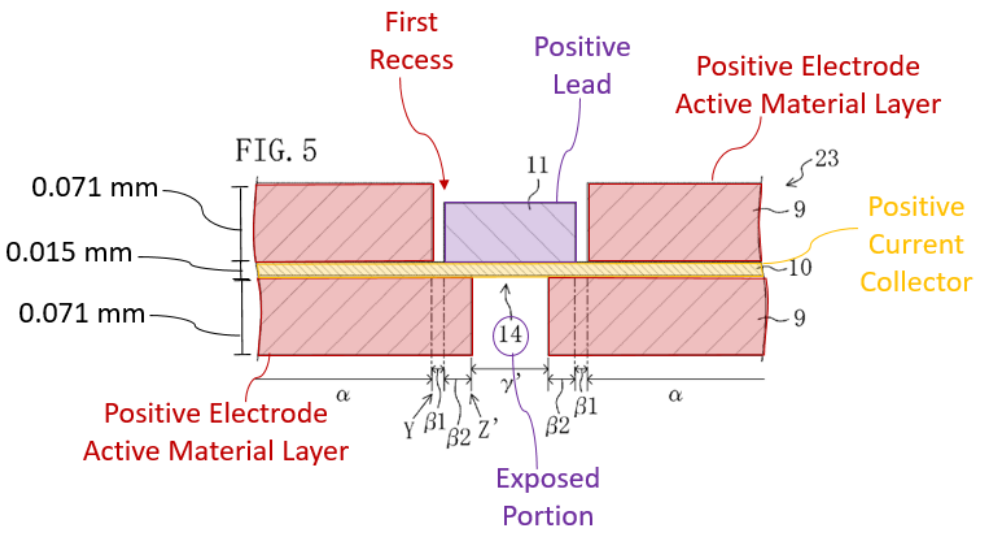


Sato's Negative Electrode, EX1003, ¶158.

2. Claim 6

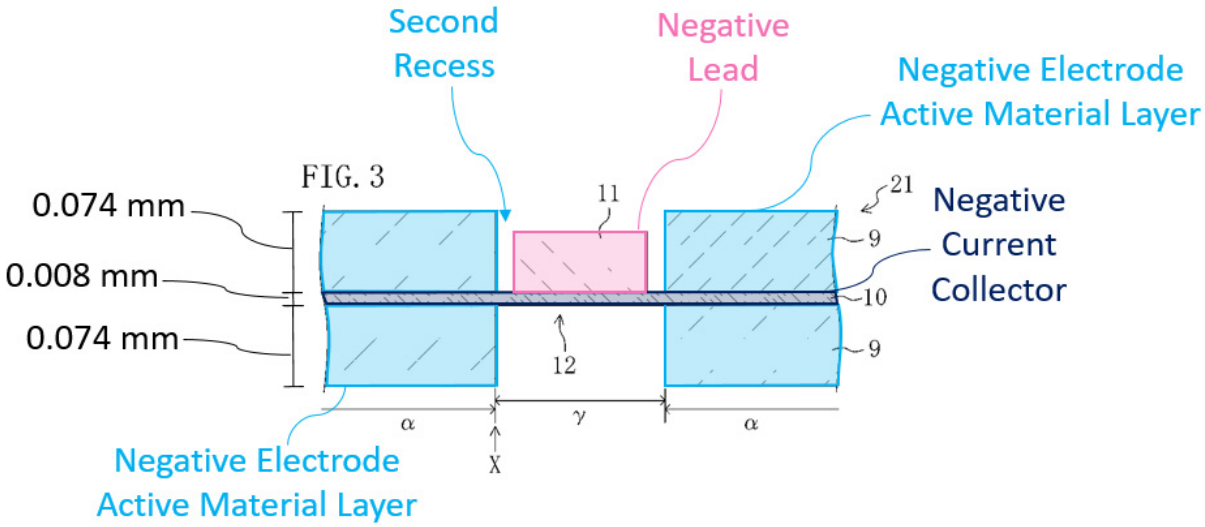
The thickness of the positive active material on Sato's positive current collector is 0.071 mm, which corresponds to the thickness of Sato's first recess. EX1005, ¶[0104]. Given the disclosed depth of Sato's recess and in view of Figures 3 and 5, Sato's first recess has a depth between 0.005 mm to 0.071 mm larger than the thickness of positive lead 11. EX1003, ¶168.

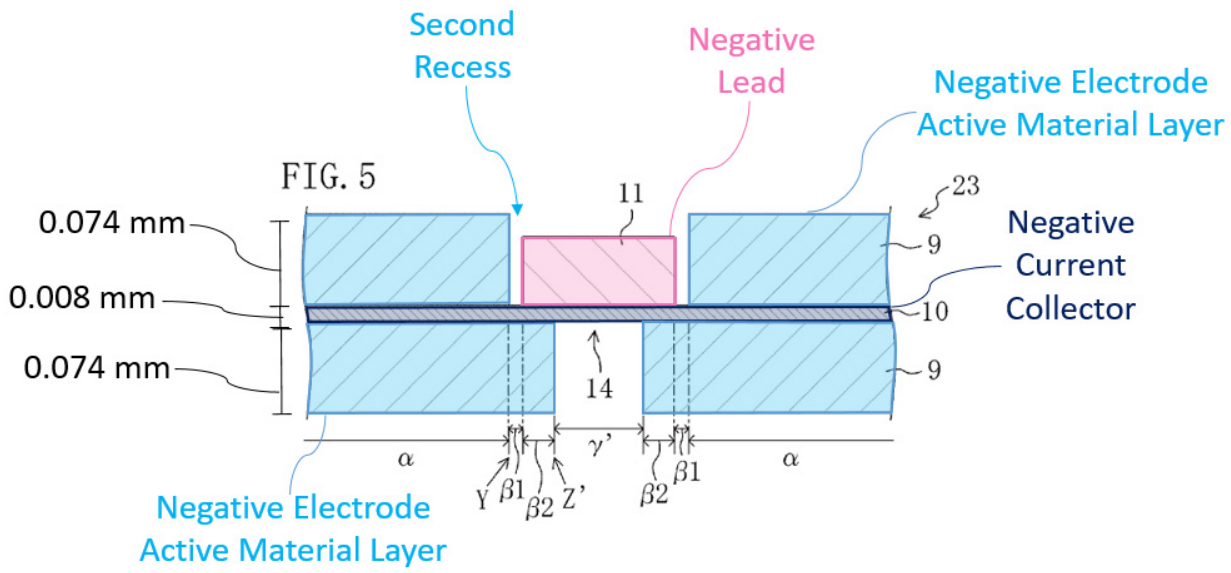




EX1005, FIGs. 3, 5 (annotated).

The thickness of the negative active material applied on Sato's negative current collector is .074 mm, which corresponds to the depth of Sato's second recess. EX1005, ¶[0107]. Given the disclosed depth of Sato's recess and in view of Figures 3 and 5, Sato's second recess has a depth between 0.005 mm to 0.074 mm larger than the thickness of negative lead 11. EX1003, ¶169.



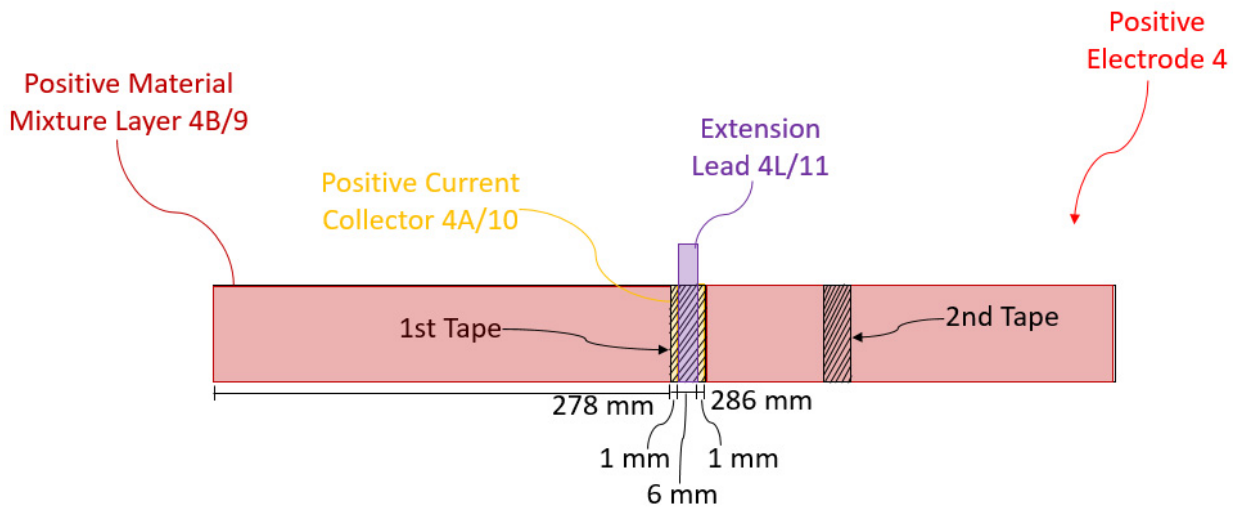


EX1005, FIGs. 3, 5 (annotated).

Furthermore, given the finite number of predictable solutions—lead thickness greater than, less than, or equal to recess depth—it would have been obvious to form Sato's lead 0.005-0.1 mm shorter than the recess depth. *KSR,* 550 U.S. at 421; *Powers-Kennedy*, 282 U.S. at 185; EX1003, ¶170.

3. Claims 8/19

Sato discloses a width (8 mm) of a portion of the positive lead in the first recess (exposed portion 12/14) is greater than a width (1 mm) of a remaining portion of the first recess not occupied by the positive lead located on one side of the positive lead. EX1005, ¶¶[0111]-[0112] (positive electrode's exposed portion has "width of 8 mm" and positive electrode lead has "width of 6 mm"). EX1003, ¶¶171-173, 184.



Sato's Positive Electrode, EX1003, ¶171.

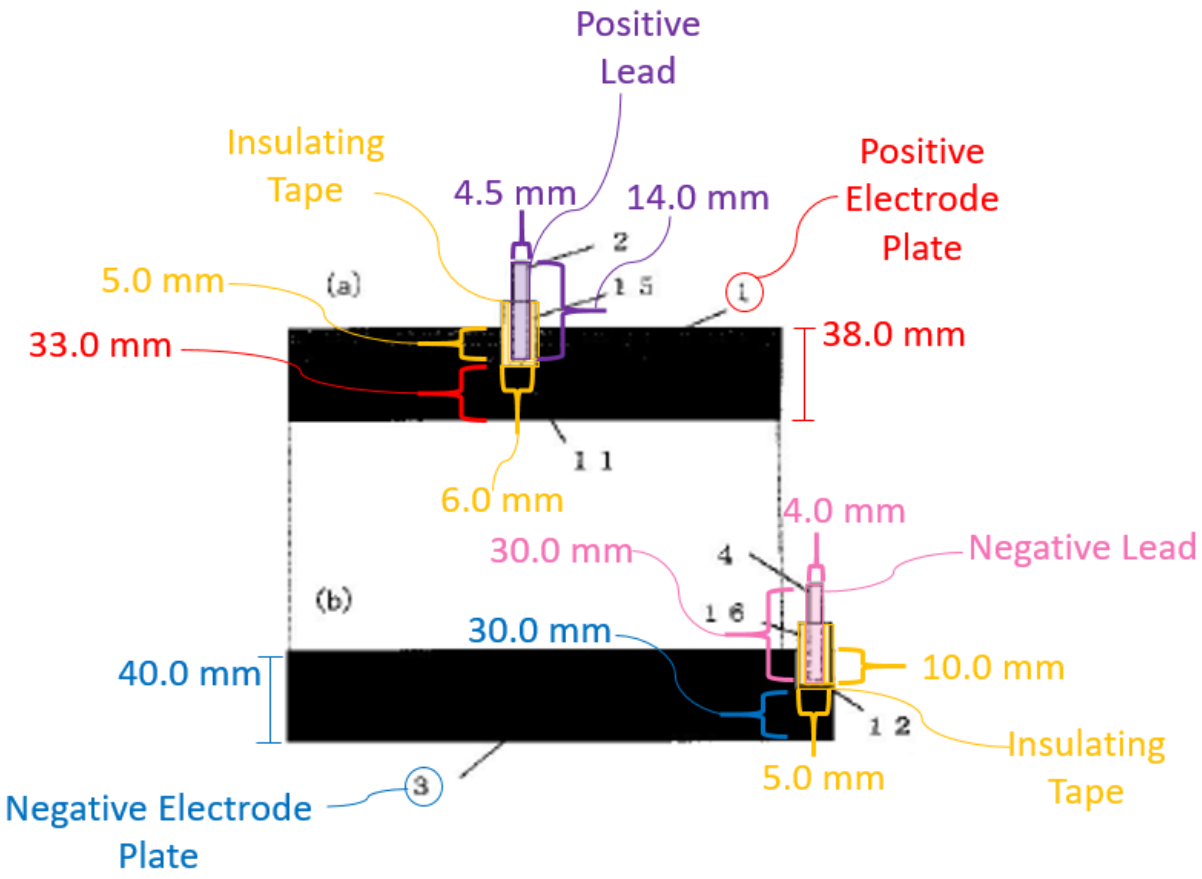
X. GROUND 2: DEPENDENT CLAIMS 4, 5, 7, AND 18 WOULD HAVE BEEN OBVIOUS IN VIEW OF SATO, TAKEMURA, AND NAKAMURA.

A. Motivation to Combine Nakamura with Sato-Takemura

Nakamura, Sato, and Takemura are analogous art—lithium-ion batteries. EX1005, ¶[0001]; EX1006, ¶[0001]; EX1012, ¶[0007]; EX1003, ¶189.

Nakamura discloses recess dimensions on the positive and negative electrodes within certain ranges to minimize the active material removed when forming "material-free portions" (recesses), while exposing enough surface of the current collector to spot-weld the lead. EX1012, ¶¶[0027], [0052]-[0053]; EX1003, ¶190. Preserving active material on the current collector increases the battery's storage capacity and minimizes insulating tape material, reducing manufacturing costs. EX1012, ¶¶[0005]-[0008], [0034], [0069]-[0073]; EX1003, ¶¶190-192. For

example, Nakamura discloses a positive active material-free portion 11 (recess) with a length (measured along Nakamura's electrode plate's width) of 5-15 mm and a width (measured along Nakamura's electrode plate's length) of 6 mm for a "positive electrode plate 1 with a width dimension of 38 mm and a length dimension of 355 mm." EX1012, ¶¶[0027], [0052]. Nakamura discloses a negative active material-free portion 12 (recess) with a length (measured along Nakamura's electrode plate's width) of 10.0 mm and a width (measured along Nakamura's electrode plate's length) of 5.0 mm for "a negative electrode plate 3 with a width dimension of 40 mm and a length dimension of 430 mm." EX1012, ¶¶[0034], [0049], [0053].



EX1012, FIG. 1 (annotated).

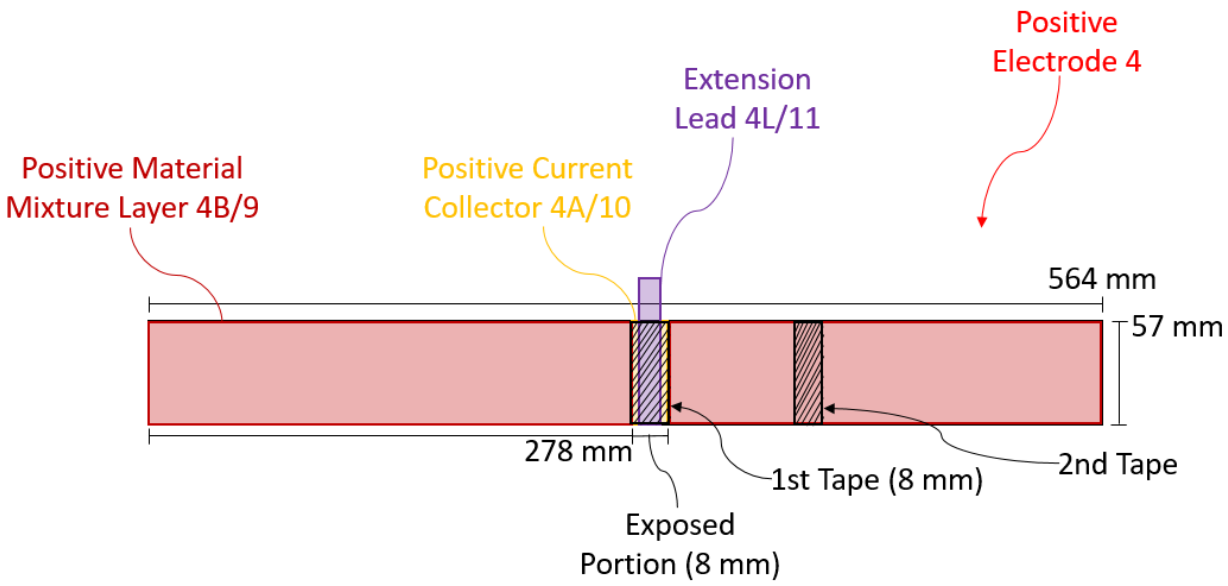
To the extent Sato does not explicitly disclose all the claimed ranges of dimensions, it would have been obvious to a POSA to modify the recess sizing in Sato's electrodes according to the dimensions taught in Nakamura to increase Sato's battery's storage capacity while exposing enough current collector surface to weld the leads. EX1003, ¶¶193, 195; EX1012, ¶¶[0027], [0073]. This would have preserved active material on the electrode's current collector, thereby maximizing the battery's storage capacity. EX1012, ¶¶[0005]-[0008], [0069]-[0073]; EX1003, ¶193. Thus, a POSA would have been motivated to combine Nakamura's recess dimensions with Sato-Takemura because doing so would have increased Sato's battery's storage capacity and reduced manufacturing costs. EX1003, ¶193.

A POSA would also have had a reasonable expectation of success in combining Nakamura's teachings with Sato-Takemura because modifying the active material dimensions on the current collector was common in lithium-ion batteries. EX1003, ¶194; EX1012, ¶¶[0005]-[0008], [0069]-[0073]. A POSA would have expected Sato's electrodes, as modified by Takemura-Nakamura, to perform their intended function of exchanging electrons and ions. EX1003, ¶194. This modification would have simply been combining a known element (Nakamura's recess dimensions) to a known device (Sato-Takemura's battery)—to increase the battery's storage capacity. *KSR,* 550 U.S. at 417; EX1003, ¶194.

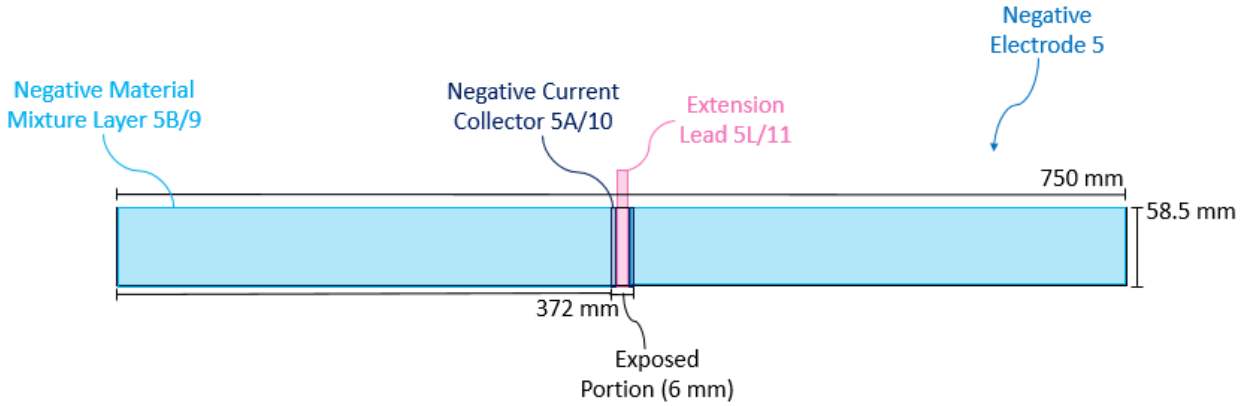
B. Claim 4

1. Sato

Sato's first recess (positive electrode 4's exposed portion 12/14) has a width (8 mm) 1-10 mm larger than a width (6 mm) of the positive lead (4L/11). EX1005, ¶¶[0111]-[0113]; EX1003, ¶196. Sato's second recess (negative electrode 5's exposed portion 12/14) has a width (6 mm) 1-10 mm larger than a width (4 mm) of the negative lead (5L/11). EX1005, ¶[0137]; EX1003, ¶197.



Sato's Positive Electrode, EX1003, ¶135.

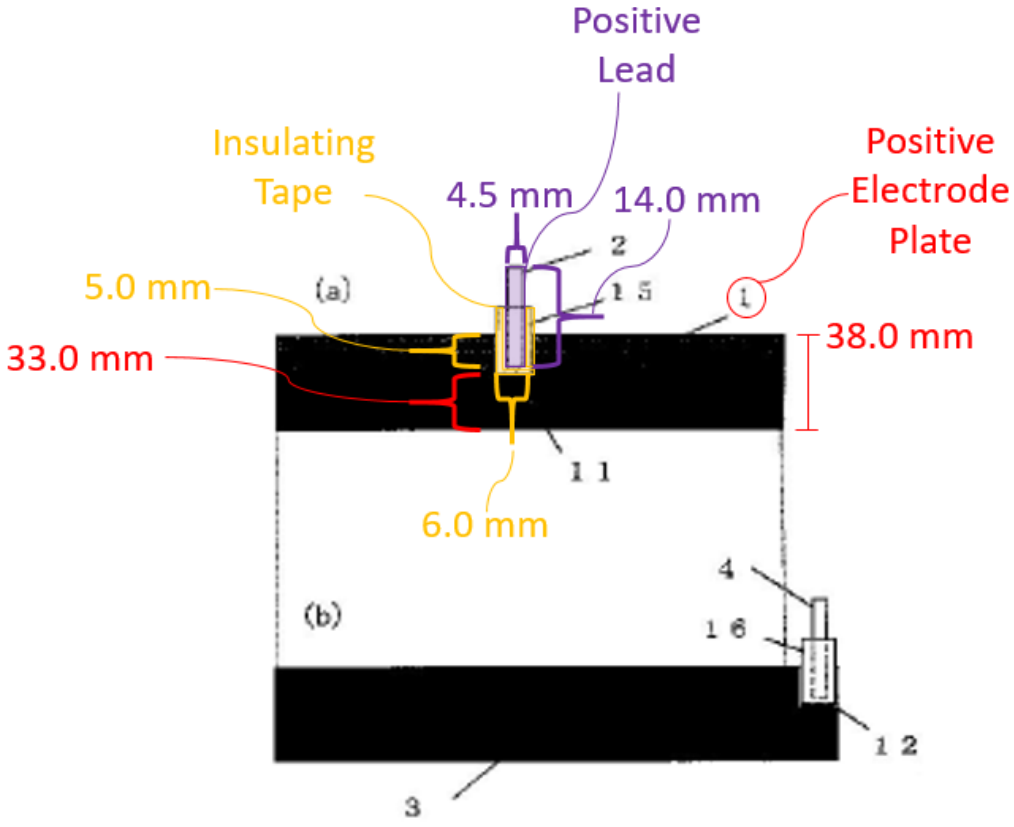


Sato's Negative Electrode, EX1003, ¶135.

Sato is silent about "the first recess ha[ving] a length of 1-100 mm less than a length of the positive lead" and "the second recess ha[ving] a length of 1-100 mm less than a length of the negative lead." However, these recess lengths were known, as Nakamura disclosed. EX1003, ¶198.

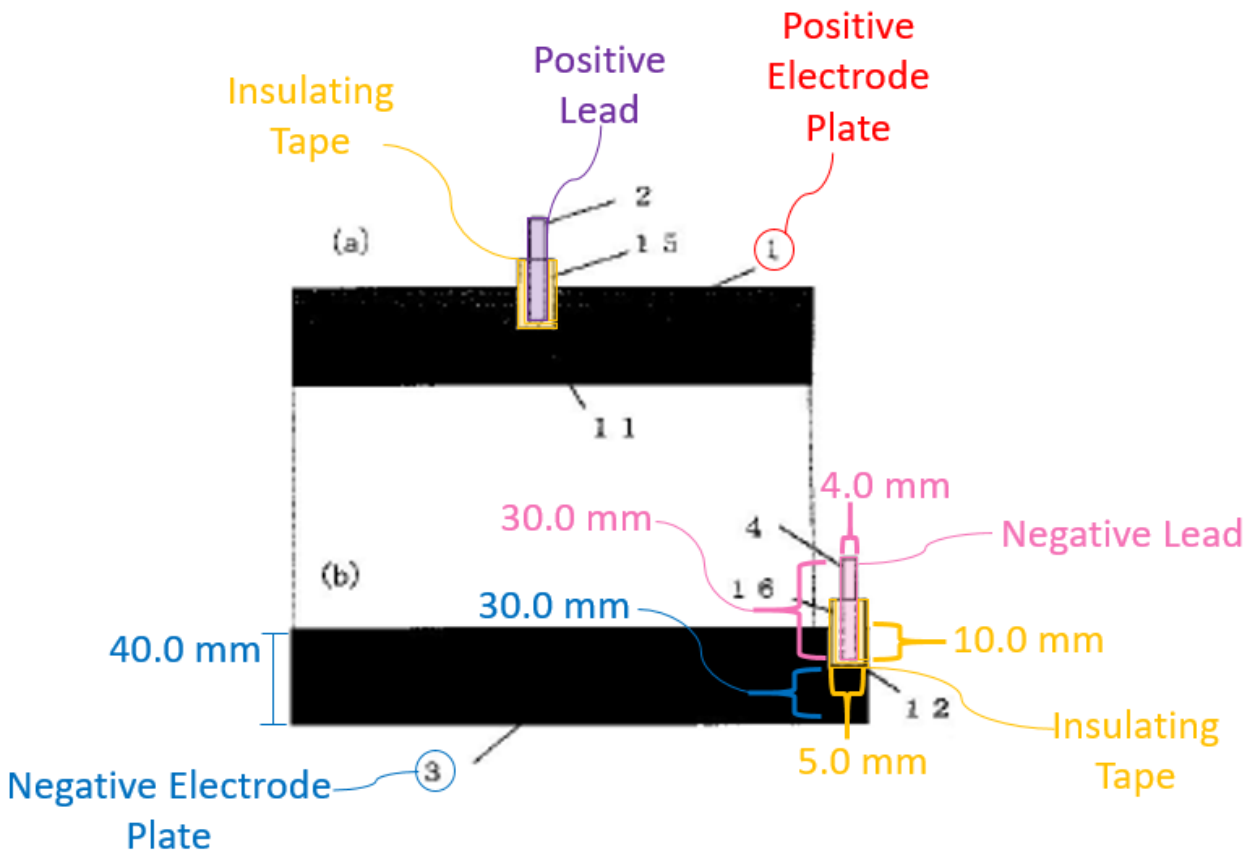
2. Nakamura

Nakamura's positive active material-free portion 11 (first recess) has a 5.0 mm length (measured along electrode's width) and a 6.0 mm width (measured along electrode's length), and Nakamura's positive lead 2 has a 14.0 mm length and a 4.5 mm width. EX1012, ¶[0052]. Thus, Nakamura's first recess 11 has a length 9 mm less than a length of positive lead 2 and a width 1.5 mm larger than a width of positive lead 2. EX1003, ¶¶199-200.



EX1012, FIG. 1 (annotated).

Similarly, Nakamura's negative active material-free portion 12 (second recess) has a 10.0 mm length (measured along the electrode's width) and a 5.0 mm width (measured along the electrode's length), and Nakamura's negative lead 4 has a 30.0 mm length and a 4.0 mm width. EX1012, ¶¶[0049], [0043]; EX1003, ¶201. Thus, Nakamura's second recess 12 has a length 20.0 mm less than a length of negative electrode lead 4 and a width 1.0 mm larger than a width of negative lead 4. EX1003, ¶¶201-202.



EX1012, FIG. 1 (annotated).

Furthermore, Nakamura renders obvious the recited recess dimension ranges. *Powers-Kennedy*, 282 U.S. at 185; EX1003, ¶202. A POSA would have been motivated to form the second recess with a length that falls within Nakamura's preferred range 5-15 mm (¶[0034]) to reduce manufacturing costs. *Id*. This would have resulted in Nakamura's second recess having a length 15 mm to 25 mm less than its negative lead length. *Id*.

3. Sato-Takemura-Nakamura Combination

For the reasons discussed in Section X.A, it would have been obvious to form the length of Sato's first and second recesses 1-100 mm less than a length of the

positive and negative leads. EX1003, ¶203; EX1005, ¶¶[0008], [0069]-[0073]. This modification would have simply been combining a known element (Nakamura's recess dimensions) with a known device (Sato-Takemura's battery) to increase the battery's capacity. EX1003, ¶¶203-204.

C. Claim 5

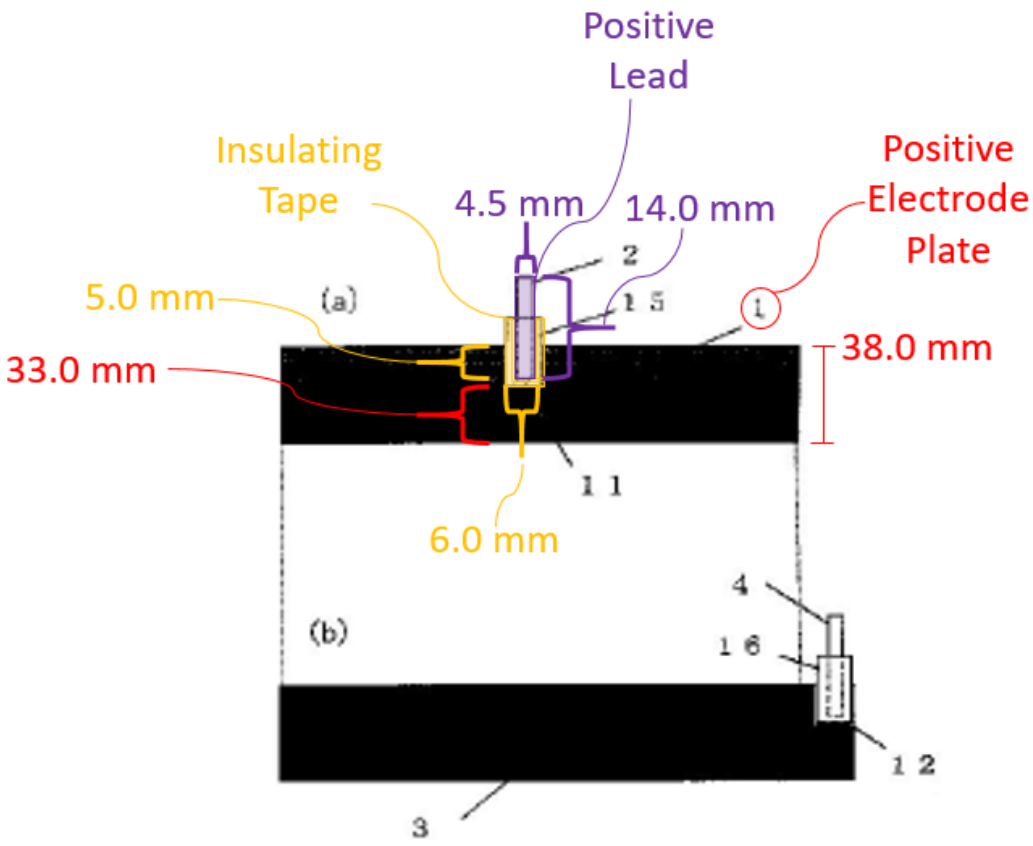
1. Sato

In Sato's example Battery 1, positive active material has a width of 57 mm, and negative active material has a width of 58.5 mm. EX1005, ¶¶[0104], [0107]; EX1003, ¶¶205-206.

Sato is silent about "the first recess ha[ving] a length of 1-100 mm less than a width of the positive electrode active material layer" and "the second recess ha[ving] a length of 1-100 mm less than a width of the negative active material layer." However, this recess length was known, as Nakamura disclosed. EX1003, ¶207.

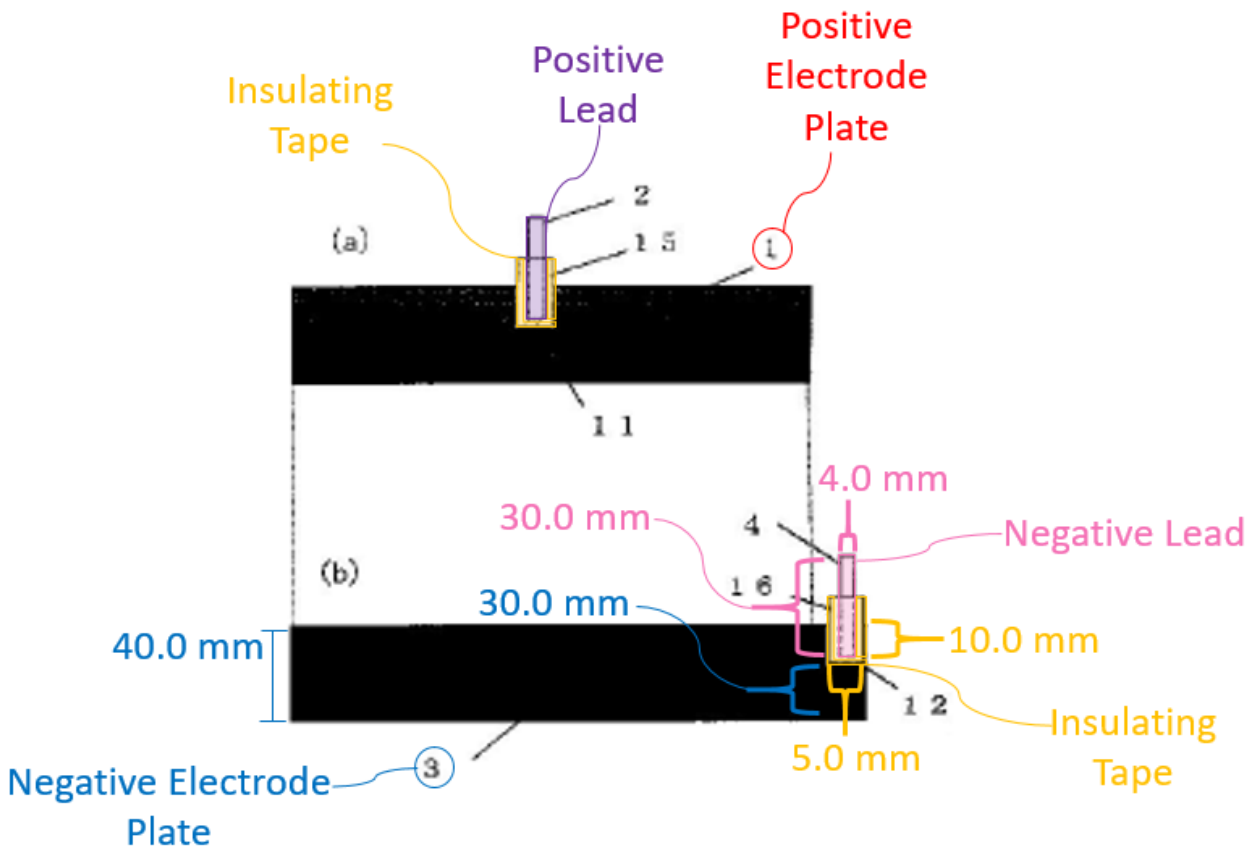
2. Nakamura

Nakamura's positive active material has "a width dimension of 38 mm," and Nakamura's first recess 11 has a 5.0 mm length (measured along the electrode plate's width). EX1012, ¶[0052]; EX1003, ¶¶208-209. The length of Nakamura's first recess 11 is 33 mm less than a width of the positive active-material (38 mm– 5 mm). EX1003, ¶209.



EX1012, FIG. 1 (annotated).

Nakamura's negative active material has "a width dimension of 40 mm," and Nakamura's second recess 12 has a 10.0 mm length (measured along the electrode's width). EX1012, ¶¶[0049], [0053]. The length of Nakamura's second recess 12 is 30.0 mm less than a width of the negative active-material. EX1003, ¶¶210-211.



EX1012, FIG. 1 (annotated).

Furthermore, Nakamura renders obvious the recited recess dimension ranges. *Powers-Kennedy*, 282 U.S. at 185; EX1003, ¶211. A POSA would have been motivated to form the second recess with a length that falls within Nakamura's preferred 5-15 mm range (¶[0034]) to reduce manufacturing costs. *Id*. This would have resulted in Nakamura's second recess having a length of 25 mm to 35 mm less than its negative active-material width. *Id*.

3. Sato-Takemura-Nakamura Combination

For the reasons discussed in Section X.A, it would have been obvious to form the length of Sato's first and second recesses to be 1-100 mm less than a width of

the positive and negative active material mixture layers. EX1003, ¶212; EX1012, ¶¶[0008], [0069]-[0073]. This modification would have simply been combining a known element (Nakamura's recess dimensions) to a known device (Sato-Takemura's battery) to increase the battery's capacity. EX1003, ¶¶212-13.

D. Claims 7/18

1. Sato

In example Battery 1, the positive active material has a width of 57.0 mm, and the recess has a width of 8.0 mm. EX1005, ¶¶[0104], [0111]; EX1003, ¶¶215-216. Sato's positive electrode lead has "a width of 6 mm." EX1005, ¶[0112].

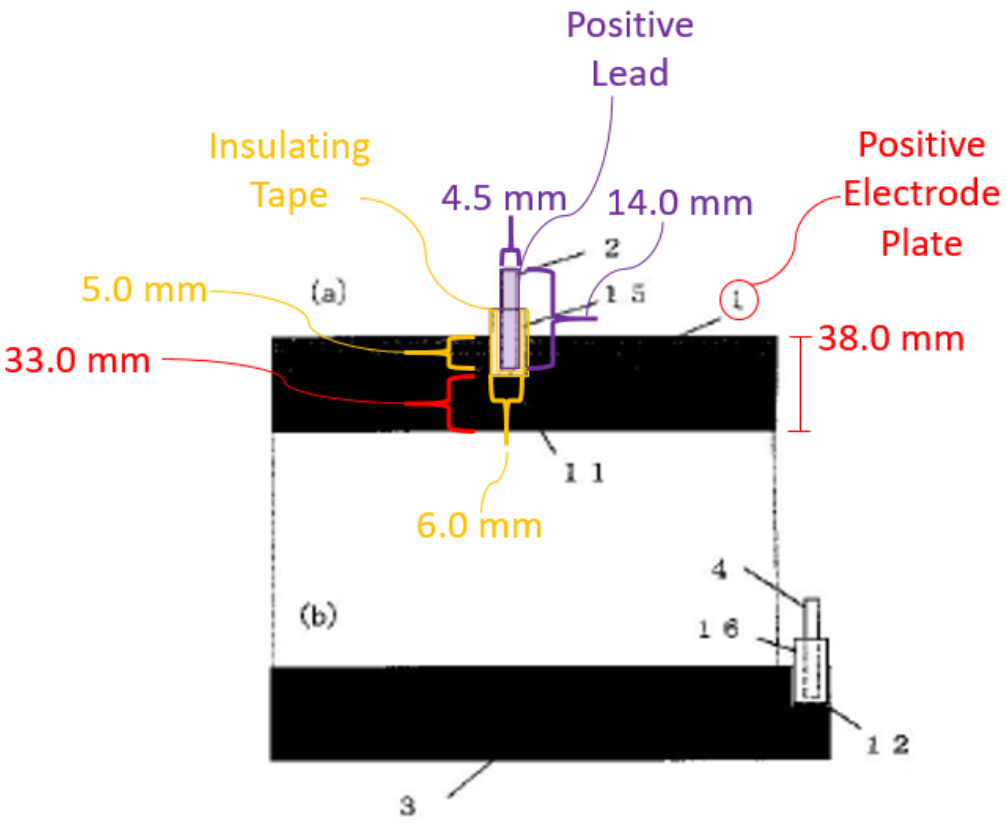
Sato is silent about "a length of a portion of the positive lead in the first recess [being] less than a width of a remaining portion of the positive electrode active material layer from an edge of the first insulating glue layer covering [a first film] the [first film] positive electrode active material layer to an edge of the [first film] positive electrode active material layer opposite to the first recess," as recited in claims 7 and 18. However, these lead and recess dimensions were known, as Nakamura disclosed. EX1003, ¶¶214-218.

2. Nakamura

Nakamura discloses electrode recess and lead connection dimensions that overlap the dimension ranges of claims 7 and 18. EX1003, ¶219. Nakamura's first recess 11 has a 5.0 mm length. EX1012, ¶[0052]. The length of the portion of Nakamura's positive electrode lead 2 located in material-free portion 11 (measured

along the width of electrode plate 1) is less than the length of first recess 11. EX1003, ¶220. Thus, the length of the portion of Nakamura's positive electrode lead 2 located in first recess 11 is less than 5.0 mm.

The width of the remaining portion of Nakamura's active material mixture layer from an edge of the insulating tape 15 covering the positive active material to an edge of the positive active material opposite to the material-free portion 11 is 33.0 mm. EX1012, ¶[0052] (plate 1 has "width of 38 mm.") Accordingly, the length (less than 5.0 mm) of the portion of Nakamura's positive lead 2 in material-free portion 11 is less than a width (33.0 mm) of the remaining portion of Nakamura's positive active material. EX1003, ¶221. Alternatively, if the insulating tape 15 (11 mm long) aligned with the top edge of the positive active material (not specifically shown), the length of Nakamura's lead in material-free portion 11 is 11 mm. Then, the remaining width of Nakamura's positive active material would be 27 mm (38 mm - 11 mm), also satisfying the claimed requirement. EX1003, ¶¶221-222.



EX1012, FIG. 1 (annotated).

3. Sato-Takemura-Nakamura Combination

For the reasons discussed in Section X.A, it would have been obvious to make the length of a portion of Sato's positive lead 4L/11 in exposed portion 12/14 (first recess) less than a width of a remaining portion of Sato's positive active material layer 4B/9 defined from the edge of Sato's adhesive tape covering the positive lead 4L/11 to an edge of Sato's positive active material layer 4B/9 opposite to exposed portion 12/14. EX1003, ¶223; EX1012, ¶¶[0008], [0069]-[0073]. This modification would have simply been applying a known technique (modifying the recess dimensions) to a known device (Sato-Takemura's battery) to increase the battery's

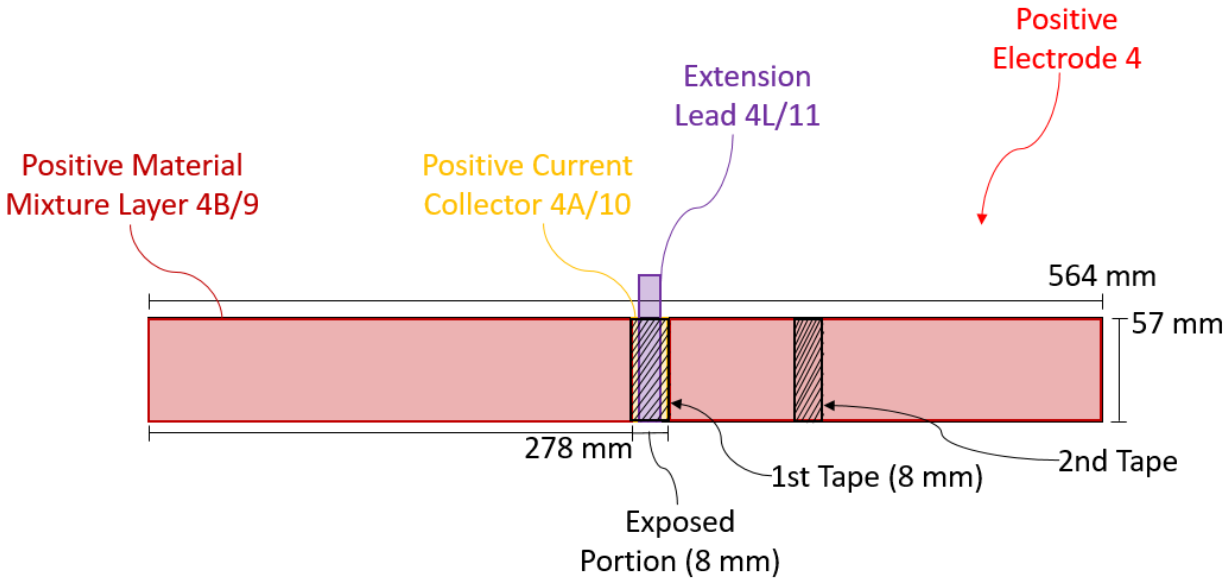
capacity. EX1003, ¶¶223-224.

XI. GROUND 3: DEPENDENT CLAIMS 20 AND 22 WOULD HAVE BEEN OBVIOUS IN VIEW OF SATO, TAKEMURA, OH-539, AND OH-144.

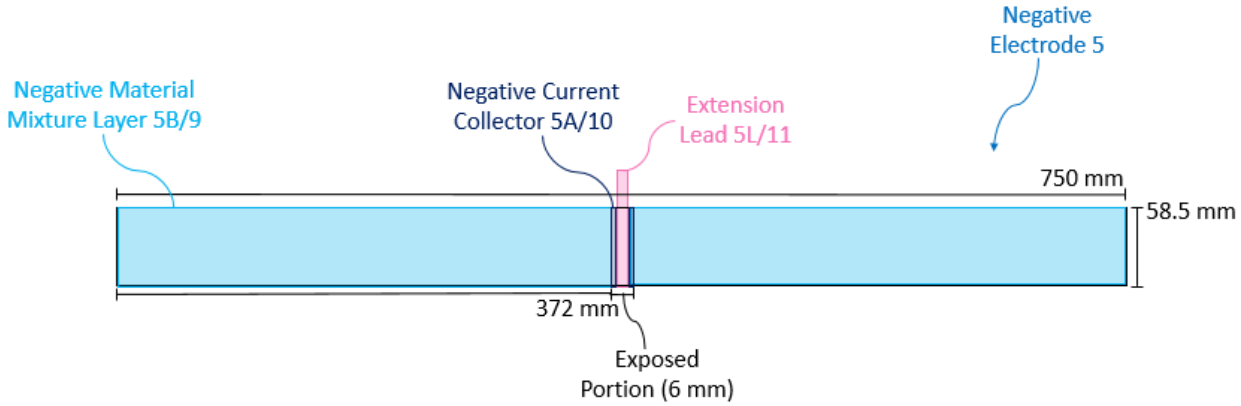
Sato, Takemura, Oh-539, and Oh-144 are analogous art—lithium-ion batteries. EX1005, ¶¶[0001], [0013]; EX1006, ¶[0001]; EX1007, ¶¶[0007], [0029]; EX1017, ¶¶[0025]-[0027]; EX1003 ¶231.

A. Motivation to Combine Oh-539 with Sato-Takemura

As discussed in Section IX.B, Sato-Takemura renders obvious a lithium-ion battery as recited in claims 1 and 17. In the Sato-Takemura combination, the positive and negative electrodes would have the following construction. EX1003, ¶232; Section IX.B.9.



Sato's Positive Electrode, EX1003, ¶232.



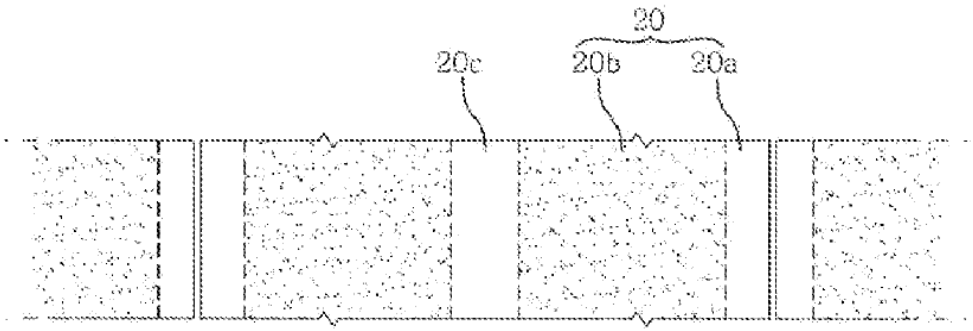
Sato's Negative Electrode, EX1003, ¶232.

Sato makes the positive electrode by applying a positive active material slurry to the aluminum foil's surfaces, drying the slurry to form a positive electrode plate, and cutting the plate to a desired width (e.g., 57 mm) and length (e.g., 564 mm). EX1005, ¶[0104]. Next, Sato explains peeling positive active material from a center of the plate to form an exposed portion for the positive lead. EX1005, ¶[0111]. Sato describes a similar method with a negative active material slurry and a copper foil to make the negative electrode with a desired width (e.g., 58.5 mm), length (e.g., 750 mm) and an exposed portion for the negative lead. EX1005, ¶¶[0107], [0137]. A POSA would have understood this method applied active material along the entire length of Sato's positive and negative electrodes. EX1003, ¶233.

Sato cuts through the active material at the electrode ends. EX1003, ¶234. While this was one known approach, a POSA would have understood it can cause manufacturing issues, including wearing the cutting tools and forming active material dust. EX1003, ¶¶234-235. Accordingly, a POSA would have been

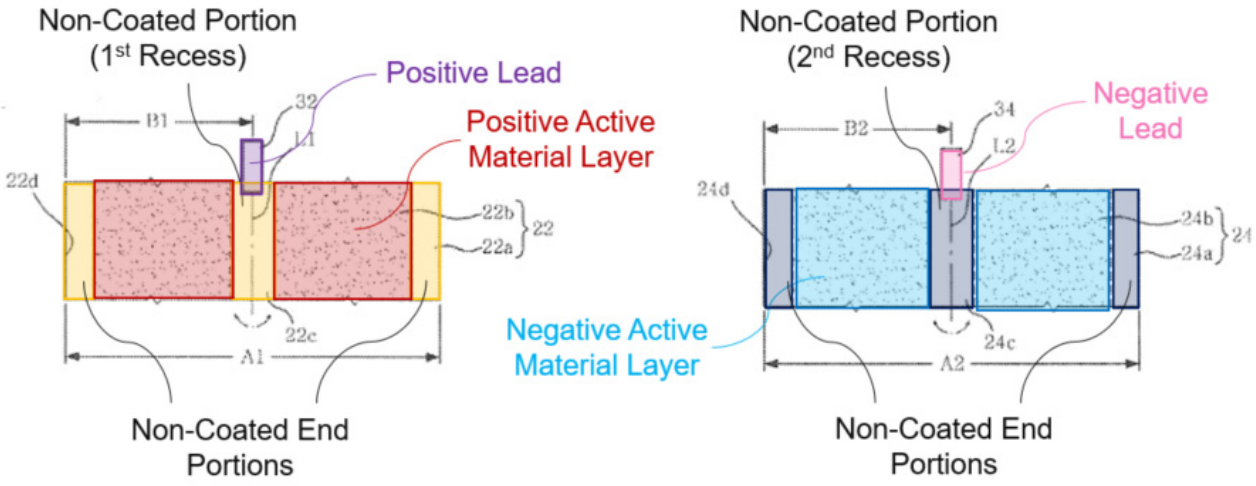
motivated to implement alternative methods of making Sato's electrodes that reduce wear and/or dust, such as Oh-539's method. EX1003, ¶236.

Oh-539 applies positive and negative active materials on metal foils at regular intervals to form exposed, non-coated portions 20c for easy manufacturing. EX1007, ¶¶[0011], [0030], [0073]-[0075]. Oh-539 cuts every other non-coated portion 20c, producing electrodes with a center non-coated portion and non-coated ends. EX1007, ¶¶[0074]-[0075]. Leads are attached to the center non-coated portion. EX1007, ¶[0076]; EX1003, ¶237.



EX1007, FIG. 6(c).

Oh-539's method simplifies the electrode manufacturing process to repeatable steps, lowering equipment cost. EX1007, ¶[0075]; EX1003, ¶238.



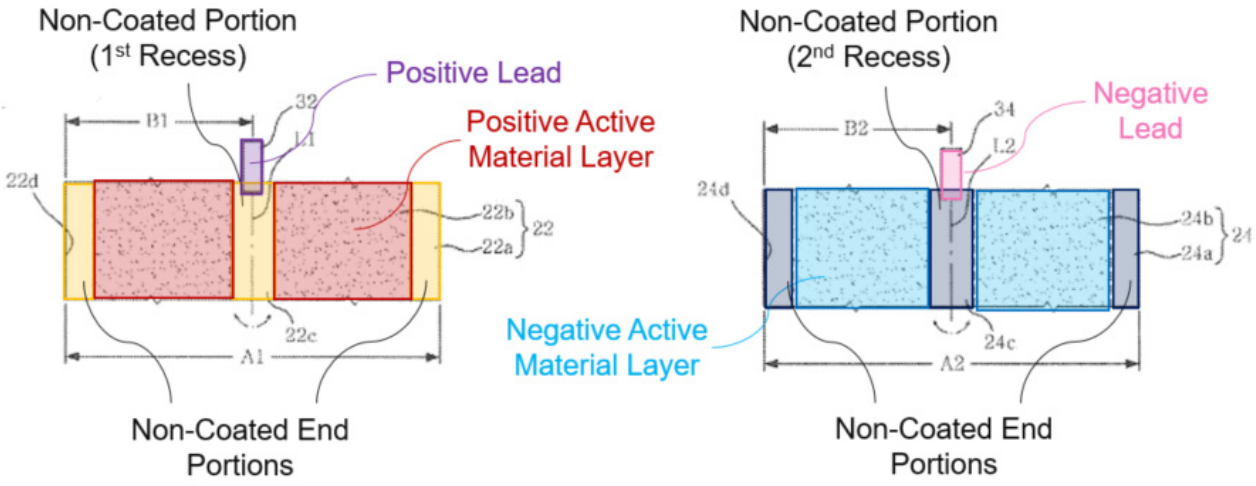
EX1007, FIGs. 2-3 (annotated).

Therefore, a POSA would have been motivated to use Oh-539's method to make Sato's electrodes to have centrally located recesses for lead attachment at reduced costs. EX1003, ¶239. This would reduce cutting tool wear and/or dust by cutting through only exposed, non-coated metal on the electrodes. EX1003, ¶239.

A POSA would have also had a reasonable expectation of success combining the teachings of Oh-539 and Sato-Takemura. EX1003, ¶240. This would have simply been applying a known technique (coating and cutting electrode plates at regular intervals) to create a known electrode construction with centrally located recesses for attaching leads. EX1003, ¶240.

B. Motivation to Combine Oh-144 with Sato-Takemura-Oh-539

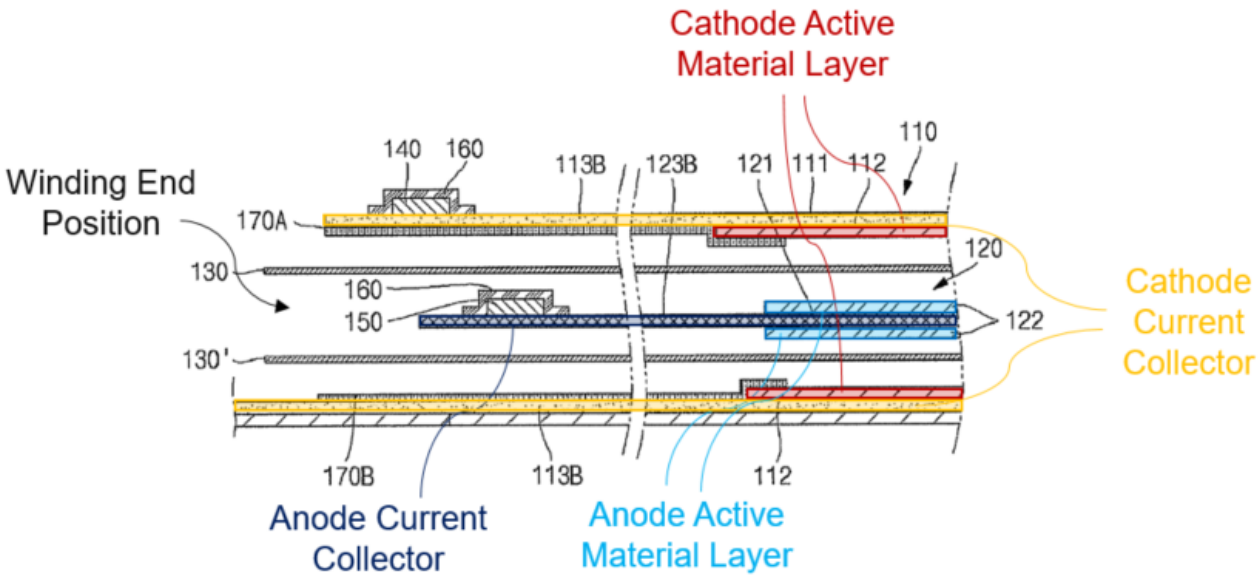
The modification above provides the Sato-Takemura battery with Oh-539's electrode layout. EX1003, ¶241.



EX1007, FIGs. 2-3 (annotated).

A POSA would have further understood that exposed metal at the non-coated ends is susceptible to short-circuiting. EX1003, ¶242; EX1008, ¶[0005]; EX1011, ¶[0009]; EX1017, ¶¶[0010]-[0011]. Accordingly, a POSA would have been motivated to implement a battery construction that helps prevent short-circuiting. EX1003, ¶242.

Oh-144's cathode plate 110 includes cathode collector 111, cathode active material 112, and uncoated cathode portions 113. EX1017, ¶[0026]. Oh-144's anode plate 120 includes anode collector 121, anode active material 122, and uncoated anode portions 123. EX1017, ¶[0027]. "[T]he uncoated portions at the winding end position are referred to as 'rear uncoated cathode or anode portions 113B or 123B.'" EX1017, ¶[0032]. The outer side surface of uncoated cathode portion 113B remains uncoated for approximately one complete revolution in the electrode winding. EX1017, ¶[0036], FIG. 3; EX1003, ¶¶243-246.



EX1017, FIG. 4 (annotated).

Oh-144 disposes two tapes 170A/170B on the cathode plate 110 at the winding end portion of the anode plate 120. EX1017, ¶¶[0038], [0039]; EX1003, ¶¶243-244.

Tape 170A covers the bottom (inner side) surface of the uncoated cathode portion 113B above exposed metal 123B on the anode collector 121 at the winding end. EX1017, ¶[0038]. Tape 170A prevents "a short circuit that could be caused by contact between the rear cathode uncoated portion 113B of the cathode plate 110 and rear anode uncoated portion 123B of the anode." EX1017, ¶[0038]; EX1003, ¶[0245].

Tape 170B covers a top (outer side) surface of the uncoated cathode portion 113B below exposed metal 123B on the anode collector 121 at the winding end. EX1017, ¶[0039]. Tape 170B prevents "a short circuit that could be caused by

contact between the rear anode uncoated portion 123B of the anode plate 120 and rear cathode uncoated portion 113B of the cathode plate 110." EX1017, ¶[0039]; EX1003, ¶246.

A POSA would have been motivated to add Oh-144's tapes 170A/170B in the Sato-Takemura-Oh-539 combination to prevent short-circuiting. EX1003, ¶247; EX1007, ¶[0092]. This simple modification places the tapes on opposite inner and outer surfaces of the positive plate (at the non-coated ends created by Oh-539's manufacturing method) such that (i) a winding end of the negative plate is located between the tapes, and (ii) the tapes extend over the winding end. EX1003, ¶247. This would prevent short-circuiting caused by contact between uncoated end portions on the cathode and anode located at the winding end of the battery coil—a known problem for pouch-type or cylindrical wound battery coils, like Sato-Takemura-Oh-539. EX1005, ¶[0084]; EX1006, ¶[0032]; EX1007, ¶[0092]; EX1017, Abstract, ¶¶[0041]-[0042], [0045]; EX1003, ¶¶246-247.

Adding Oh-144's tapes would simply have been applying a known technique (placing tapes on inner/outer surfaces of the positive electrode around exposed metal at the winding end of the negative electrode) to a known device to prevent short-circuiting. *KSR*, 550 U.S. at 417; EX1003, ¶248.

A POSA would also have had a reasonable expectation of success doing so because applying insulating tapes in coiled lithium-ion battery cells was a common

solution for preventing short-circuiting. EX1006, ¶¶[0003], [0008], [0022]; EX1009, ¶[0008]; EX1010, ¶[0029]; EX1011, ¶¶[0009], [0014]; EX1003, ¶249. A POSA would have expected Oh-144's tapes to insulate exposed metal at the winding end of the coil. EX1003, ¶249.

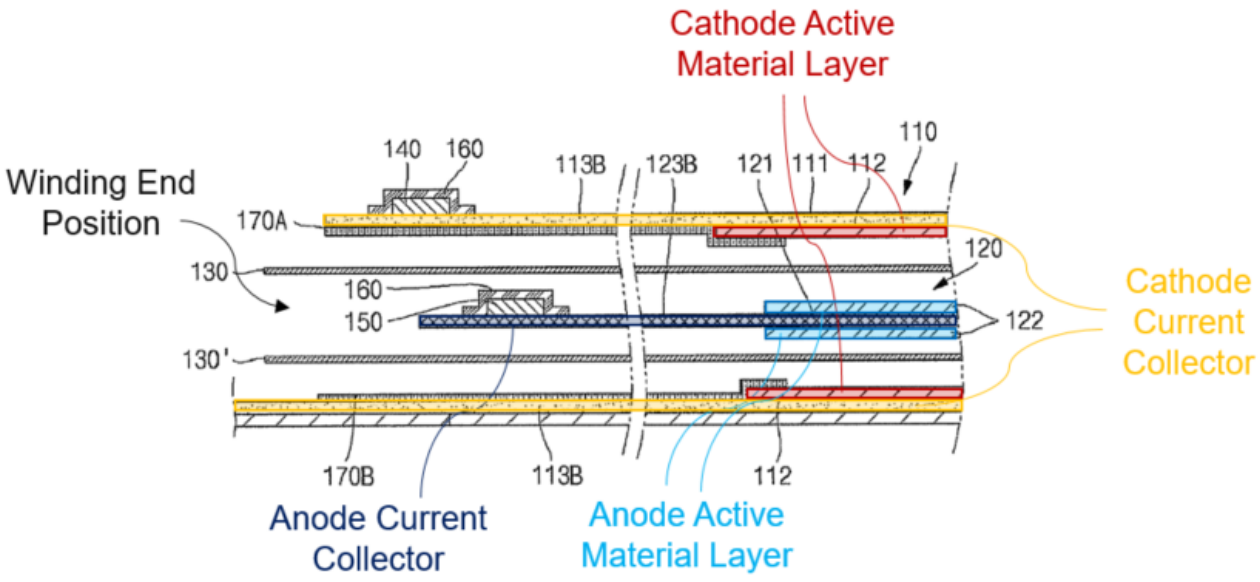
C. Claims 20 and 22

1. Sato-Takemura-Oh-539 Combination

The Sato-Takemura-Oh-539 combination does not explicitly disclose two insulating layers disposed on opposite surfaces of the positive plate such that a winding end of the negative plate is located between the two layers and the two layers extend over the winding end. But including these two insulating layers in the Sato-Takemura-Oh-539 battery would have been obvious in view of Oh-144. EX1003, ¶¶250-252.

2. Oh-144

As discussed in Section XI.B, Oh-144 discloses a winding end (123B) of a negative plate (cathode 120) located between two insulating layers (tapes 170A-B), which extend over the winding end (123B) along the winding direction. EX1017, ¶¶[0038], [0039]; EX1003, ¶253.



EX1017, FIG. 4 (annotated).

3. Sato-Takemura-Oh-539-Oh-144 Combination

As discussed in Section XI.B, it would have been obvious to position Oh-144's tapes 170A-B on inner/outer surfaces of the non-coated end portions of the positive electrode in the Sato-Takemura-Oh-539 battery such that the winding end is located between the tapes and the tapes extend over the winding end. EX1003, ¶¶254-256.

XII. GROUND 4: CLAIMS 9-11, 14, AND 16 WOULD HAVE BEEN OBVIOUS IN VIEW OF SATO, TAKEMURA, AND KOBAYASHI.

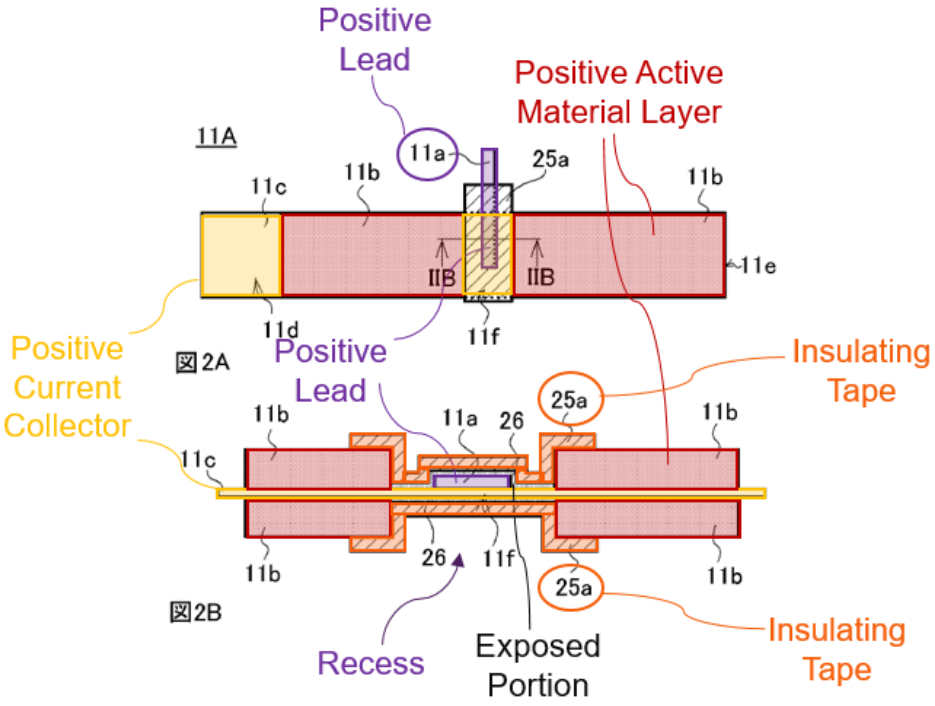
A. Motivation to Combine Sato, Takemura, and Kobayashi

Sato, Takemura, and Kobayashi are analogous art—lithium-ion batteries. EX1005, ¶[0001]; EX1006, ¶[0001]; EX1008, ¶¶[0014]-[0016]; EX1003, ¶¶263-265. As discussed in Section IX.A, a POSA would have been motivated to combine Takemura with Sato such that Sato's second insulating tape is located on the

positive active material opposite to the negative lead connection. EX1003, ¶¶263-265; EX1006, ¶¶[0003], [0008], [0022]; EX1009, ¶[0008]; EX1010, ¶[0029]; EX1011, ¶[0018].

As discussed in Section IX.B.8, Sato discloses covering the top surface of positive current collector 4A/10 connected to positive lead 4L/11 with a first insulating tape. Sato does not explicitly disclose covering the opposite, bottom exposed surface of positive current collector 4A/10 with another first insulating tape. But covering both the top and bottom surfaces with insulating tapes was known, as Kobayashi disclosed. EX1003, ¶¶266-268.

As shown in Figures 2A-2B, Kobayashi discloses tapes 25a on the top and bottom surfaces of the exposed portion 11f of the positive electrode plate 11A. EX1008, ¶¶[0034]-[0035]. A first tape 25a on the top surface covers the positive current collecting tab 11a and edges of the positive active material 11b adjacent the positive current collecting tab 11a. EX1008, ¶¶[0034]-[0035]. Similarly, a second tape 25a on the bottom surface covers exposed metal foil opposite the positive current collecting tab 11a and edges of the positive active material 11b on the bottom surface. EX1008, ¶¶[0034]-[0035]; EX1003, ¶269.



EX1008, FIGs. 2A-2B (annotated).

Kobayashi's tapes 25a cover the positive current collecting tab 11a and exposed metal foil within exposed portion 11f, to prevent short-circuiting caused by burrs produced on the positive active material edges at exposed portion 11f during manufacturing. EX1008, ¶¶[0005], [0010], [0014]; EX1003, ¶¶269-270.

A POSA would have been motivated to cover the exposed portion 12/14 on the bottom side of Sato's positive current collector 4A/10 with another first insulating tape, as Kobayashi teaches, to protect the exposed surface from inadvertent contact with another conductor, preventing short-circuiting. EX1008, ¶¶[0005], [0010], [0014]; EX1003, ¶271. Indeed, Kobayashi describes localized pressure gradients and burrs can occur at stepped surfaces of the electrodes, leading

to short-circuiting. EX1008, ¶¶[0005], [0010]. A POSA would have understood that the exposed portion 12/14 on the bottom side of Sato's positive current collector 4A/10 is likely to experience these pressure gradients, making it susceptible to short-circuiting. EX1003, ¶271. Accordingly, a POSA would have been motivated to cover this exposed portion on the bottom side of Sato's positive current collector with an insulating layer, as Kobayashi teaches, to prevent short-circuiting, prolonging the battery's operability. *Id.*

A POSA would also have had a reasonable expectation of success in combining Kobayashi's additional insulating tape—a common solution—with Sato-Takemura to prevent short-circuiting. EX1003, ¶272. A POSA would have expected Kobayashi's insulating tape, incorporated into the Sato-Takemura battery, to insulate exposed metal and the positive active material edges. EX1003, ¶272. Combining Kobayashi's insulating tape with the Sato-Takemura battery would have simply been applying a known technique (placing Kobayashi's tape at a known position) to a known device (the Sato-Takemura battery) to prevent short-circuiting. *KSR*, 550 U.S. at 417; EX1003, ¶272.

B. Claim 9

1. [9.P]-[9.G]

Sato discloses [9.P]-[9.G] for the same reasons as [1.P]-[1.G]/[17.P]-[17.G], respectively. Sections IX.B.1-8; EX1003, ¶¶273-281.

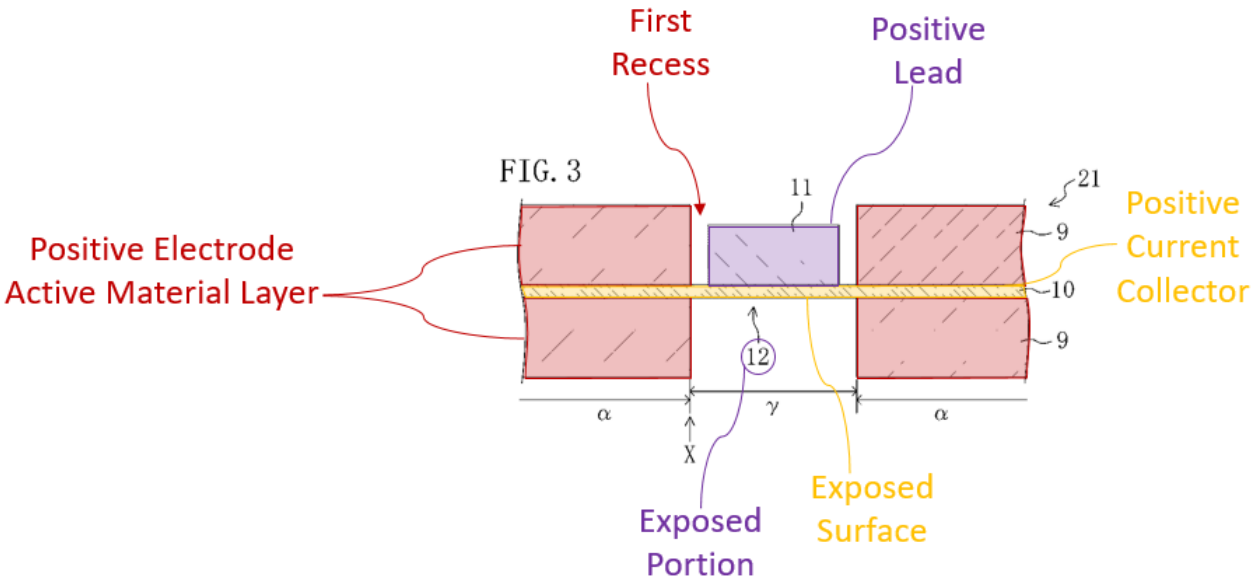
2. [9.H]

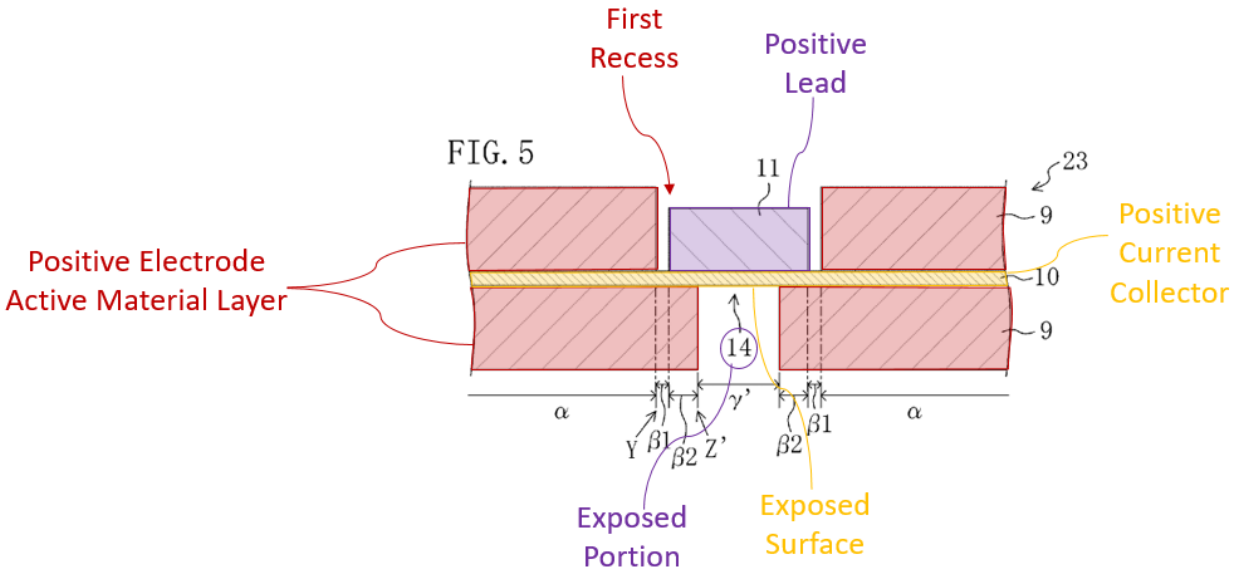
Sato-Takemura discloses [9.H] for the same reasons as [1.H]/[17.H]. Section IX.B.9; EX1003, ¶282.

3. [9.I.1]

(a) Sato

Sato discloses an exposed bottom surface (12/14) of positive current collector 4A/10 that is opposite the surface of the positive current collector connected to positive lead 4L/11.



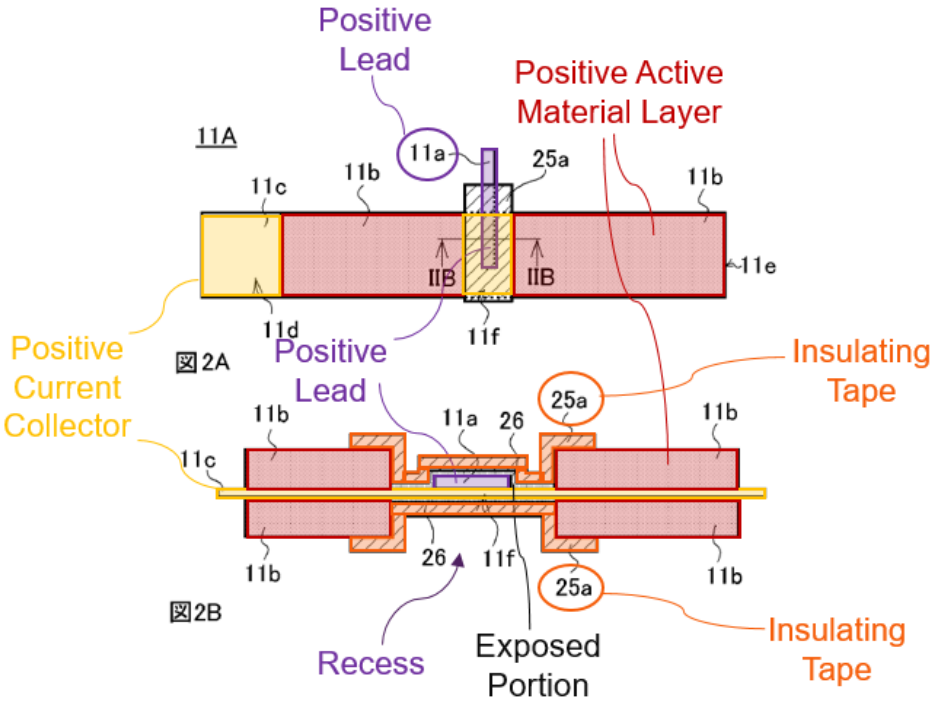


EX1005, FIGs. 3, 5 (annotated).

While Sato describes covering the top surface of positive current collector connected to the positive lead with a first insulating tape, Sato does not explicitly disclose covering the opposite, bottom exposed surface of positive current collector with another first insulating tape. EX1003, ¶¶283-284. But this would have been obvious in view of Kobayashi. *Id.*, ¶284.

(b) Kobayashi

As discussed in Section XII.A, Kobayashi discloses covering a third location 11f of a surface of the positive current collector 11c opposite the surface of the positive current collector 11c connected to the positive lead 11a with another first insulating tape 25a, as recited in [9.I.1]. EX1008, ¶¶[0034]-[0035]; EX1003,¶¶285-286.



EX1008, FIGs. 2A, 2B (annotated).

(c) Sato-Takemura-Kobayashi Combination

As discussed in Section XII.A, it would have been obvious to apply Kobayashi's second piece of tape 25a on the bottom of Sato's positive current collector 4A/10 to cover exposed metal opposite Sato's positive lead 11 and Sato's positive active material edges. EX1003, ¶¶287-288; EX1008, ¶¶[0005], [0010], [0014]. This modification would have simply been combining a known element (another insulating tape) to a known device (Sato-Takemura battery), to prevent short-circuiting. EX1003, ¶¶289-290.

4. [9.I.2]

Sato-Takemura-Kobayashi discloses [9.I.2] for the same reasons as Sato-Takemura for [1.I]/[17.I]. Section IX.B.10; EX1003, ¶291.

C. Claim 10

Sato discloses claim 10 for the same reasons as claim 2. Section IX.C.1; EX1003, ¶¶292-293.

D. Claim 11

Sato discloses claim 11 for the same reasons as claim 3. Section IX.C.1; EX1003, ¶¶294-295.

E. Claim 14

Sato discloses or renders obvious claim 14 for the same reasons as claim 6. Section IX.C.2; EX1003, ¶¶296-298.

F. Claim 16

Sato discloses claim 16 for the same reasons as claim 8. Section IX.C.3; EX1003, ¶299.

XIII. GROUND 5: CLAIMS 12, 13, AND 15 WOULD HAVE BEEN OBVIOUS IN VIEW OF SATO, TAKEMURA, KOBAYASHI, AND NAKAMURA.

A. Motivation to Combine Nakamura with Sato-Takemura-Kobayashi

Nakamura, Sato, Takemura, and Kobayashi are analogous art—lithium-ion batteries. EX1005, ¶¶[0001], [0113]; EX1006, ¶¶[0001], [0003]; EX1008, ¶¶[0013]-[0014]; EX1012, ¶¶[0007], [0025], [0028], [0034]-[0035], [0054]; EX1003, ¶301.

As discussed in Section X.A, Nakamura discloses recess dimensions on the positive and negative electrode plates that minimize the active material removed from the electrode current collector when forming recesses in the electrodes. EX1012, ¶¶[0005]-[0008], [0027], [0052]-[0053], [0069]-[0073]; EX1003, ¶302. As

also discussed in Section X.A, it would have been obvious to modify the recess sizing in Sato's positive and negative electrodes according to the dimensions taught in Nakamura to increase the battery's storage capacity while exposing enough current collector surface for lead welding. EX1003, ¶302. For the reasons discussed in Section X.A, a POSA would have been motivated to combine Nakamura's recess dimensions with the Sato-Takemura-Kobayashi battery to preserve active material on the current collector while exposing enough current collector surface for lead welding, thereby increasing the battery's capacity and reducing manufacturing costs. EX1003, ¶¶303-306; EX1012, ¶¶[0005]-[0008], [0034], [0069]-[0073]. A POSA would have had a reasonable expectation of success in doing so because this modification would have been simply combining a known element (Nakamura's recess dimensions) to a known device (Sato-Takemura-Kobayashi battery) to increase the battery's storage capacity. EX1003, ¶305.

B. Claim 12

The language of claim 12 is identical to claim 4. EX1001, 11:17-23, 12:22-28.

1. Sato

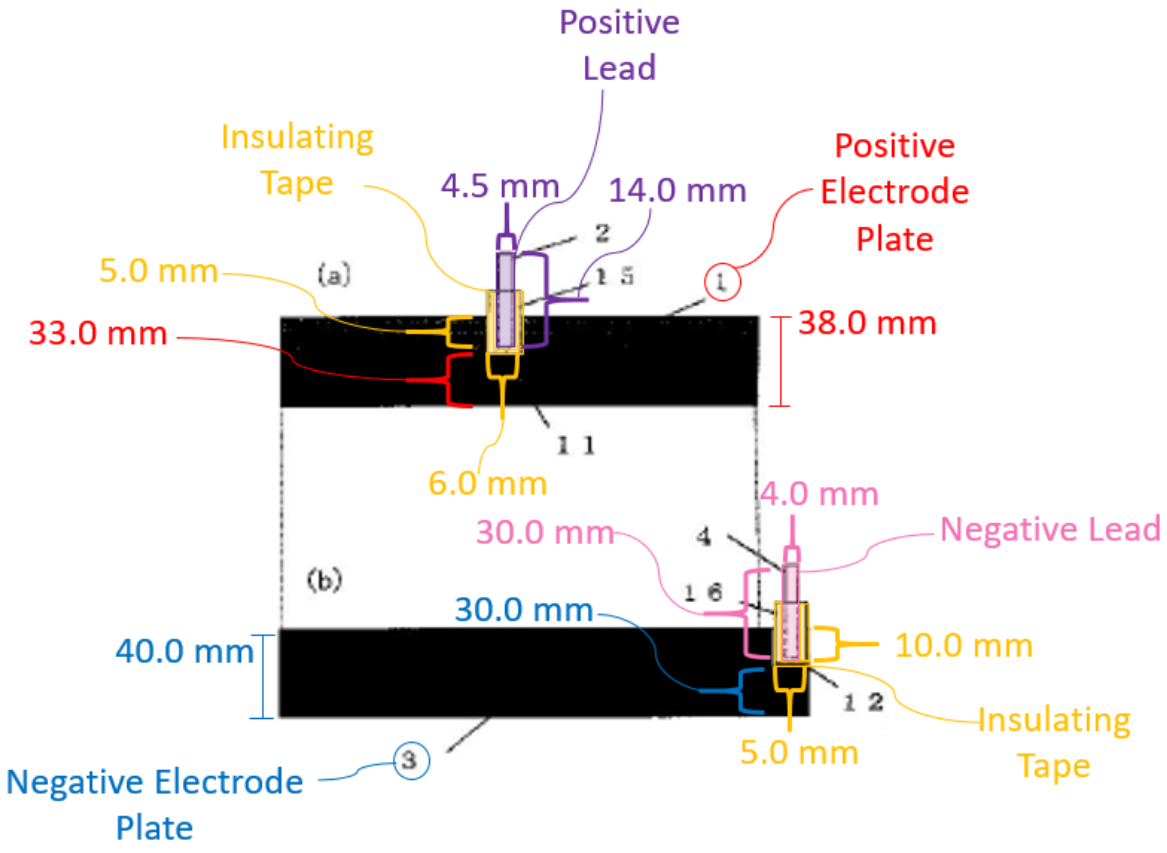
As discussed in Section X.B.1, Sato's first recess has a width (8 mm) of 1-10 mm larger than a width (6 mm) of Sato's positive lead. EX1005, ¶¶[0111]-[0113]. Sato's second recess has a width (6 mm) of 1-10 mm larger than a width (4 mm) of Sato's negative lead. EX1005, ¶¶[0112], [0137]; EX1003, ¶¶307-308.

Sato is silent about the first and second recesses having a length of 1-100 mm

less than a length of the positive lead and the negative lead, respectively. However, recesses on positive and negative electrodes with lengths as recited in claim 12 would have been obvious view of Nakamura. EX1003, ¶309.

2. Nakamura

As discussed in Section X.B.2, Nakamura's first recess 11 has a length (5.0 mm) of 1-100 mm less than a length (14.0 mm) of Nakamura's positive lead, and Nakamura's second recess 12 has a length (5-15 mm) of 1-100 mm less than a length (30 mm) of Nakamura's negative lead. EX1003, ¶¶310-313.



EX1012, FIG. 1 (annotated).

3. Sato-Takemura-Kobayashi-Nakamura Combination

For the reasons discussed in Section X.B.3, it would have been obvious to form the length of Sato's first and second recesses to be 1-100 mm less than a length of the positive and negative leads, as taught by Nakamura, to preserve active material applied to the current collector. EX1003, ¶¶314-315.

C. Claim 13

The language of claim 13 is identical to claim 5. EX1001, 11:24-28, 12:29-34.

1. Sato

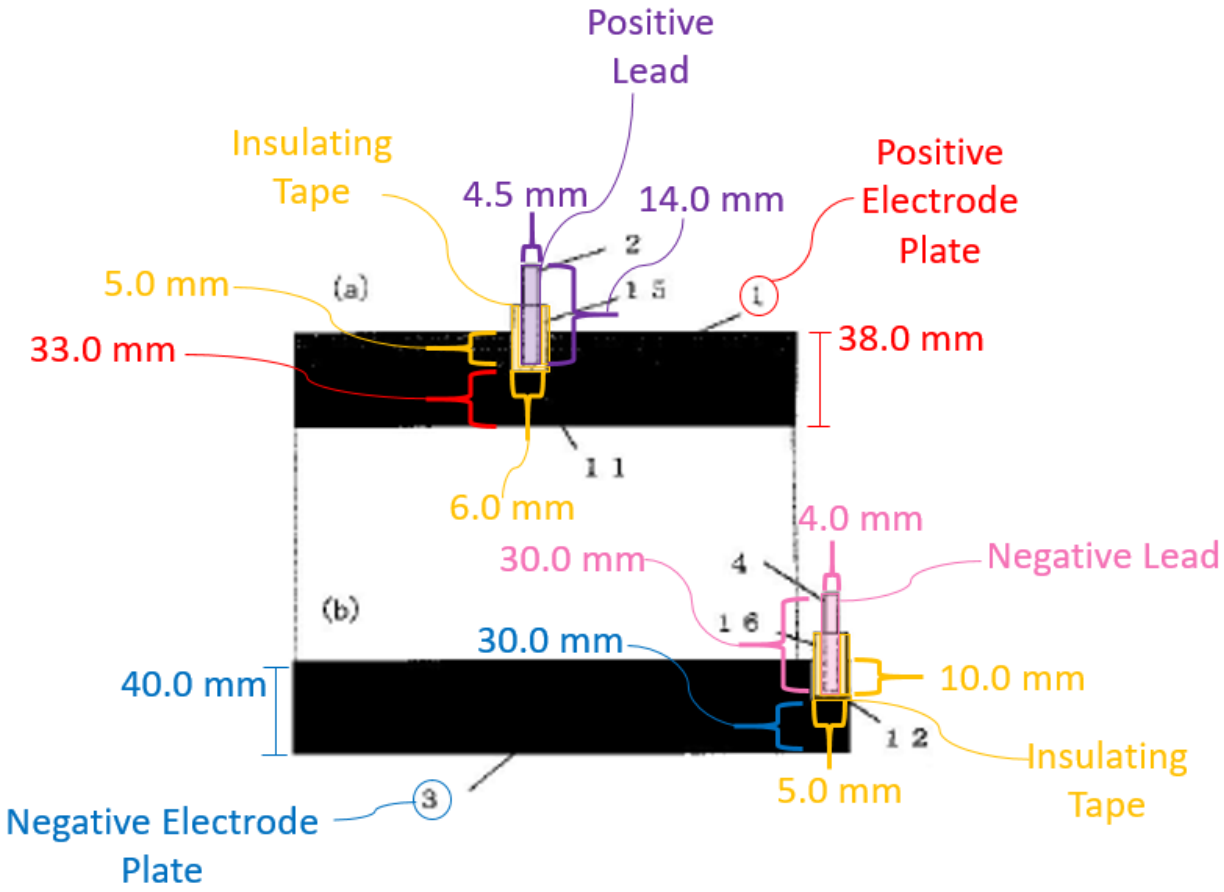
As discussed in Section X.C.1, Sato's positive active material has a 57 mm width, and Sato's negative active material layer has a 58.8 mm width. EX1005, ¶[0104]; EX1003, ¶¶316-317.

Sato is silent about the first and second recesses having a length of 1-100 mm less than a width of the positive electrode active material and the negative active material, respectively. However, these recess lengths would have been obvious in view of Nakamura. EX1003, ¶318.

2. Nakamura

As discussed in Section X.C.2, Nakamura discloses the recited first and second recess length ranges of claim 13. EX1012, ¶¶[0052] (describing a recess width being 33 mm less than a positive electrode width), [0034], [0049], [0053] (describing a recess width being 25-35 mm less than a negative electrode width).

EX1003, ¶¶319-322.



EX1012, FIG. 1 (annotated).

3. Sato-Takemura-Kobayashi-Nakamura Combination

For the reasons discussed in Section X.C.3, it would have been obvious to form the length of Sato's first and second recesses to be 1-100 mm less than a width of the positive and negative active material mixture layers, as taught by Nakamura, to preserve active material applied to the current collector. EX1003, ¶¶323-324.

D. Claim 15

The language of claim 15 is identical to claim 7 and patentably indistinct from claim 18. EX1001, 11:33-39, 12:38-44; 13:8-12; EX1003, ¶214.

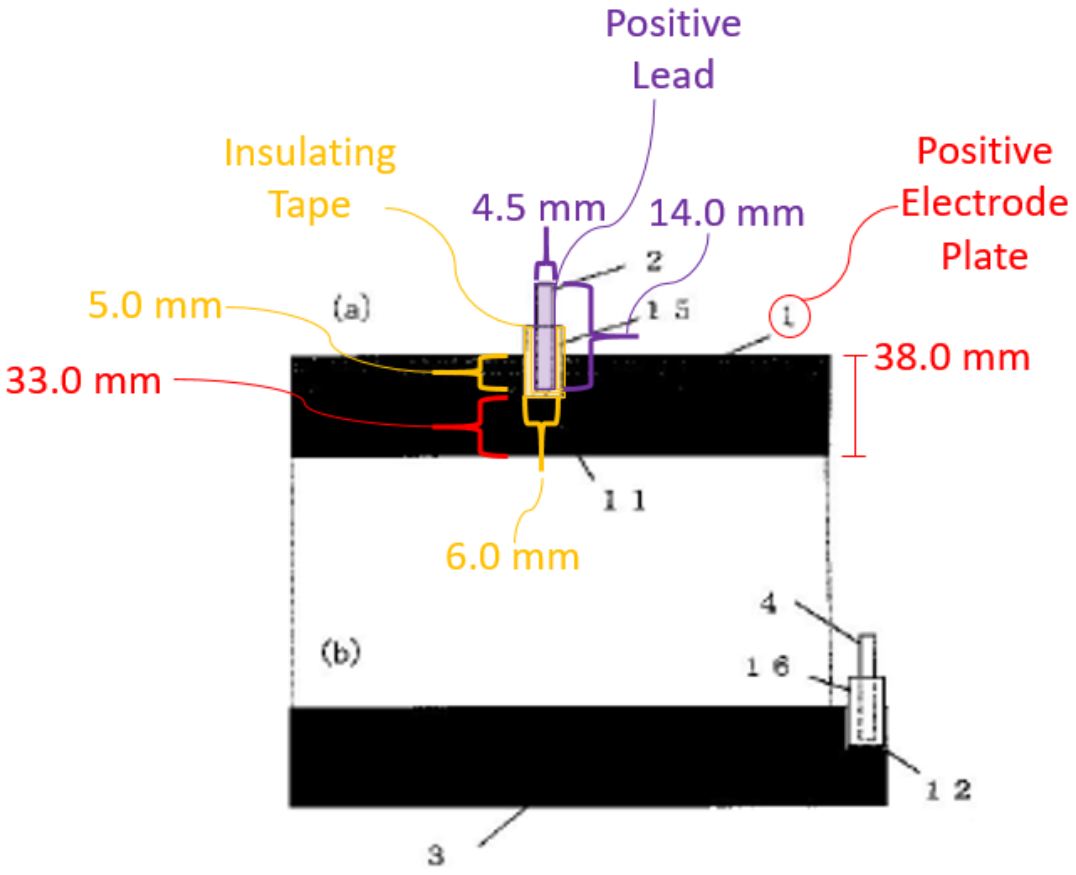
1. Sato

As discussed in Section X.D.1, Sato's positive active material has a 57 mm width and a first recess with a 8 mm width, and Sato's positive lead has a 6 mm width. EX1003, ¶¶325-326.

Sato is silent about the dimensions of the positive electrode's exposed portion 12/14 (the first recess) relative to a width direction of the positive electrode 4 and the length of positive lead 4L/11. EX1003, ¶¶327-328.

2. Nakamura

As discussed in Section X.D.2, the length (less than 6.0 mm) of the portion of Nakamura's positive lead 2 in the first recess is less than a width (33.0 mm) of the remaining portion of Nakamura's positive active material defined from an edge of insulating tape 15 to an edge of the positive active material opposite to material-free portion 11. EX1012, ¶[0052], FIG. 1; EX1003, ¶¶328-332.



EX1012, FIG. 1 (annotated).

3. Sato-Takemura-Kobayashi-Nakamura Combination

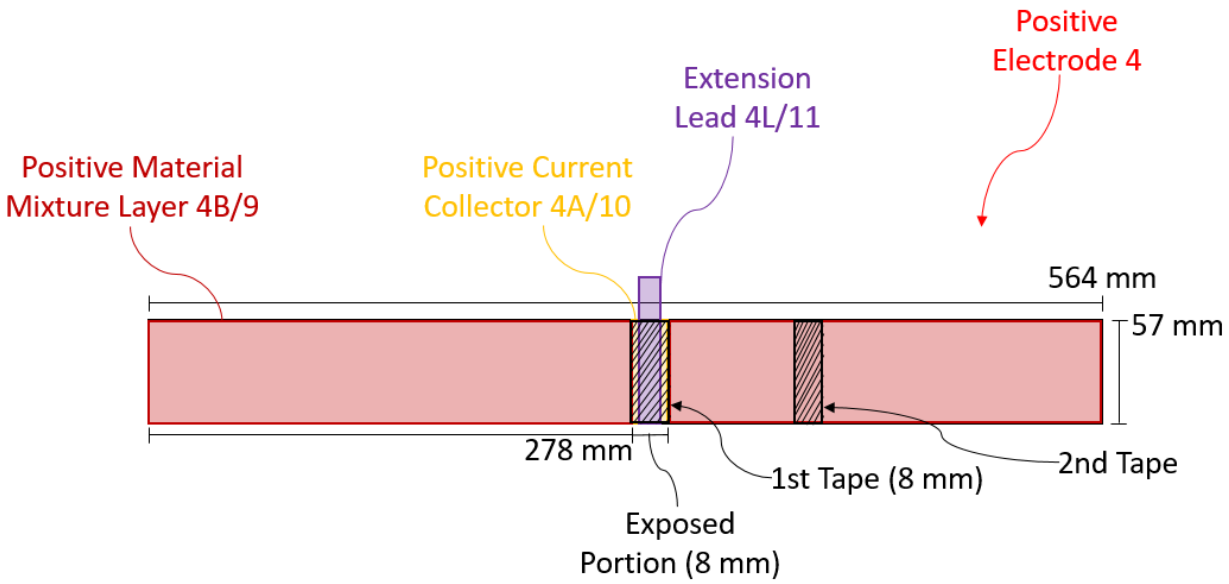
For the reasons discussed in Section X.D.3, it would have been obvious to make the length of a portion of Sato's positive lead 4L/11 in exposed portion 12/14 (the first recess) to be less than a width of a remaining portion of Sato's positive active material layer 4B/9 defined from the edge of Sato's adhesive tape covering the positive lead 4L/11 to an edge of Sato's positive active material layer 4B/9 opposite to exposed portion 12/14, as taught by Nakamura, to preserve active material applied to the current collector. EX1003, ¶¶333-334.

XIV. GROUND 6: DEPENDENT CLAIM 21 WOULD HAVE BEEN OBVIOUS IN VIEW OF SATO, TAKEMURA, KOBAYASHI, OH-539, AND OH-144.

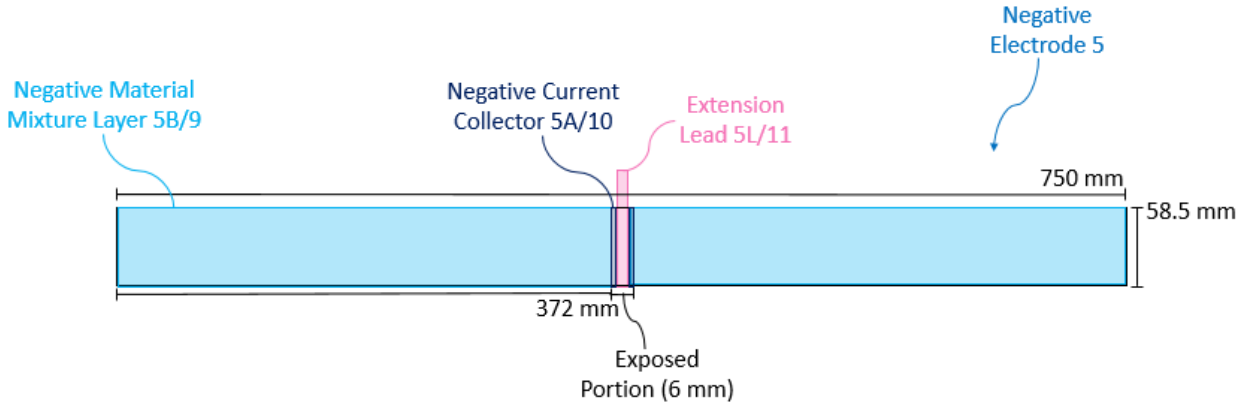
Sato, Takemura, Kobayashi, Oh-539, and Oh-144 are analogous art—lithium-ion batteries. EX1005, ¶¶[0001], [0013]; EX1006, ¶[0001]; EX1007, ¶¶[0007], [0029]; EX1008, ¶¶[0014]-[0016]; EX1017, ¶¶[0025]-[0027]; EX1003, ¶337.

A. Motivation to Combine Oh-539 with Sato-Takemura-Kobayashi

As discussed in Section XII.B, the Sato-Takemura-Kobayashi combination renders obvious a lithium-ion battery as recited in claim 9. In this combination, the positive electrode and the negative electrode would have the following construction. EX1003, ¶338; Section XII.A.

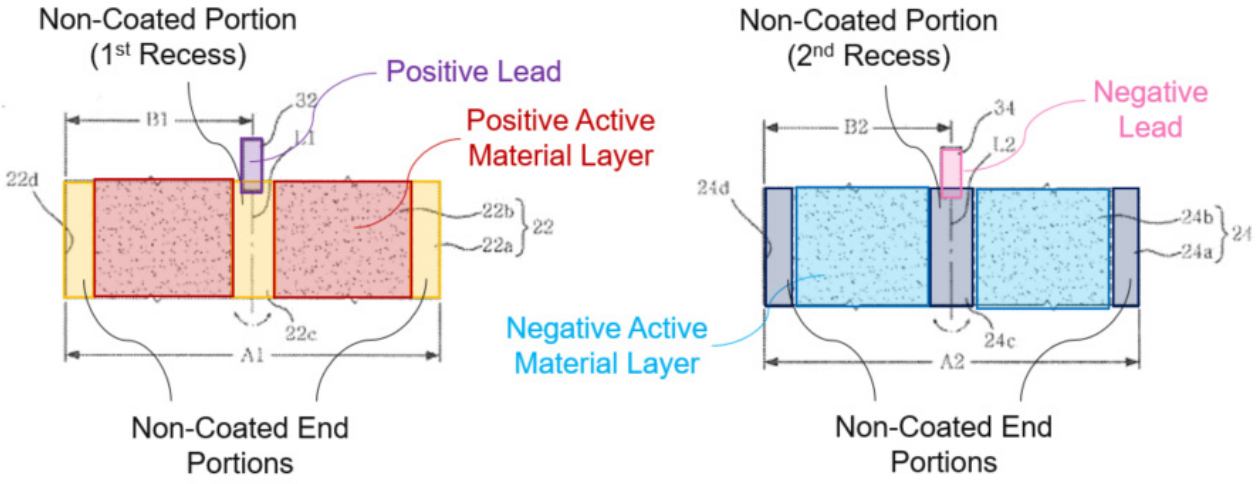


Sato's Positive Electrode, EX1003, ¶338.



Sato's Negative Electrode, EX1003, ¶338.

As discussed in Section XI.A, it would have been obvious to make Sato's electrodes using Oh-539's method, resulting in the Sato-Takemura-Kobayashi battery having Oh-539's electrode layout. EX1003, ¶339.



EX1007, FIGS. 2 and 3 (annotated).

B. Motivation to Combine Oh-144 with Sato-Takemura-Kobayashi-Oh-539

As discussed in Section XI.B, a POSA would have been motivated to add Oh-144's tapes 170A/170B to the inner/outer surfaces of the exposed ends such that a

winding end of Sato's modified negative plate is located between the two tapes and the two tapes extend over the winding end to prevent short-circuiting. EX1003, ¶340. A POSA would also have had a reasonable expectation of success combining Sato, Takemura, Kobayashi, Oh-539, and Oh-144 because applying insulating tapes in coiled lithium-ion battery cells was a common solution for preventing short-circuiting. EX1003, ¶341; Section XI.B.

C. Claim 21

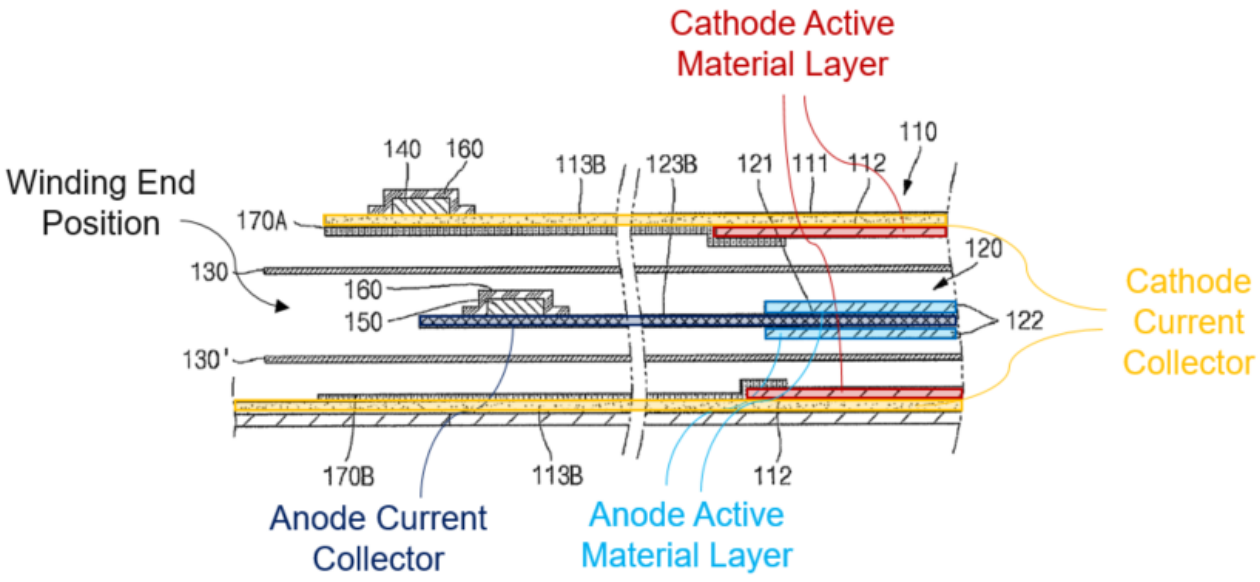
The language of claim 21 is identical to claims 20 and 22. EX1001, 13:18-14:17; EX1003, ¶342.

1. Sato-Takemura-Kobayashi-Oh-539

The Sato-Takemura-Kobayashi-Oh-539 combination does not explicitly disclose locating a winding end of the negative plate between two insulating layers that extend over the winding end. EX1003, ¶¶343-344.

2. Oh-144

As discussed in Sections XI.A and XI.C.2, Oh-144 discloses a winding end (123B) of a negative plate (cathode 120) located between two insulating layers (tapes 170A-B), which extend over the winding end along the winding direction. EX1017, ¶¶[0038], [0039]; EX1003, ¶345.



EX1017, FIG. 4 (annotated).

3. Sato-Takemura-Kobayashi-Oh-539-Oh-144 Combination

As discussed in Section XIV.B, it would have been obvious to position Oh-144's tapes 170A/170B on inner/outer surfaces of non-coated end portions of the positive electrode in the Sato-Takemura-Kobayashi-Oh-539 battery such that the winding end is located between two tapes and the two tapes extend over the winding end. EX1003, ¶346; Section XIV.B. This would prevent short-circuiting caused by contact between uncoated end portions on the cathode and anode located at the winding end of the battery coil. EX1003, ¶¶347-348.

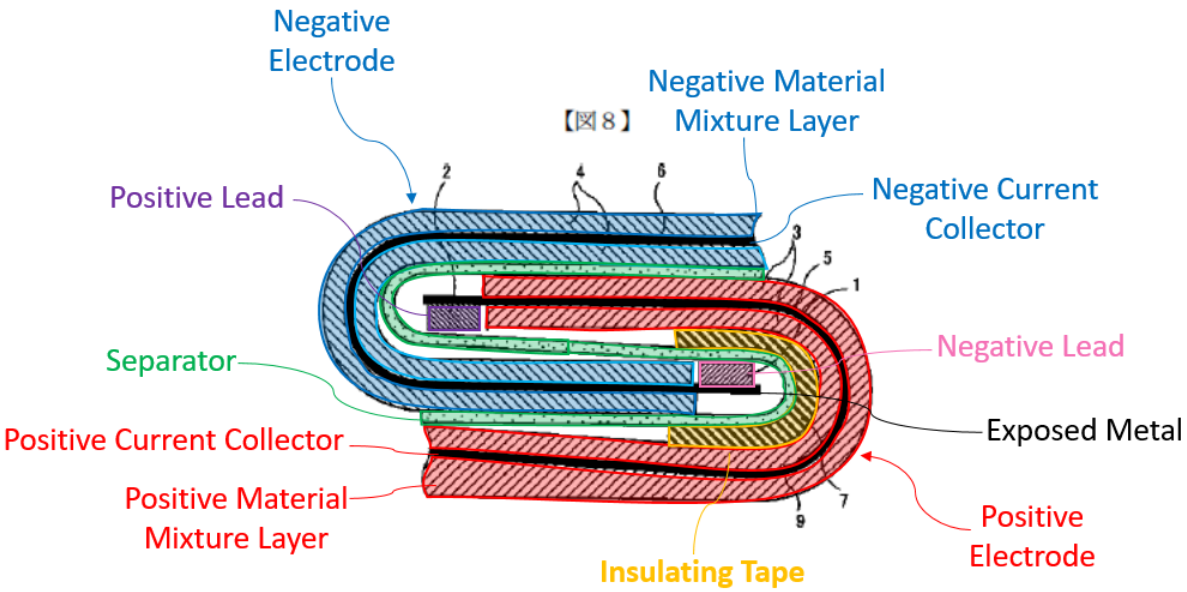
XV. GROUND 7: CLAIMS 1-3, 9-11, AND 17 WOULD HAVE BEEN OBVIOUS IN VIEW OF TAKEMURA, OH-539, AND KOBAYASHI.

Takemura, Oh-539, and Kobayashi are analogous art—lithium-ion batteries. EX1003, ¶352; EX1006, ¶[0001]; EX1007, ¶¶[0007], [0029]; EX1008, ¶¶[0014]-[0016]. Each includes the same building blocks—positive/negative electrode plates

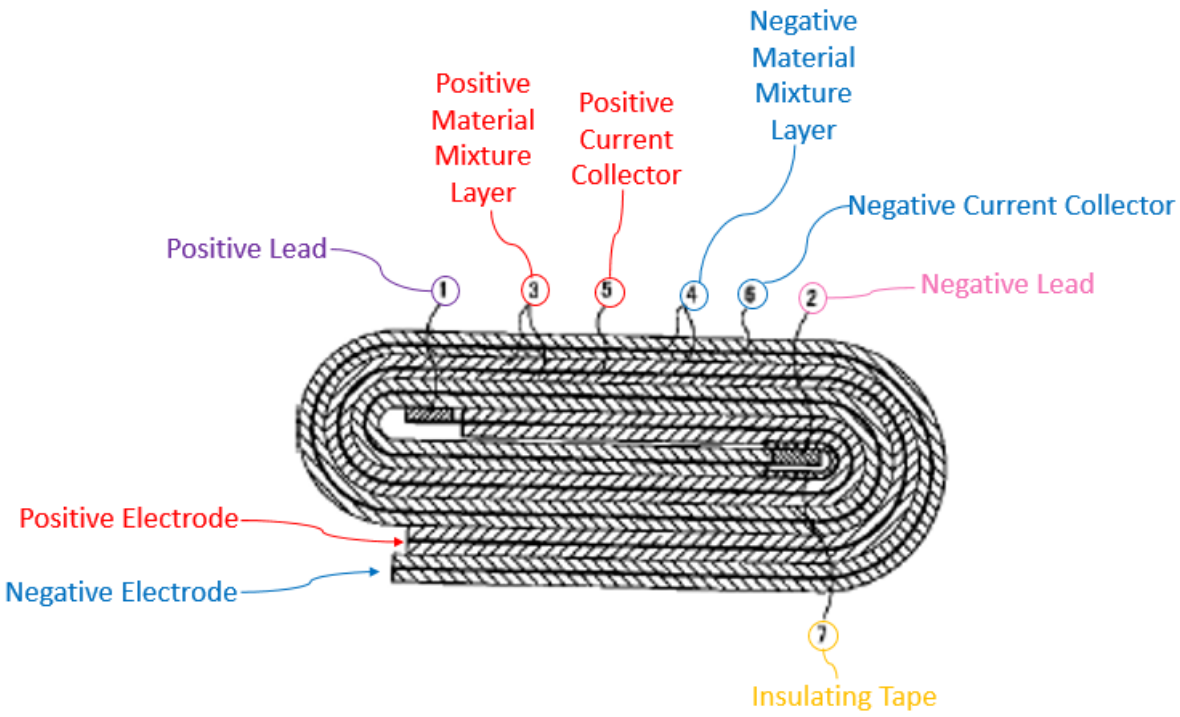
coated with positive/negative active material, respectively, and positive/negative leads attached to the respective positive/negative electrode plate's exposed portion. EX1006, ¶[0005]; EX1007, ¶¶[0039], [0043]; EX1008, ¶¶[0007], [0034]; EX1003, ¶¶349-352.

A. Motivation to Combine Takemura and Oh-539

Takemura discloses attaching leads 2 and 3 at the ends of positive and negative electrodes. EX1003, ¶353.

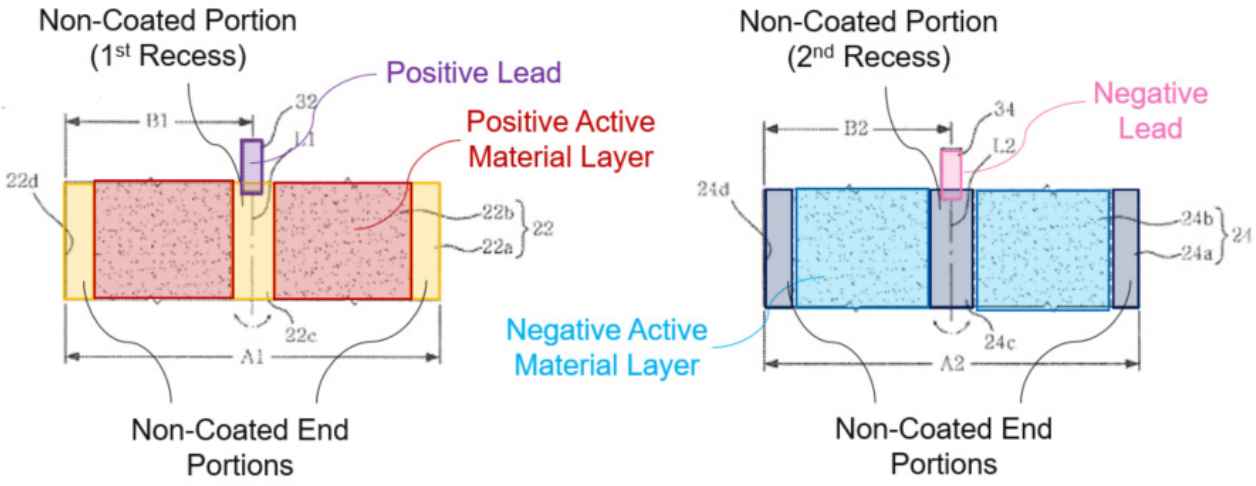


EX1006, FIG. 8 (annotated).



EX1006, FIG. 9 (annotated).

Oh-539 teaches leads in centrally-located recesses formed in the active materials. EX1007, ¶[0025]-[0026], [0045], [0051], [0058], [0061], FIGs. 2-3. This reduces the length current must travel, improving the battery's high-discharging capacity and reliability. EX1007, ¶¶[0007], [0009]-[0010], [0100]-[0105], FIGS. 8-11; EX1003, ¶354. These were well-known advantages. EX1003, ¶354; EX1015, ¶[0024] ("[B]y connecting a current collecting lead to the center exposed portion, the electric resistance of the electrode that is connected to the current collecting lead can be reduced.").



EX1007, FIGs. 2-3 (annotated).

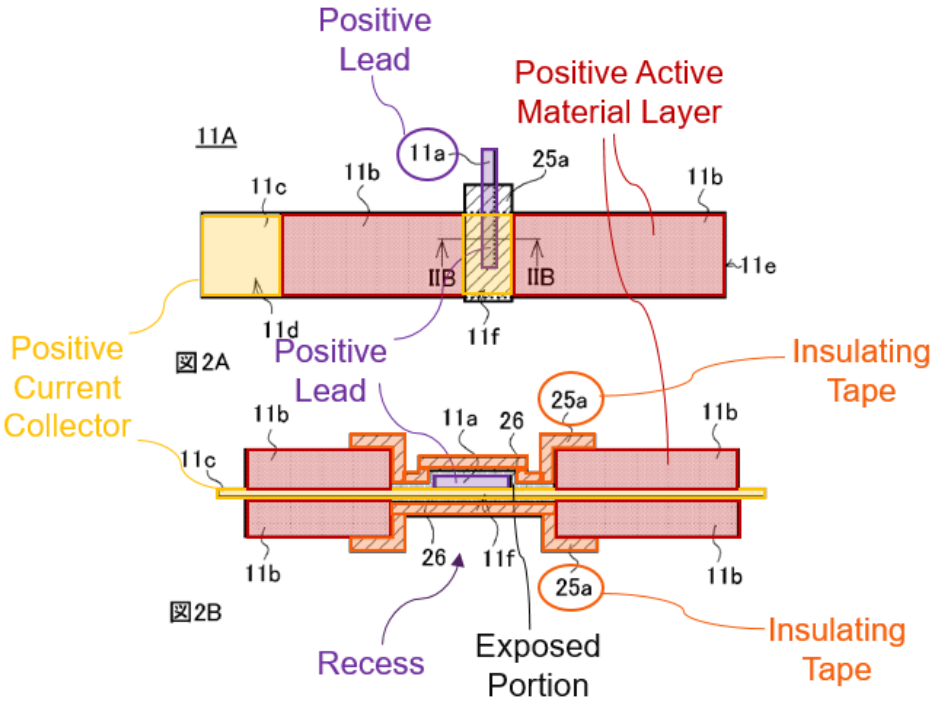
A POSA would have been motivated to move Takemura's positive and negative leads into recesses formed in the positive and negative active materials, as taught by Oh-539, to improve battery discharge rate. EX1003, ¶355; EX1007, ¶[0009]; EX1015, ¶[0024]. This modification would have reduced the current flow distance, allowing current output at a higher rate while maintaining safer operating temperatures. EX1007, ¶[0049]. Moving Takemura's leads into recesses, as Oh-539 disclosed, would simply have been applying a known technique (placing leads within central recesses) to a known device (Takemura's battery) to improve high discharge rate and reliability. EX1003, ¶355; EX1007, ¶¶[0100]-[0105].

A POSA would have also had a reasonable expectation of success combining Oh-539's lead connection placements with Takemura. Moving Takemura's leads into recesses would simply entail repositioning and attaching the leads using known techniques. EX1003, ¶356; *KSR,* 550 U.S. at 417. This would not have changed the

function of Takemura's leads—establishing a current path from the current collector to the battery's terminal. EX1003, ¶356. Like conventional leads, Takemura's and Oh-539's leads carry current to and from the positive electrode and negative electrode via a welded connection. EX1003, ¶356.

B. Motivation to Combine Kobayashi with Takemura-Oh-539

When modifying Takemura to have recesses for leads, a POSA would have been motivated to cover the positive electrode lead (and nearby exposed metal), with insulating tapes in view of Kobayashi. EX1003, ¶357. Kobayashi teaches that the positive lead connection, nearby exposed metal, and edges of positive active material at the recess are susceptible to "localized pressurization," causing short-circuiting from inadvertent contact between conductive components. EX1008, ¶¶[0005], [0014]. Accordingly, Kobayashi affixed insulating tape "at potential short-circuit locations where such short-circuits can be expected to occur in order to prevent short-circuits due to contact with the opposing electrode at potential short-circuit locations." EX1008, ¶[0005]; EX1003, ¶358.



EX1008, FIGs. 2A-2B (annotated).

Thus, a POSA would have been motivated to apply insulating tape to the positive lead and associated recess of the Takemura-Oh-539 battery. EX1003, ¶358. Indeed, protecting leads and regions surrounding them from short-circuits was well known. EX1010, ¶¶[0029], [0031]; EX1012, ¶¶[0052]-[0053]; EX1013, ¶¶[0007], [0011]; EX1015, ¶¶[0006], [0012]; EX1017, ¶¶[0030], [0031], [0037]-[0039]. Adding insulating tape(s), as Kobayashi disclosed, would protect Takemura-Oh-539's positive lead, exposed metal, and edges of positive active material at the recess. EX1003, ¶358; EX1008, ¶¶[0005], [0014]. This modification would have simply been combining a known component (Kobayashi's insulating tape) to a known device (Takemura-Oh-539 battery) at a known location, yielding predictable

results of preventing short-circuiting and improving battery reliability. EX1003, ¶359; *KSR,* 550 U.S. at 417.

A POSA would also have had a reasonable expectation of success combining Kobayashi's insulating tapes with Takemura-Oh-539 to prevent short-circuiting because locating insulating tapes on lead connections of battery electrodes was a common solution for preventing short-circuiting. EX1006, ¶¶3, 8, 22; EX1009, ¶8; EX1010, ¶29; EX1011, ¶¶[0014], [0018], [0033]-[0034]; EX1012, ¶¶[0037]-[0038]; EX1017, ¶¶[0037]-[0038]; EX1003, ¶359. A POSA would have expected Kobayashi's insulating tape to perform its intended function of insulating the positive lead, exposed metal, and edges of the positive active material to prevent short-circuiting. EX1003, ¶359.

C. Independent claims 1, 9, and 17 would have been obvious in view of Takemura, Oh-539, and Kobayashi.

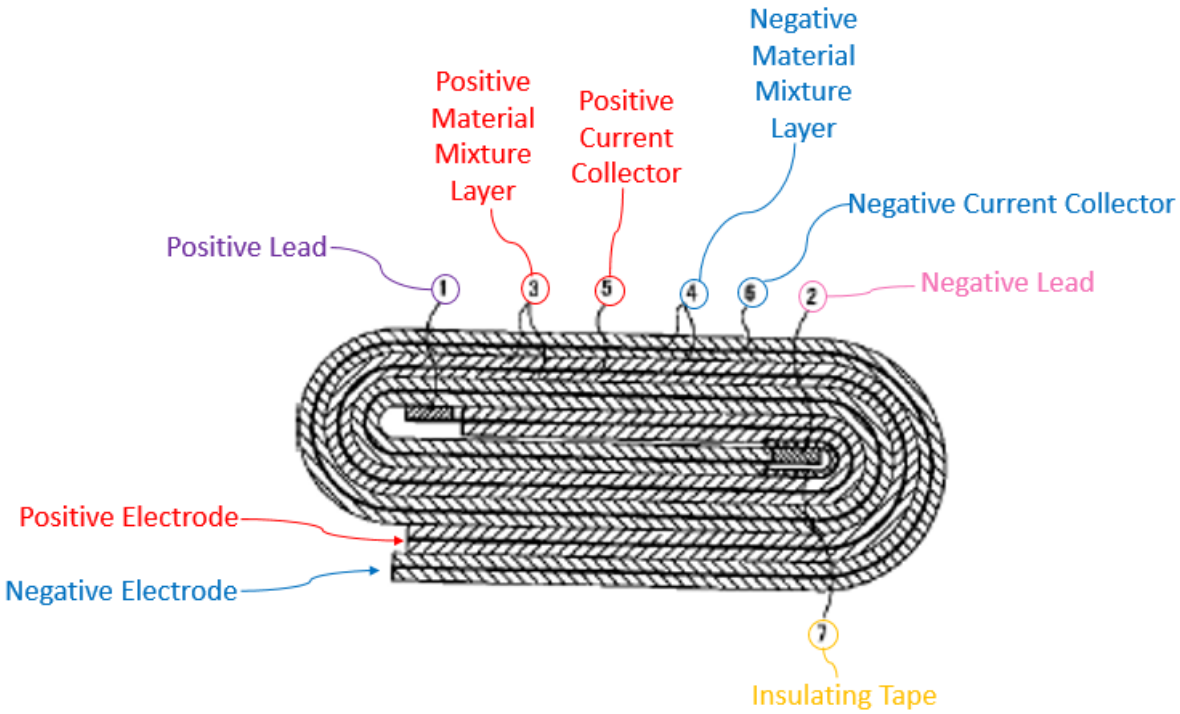
1. [1.P]/[9.P]/[17.P]

Takemura discloses a lithium-ion battery. EX1006, ¶¶[0003] ("a conventional lithium-ion secondary battery"), [0035], FIGs. 8-9; EX1003, ¶¶361-362, 407, 439.

2. [1.A]/[9.A]/[17.A]

Takemura discloses a positive electrode with a positive current collector 5 and a positive active material 3 formed on the positive current collector 5. EX1006, ¶[0003], FIGs. 8-9. Takemura's positive active material 3 contains "$LiCoO_2$"; EX1006, ¶¶[0025], [0031] (example battery in Figure 9 formed from same materials

as example 1 in [0025]); EX1003, ¶¶363, 408, 440.

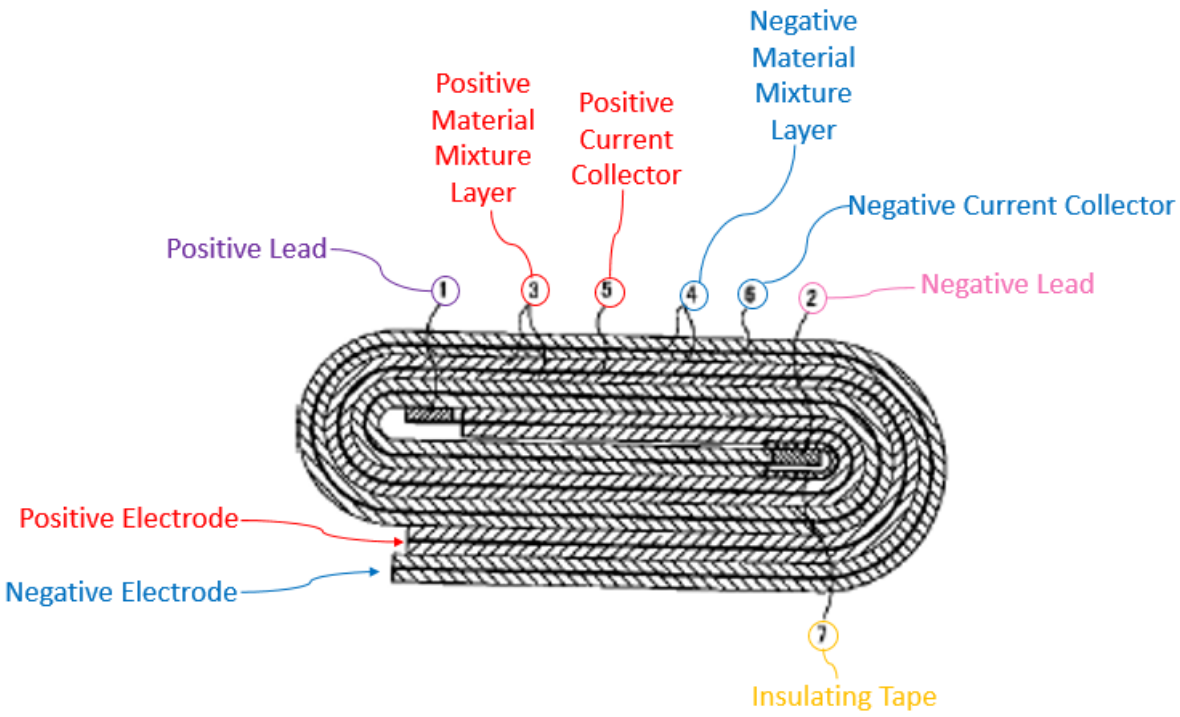


EX1006, FIG. 9 (annotated).

3. [1.B]/[9.B]/[17.B]

(a) Takemura

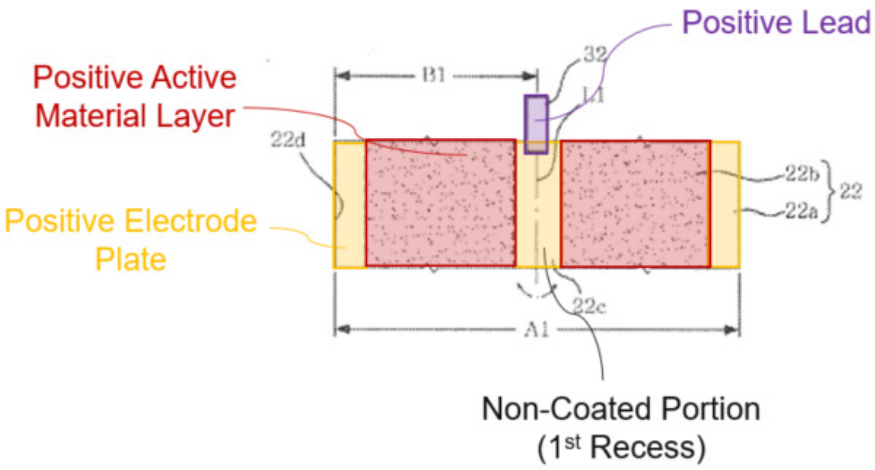
Takemura's positive active material 3 has a bare, exposed end portion to couple a positive lead 1 with positive current collector 5. EX1006, ¶[0003], FIGs. 8-9; EX1003, ¶¶366-367, 409, 441.



EX1006, FIG. 9 (annotated).

(b) Oh-539

Oh-539 discloses placing a positive lead (cathode tab 32) in a first recess (non-coated portion 22c) formed in the positive active material (cathode active material 22b) on a positive electrode 22 of a lithium-ion battery to reduce current flow path. EX1007, ¶¶[0039]-[0046], [0100]-[0105], FIG. 2; EX1003, ¶¶368-369, 410, 442.



EX1007, FIG. 2 (annotated).

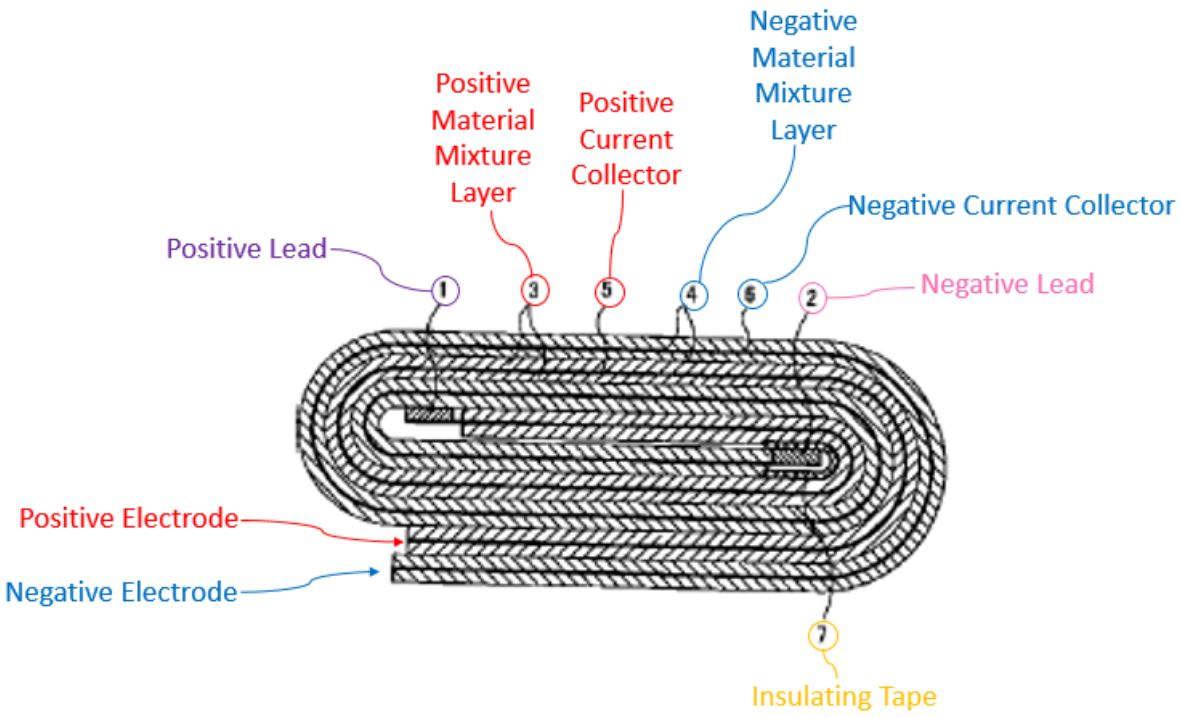
(c) Combination of Takemura and Oh-539

As discussed in Section XV.A, it would have been obvious to move Takemura's positive lead 1 into a recess formed in positive active material 3 of positive current collector 5, improving high-rate discharging and reliability. EX1003, ¶¶370-371, 411-412, 443-444; EX1007, ¶[0009].

4. [1.C]/[9.C]/[17.C]

(a) Takemura

Takemura discloses a negative electrode having a negative current collector 6 and negative active material 4 formed on the negative current collector. EX1006, ¶[0003], FIGs. 8-9; EX1003, ¶¶372, 413, 445.



EX1006, FIG. 9 (annotated).

Takemura's negative active material 4 contains a carbon-based material (mesophase carbon microbeads) EX1006, ¶¶[0026], [0031]; EX1003, ¶373.

(b) Oh-539

To the extent Takemura does not explicitly disclose negative active material including graphite, Oh-539 discloses negative active material (anode active material 24b) containing graphite. EX1007, ¶¶[0088], [0096]; EX1003, ¶¶374, 413, 445. Oh-539 pairs the negative active material comprising graphite with a positive active material (cathode active material 22b) comprising $LiCoO_2$. EX1007, ¶¶[0084], [0093].

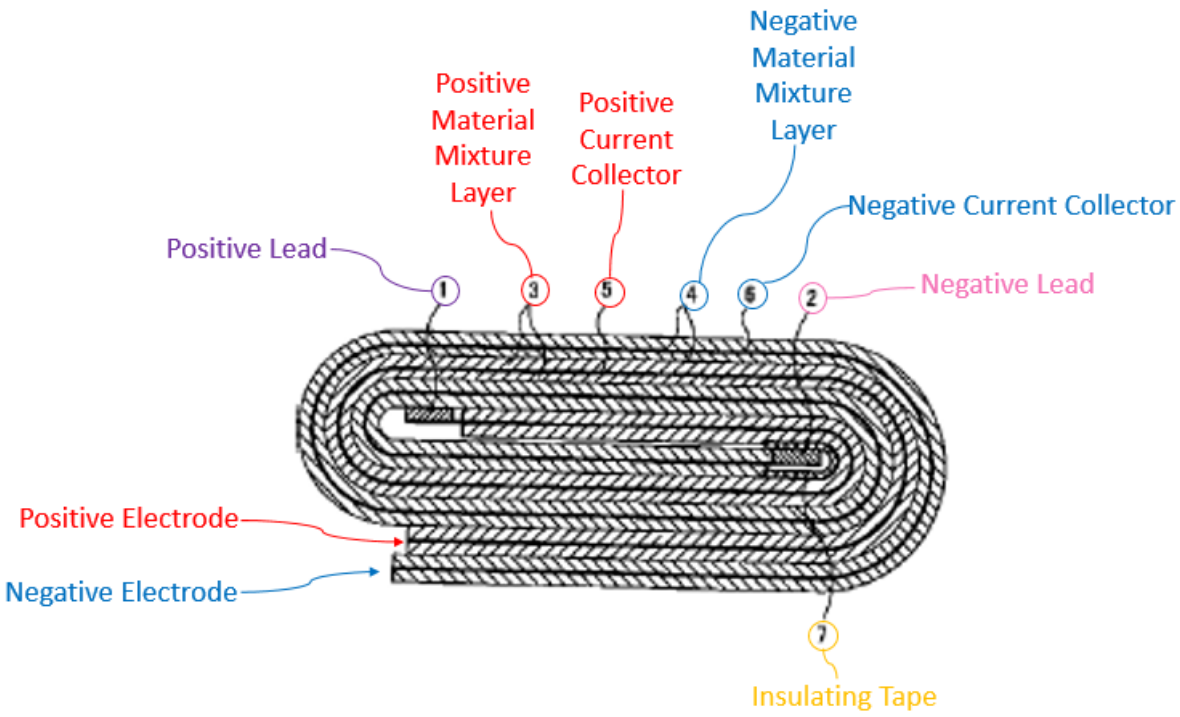
(c) Combination of Takemura and Oh-539

It would have been obvious to a POSA to include graphite in Takemura's negative active material. EX1003, ¶375. Well before 2014, graphite was a standard negative active material in lithium-ion batteries and paired with positive active material comprising $LiCoO_2$—as in Takemura. EX1007, ¶¶[0084], [0088], [0096]; EX1003, ¶375. Substituting graphite for some or all of Takemura's mesophase carbon microbeads would have simply been substituting one known negative active material for another, to form a negative electrode. EX1003, ¶¶376, 413, 445.

5. [1.D]/[9.D]/[17.D]

(a) Takemura

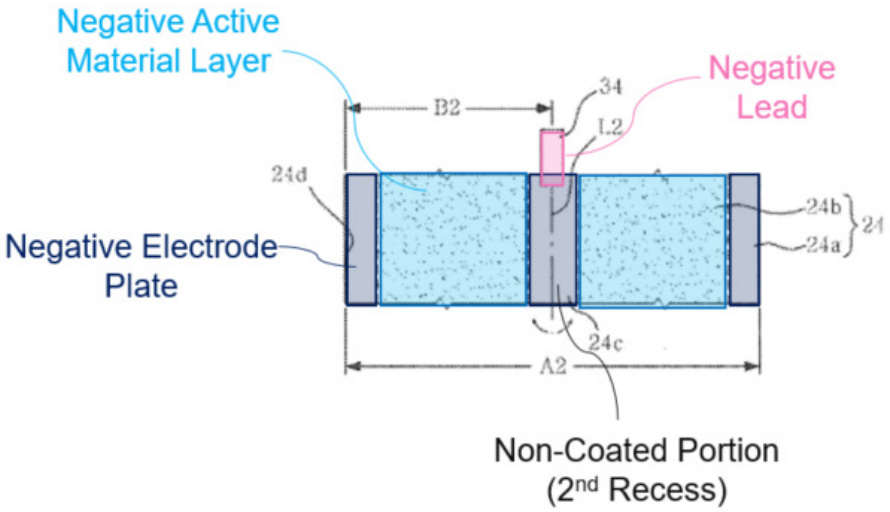
Takemura's negative active material 4 has a bare, exposed end portion to couple negative lead 2 with negative current collector 6. EX1006, ¶[0003], FIGs. 8-9; EX1003, ¶¶378-379, 414, 446.



EX1006, FIG. 9 (annotated).

(b) Oh-539

Oh-539 places a negative lead (anode tab 34) in a recess (non-coated portion 24c) formed in the negative active material (anode active material 24b) on a negative electrode 24 of a lithium-ion battery to reduce current flow path. EX1007, ¶¶[0056]-[0059], [0100]-[0105], FIG. 3; EX1003, ¶¶380-381, 415, 447.



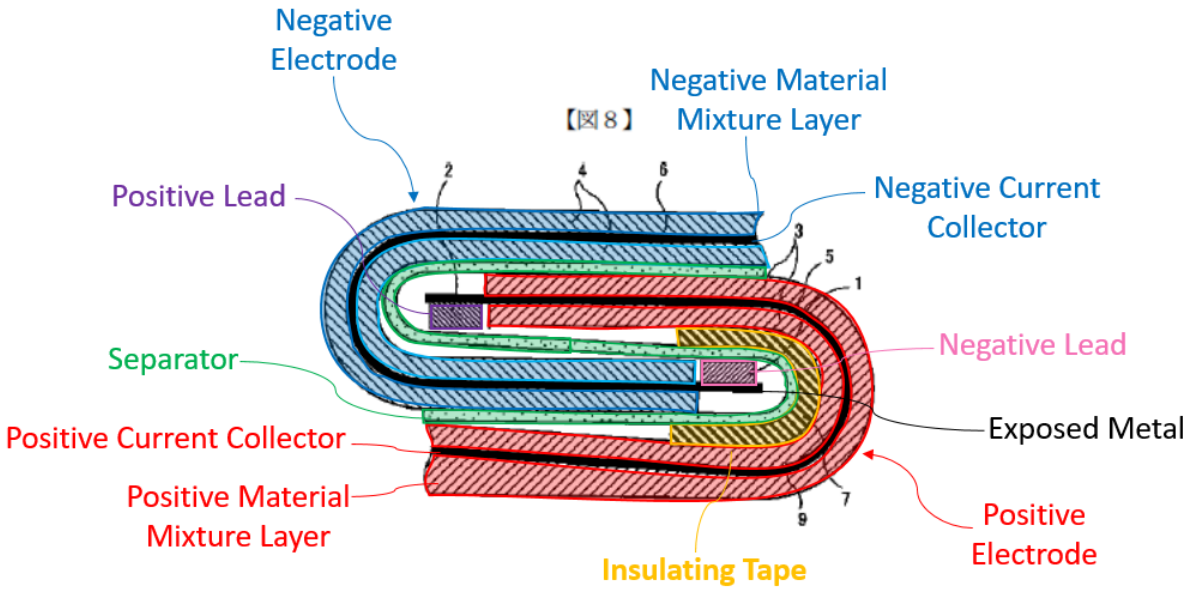
EX1007, FIG. 3 (annotated).

(c) Combination of Takemura and Oh-539

As discussed in Section XV.A, it would have been obvious to move Takemura's negative lead 2 into a recess formed in negative active material 5 of negative current collector 6, improving high-rate discharging and reliability. EX1003, ¶¶382, 416-417, 448.

6. [1.E]/[9.E]/[17.E]

Takemura discloses a separator (green) disposed between the positive and negative electrode. EX1006, ¶[0003], FIG. 8; EX1003, ¶¶384-385, 418, 450-451.



EX1006, FIG. 8 (annotated).

7. [1.F]/[9.F]/[17.F]

Takemura discloses an electrolyte, e.g., "a non-aqueous electrolyte solution." EX1006, ¶[0003]; EX1003, ¶¶386-387, 419, 451.

8. [1.G] /[9.G]/[17.G]

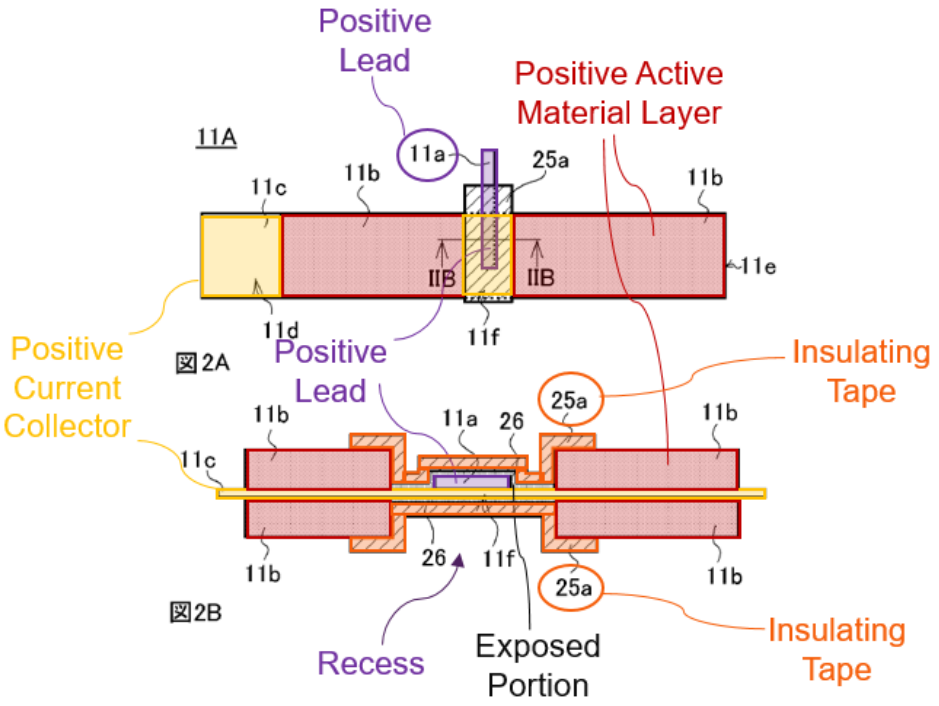
(a) Takemura-Oh-539

As discussed for [1.B]/[9.B]/[17.B], Takemura-Oh-539 teaches forming a recess in the positive active material for a lead connection. EX1003, ¶388; Section XV.C.3. Takemura-Oh-539 does not explicitly disclose applying a first insulating tape on a top surface of the positive lead. But this was well known, as Kobayashi disclosed. EX1003, ¶¶388, 420, 452.

(b) Kobayashi

Kobayashi applies an insulating tape 25a on the top surface of the exposed

portion 11f of the positive electrode plate 11A and the top surface of positive lead (positive current collecting tab 11a) to prevent short-circuiting caused by pressure or burrs. EX1008, ¶¶[0013]-[0014], [0034]-[0035], FIGs. 2A-B; EX1003, ¶¶389-390, 421, 453. Insulating tape 25a adheres to the top surfaces of the positive lead 11a and the exposed current collector 11c by a glue layer 26. EX1008, ¶¶[0034]-[0035]. In the related district court complaint, Patent Owner equates insulating glue layers to adhesive tapes. EX1024, 8, 27, 28. Under Patent Owner's position, Kobayashi's insulating tape 25a with glue layer 26 is an insulating glue layer.



EX1008, FIGs. 2A-2B (annotated).

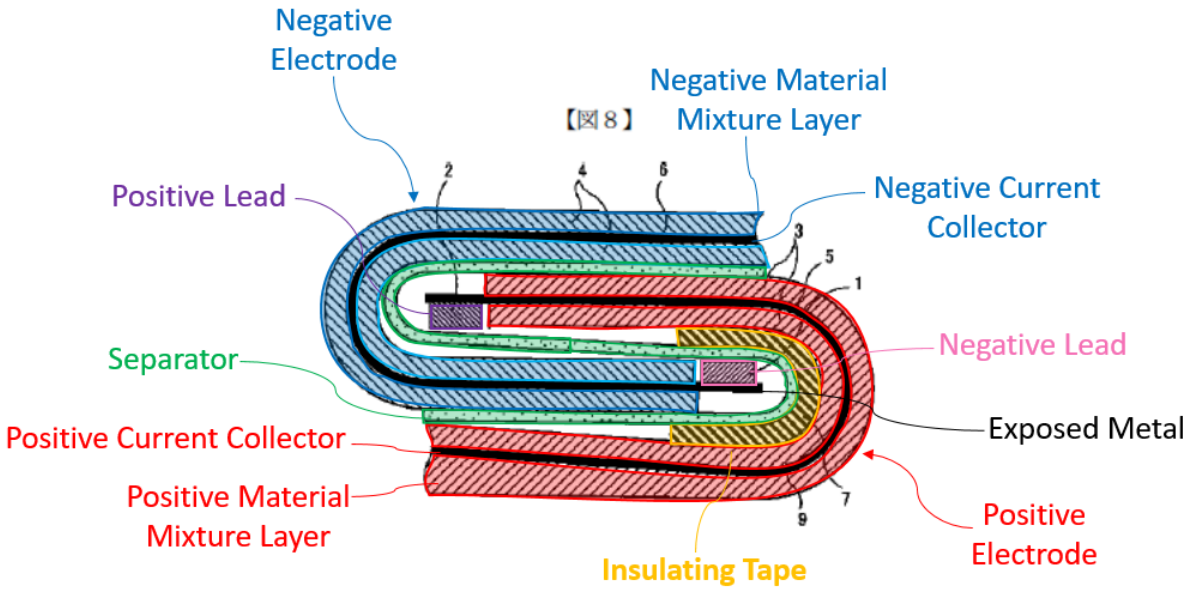
(c) Combination of Kobayashi with Takemura-Oh-539

As discussed in Section XV.B, it would have been obvious to apply Kobayashi's tape 25a on the top surface of the positive lead positioned within the

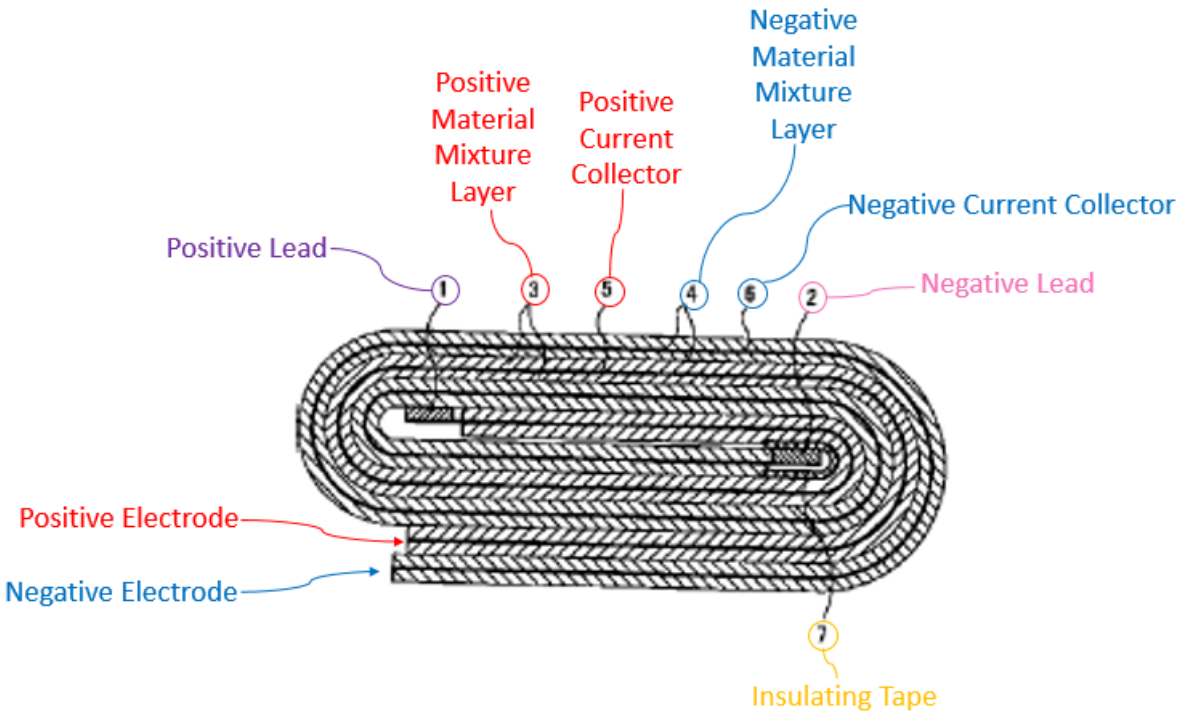
first recess in the Takemura-Oh-539 battery to prevent short-circuiting. EX1008, ¶[0014]; EX1003, ¶391. This modification would have simply been combining a known element (Kobayashi's insulating tape) with a known device (Takemura-Oh-539 battery's) at a known location, to prevent short-circuiting. EX1003, ¶¶391, 422-423, 454-455.

9. [1.H]/[9.H]/[17.H]

As discussed for [1.D]/[9.D]/[17.D], Takemura-Oh-539 teaches forming a recess in the negative active material layer for a lead connected to the negative current collector. EX1003, ¶¶393, 424, 456; Section XV.C.5. As discussed in Section IX.B.9.b, Takemura discloses attaching an insulating tape 7 to positive active material 3 adjacent to separator 8 and across from a bare negative electrode current collector 6 where negative lead 1 is attached. EX1006, ¶[0008], FIGs. 8-9. Takemura's insulating tape location in Figures 8 and 9 corresponds to the position of the claimed "second insulating layer" because Takemura's tape 7 is located on the positive active material layer's surface opposite a negative lead connection. EX1003, ¶¶393, 424-427, 456-459.



Takemura, FIG. 8 (annotated).

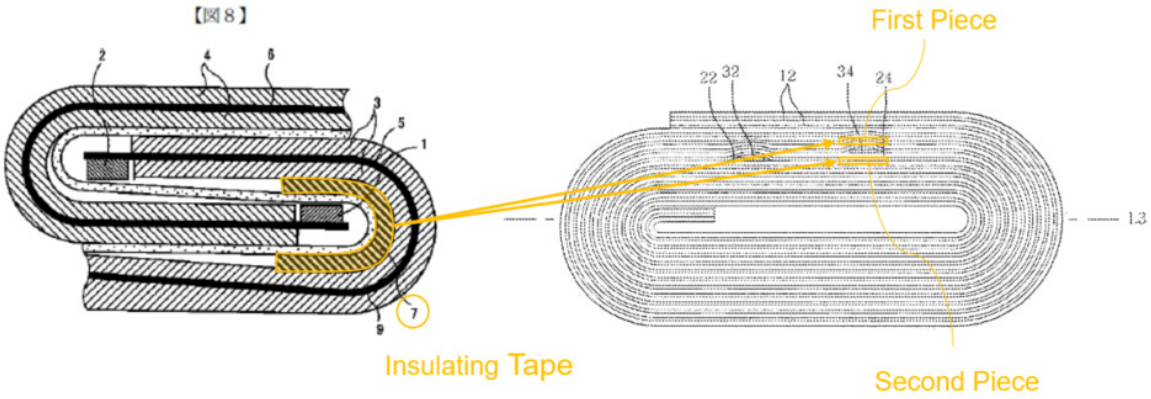


Takemura, FIG. 9 (annotated).

In combining Oh-539's central placement of the negative lead connection with Takemura, a POSA would have likewise shifted Takemura's tape on the

surface of positive active material layer to remain opposite the negative lead connection to shield the exposed metal surfaces of the negative lead connection from lithium plating. EX1003, ¶394. Specifically, a POSA would have placed Takemura's tape on the positive material layer surface opposite the second recess of Takemura-Oh-539 battery. EX1003, ¶394.

Dr. von Sacken's annotated images of Takemura's Figure 8 and Oh-539's Figure 4 illustrate how a POSA would have applied Takemura's insulating tape to the surface of the positive active material layer after moving the negative lead into a centrally-located recess. EX1003, ¶395. Therefore, in the Takemura-Oh-539 battery, a POSA would have applied a piece of Takemura's insulating tape to a surface of the positive active material opposite to the recess for the negative lead (or, at a minimum, found it obvious to do so). EX1003, ¶395.



EX1006, FIG. 8 (annotated); EX1007, FIG. 4 (annotated).

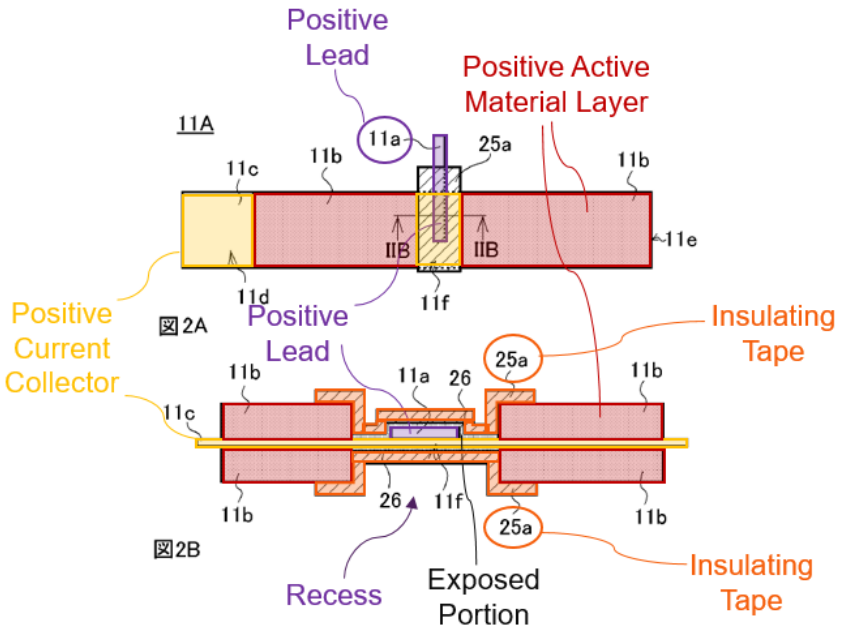
10. [9.I.1]

(a) Takemura-Oh-539

As discussed for [1.B]/[9.B]/[17.B], Takemura-Oh-539 provides a recess in the positive active material layer for a lead connected to the positive current collector. EX1003, ¶428. Takemura-Oh-539 does not explicitly disclose applying another first insulating tape at a third location of a surface of the positive current collector that is opposite the surface of the positive current collector connected to the positive lead. But this was well known, as Kobayashi discloses. *Id.*

(b) Kobayashi

Kobayashi discloses tapes 25a on the top and bottom surfaces of exposed portion 11f of positive electrode plate 11A to prevent short-circuiting. EX1008, ¶¶[0005], [0010], [0014], [0034]-[0035], FIGs. 2A-2B; EX1003, ¶429.



EX1008, FIGs. 2A-2B (annotated).

(c) Combination of Takemura, Oh-539, and Kobayashi

For the same reasons in Sections XII.A and XII.B.3.c, it would have been obvious to apply another first insulating tape on the bottom of Takemura-Oh-539's positive current collector, as taught by Kobayashi, to cover the exposed metal opposite the positive lead. EX1003, ¶430. Doing so would protect the exposed metal surface from inadvertent contact with another conductor, preventing short-circuiting. EX1008, ¶[0005], [0010], [0014]; EX1003, ¶430. This modification would have simply been combining a known element (another insulating tape) with a known device (Takemura-Oh-539-Kobayashi's battery), to prevent short-circuiting. EX1003, ¶430.

11. [1.I]/[9.I.2]/[17.I]

As discussed in Section IX.B.10.b-IX.B.10.c, Takemura discloses an insulating tape 7 having a width (measured along the negative electrode's length) greater than the exposed metal on negative electrode current collector 6. EX1003, ¶¶397-398, 432-434, 460-462. When implementing Oh-539's centrally-located negative lead connection with Takemura, a POSA would have kept the width of Takemura's insulating tape greater than the width of the recess formed in the negative active material of Takemura's negative electrode to cover all exposed metal. *Id*.

Takemura does not explicitly disclose that the insulating tape has a length larger than the length of the exposed metal on the negative electrode current

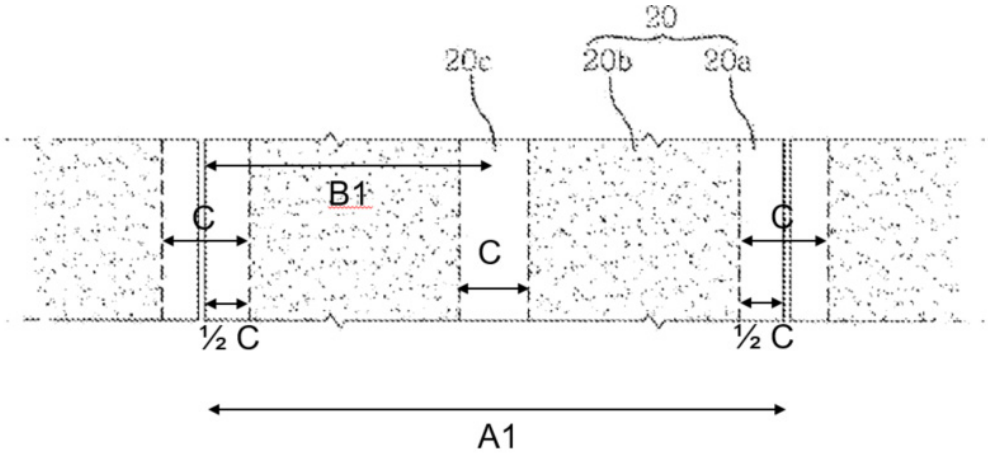
collector. But a POSA would have made the length of Takemura's tape (measured along the electrode's width) larger than the length of the current collector's exposed surface in the Takemura-Oh-539 battery to avoid exposing negative electrode metal to lithium plating (or, at least, found this obvious). EX1003, ¶398; Section IX.B.10. Doing so would have helped ensure covering metal as result of alignment variances. EX1003, ¶¶398, 433, 461; Section IX.B.10.

Furthermore, merely changing a component's size, such as Takemura's tape, without any unexpected result does not give rise to a patentable invention. *Powers-Kennedy Contracting Corp*, 282 U.S. at 185; EX1003, ¶398, 433, 461.

D. Claims 2/10

Oh-539 discloses that the cathode 22 and anode 24 include a centrally-located recess (non-coated portion 20c) having a length "C" and two non-coated portions at opposing ends of the cathode 22 having a length "½ C." Oh-539's non-coated portions 22c (on cathode) and 24c (on anode) are located at distance B1/B2, 40% to 60% of the total length A1/A2 of Oh-539's cathode 22 and anode 24, respectively. EX1007, ¶¶[0050]-[0051], [0061]-[0062]. Given the symmetrical, repeated nature of Oh-539's cathode 22 and anode 24, a distance between a center of the non-coated portions 22c/24c and one end of the electrode active material 22b/24b would be 40% to 60% of the total length of the electrode active material 22b/24b. EX1003, ¶¶399-400; EX1007, ¶¶[0045], [0058]. Thus, the distance from the center of the

non-coated portions 22c/24c to the ends of the electrode active materials 22b/24b satisfies Oh-539's 40% to 60% requirement. This range falls with the claimed ranges of ¼ to ¾ of a length of the positive and negative active materials. EX1003, ¶¶400, 435.



EX1007, FIG. 6(c) (annotated).

When implementing Oh-539's recesses and lead connections with Takemura, a POSA would have been motivated to locate the center of the first and second recesses at a distance from one end of the positive/negative active material corresponding to ¼ to ¾ of the positive/negative active material length, as taught by Oh-539, to improve the battery's discharge rate. EX1003, ¶¶401, 436; Section XV.A.

E. Claims 3/11

As discussed in Section XV.D, Oh-539 discloses that the distance between the center of the centrally-located non-coated portion 22c/24c and one end of the

electrode active material 22b/24c is 40%-60% of the total electrode active material's length. This range includes the claimed ½ value. EX1003, ¶¶405, 437.

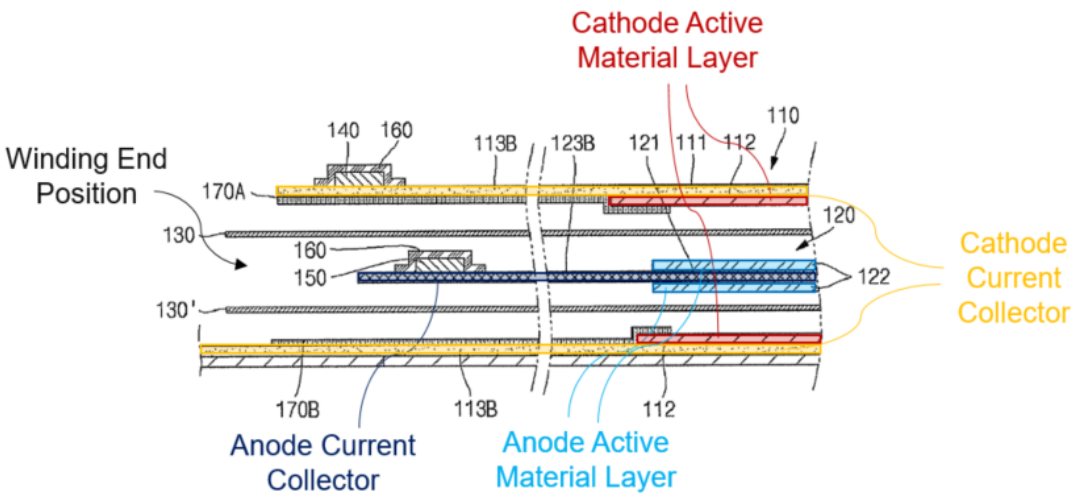
When implementing Oh-539's recesses and lead connections with Takemura, a POSA would have been motivated to locate the center of the first/second recesses at a distance from one end of the positive/negative active material corresponding to half of the positive/negative active material length, as taught by Oh-539, to improve the battery's discharge rate. EX1003, ¶¶406, 438; Section XV.A.

XVI. GROUND 8: CLAIMS 20-22 WOULD HAVE BEEN OBVIOUS IN VIEW OF TAKEMURA, OH-539, KOBAYASHI, AND OH-144.

A. Motivation to Combine Oh-144 with Takemura-Oh-539-Kobayashi

Takemura, Oh-539, Kobayashi, and Oh-144 are analogous art—lithium-ion batteries. EX1006, ¶[0001]; EX1007, ¶¶[0007], [0029]; EX1008, ¶¶[0014]-[0016]; EX1017, ¶¶[0025]-[0027]; EX1003, ¶¶464-471.

As discussed in Section XI.B, Oh-144 discloses a lithium-ion battery with a cathode 110, anode 120, and separator 130 wounded together. EX1017, ¶[0025], FIGs. 3-4; EX1003, ¶465.



EX1017, FIG. 4 (annotated).

As also discussed in Section XI.B, Oh-144 discloses disposing two tapes—first tape 170A and second tape 170B—on cathode 110 at the winding end portion of anode 120 to prevent short-circuiting. EX1017, ¶¶[0038], [0039]; EX1003, ¶¶466-468.

A POSA would have been motivated to add Oh-144's first/second tapes 170A/170B on opposite inner/outer surfaces of the positive plate in the Takemura-Oh-539-Kobayashi combination such that (i) a winding end of the negative plate is located between the two insulating tapes and (ii) the two insulating tapes extend over the winding end. EX1003, ¶¶469-470. Including these two tapes would have helped prevent short-circuiting caused by inadvertent contact between uncoated portions at the winding end of the cathode/anode—a known problem for pouch-type or cylindrical wound battery coils, like Takemura-Oh-539-Kobayashi. EX1006, ¶[0032]; EX1007, ¶[0092]; EX1017, Abstract, ¶¶[0041]-[0042]; EX1003, ¶¶469-

470. Further, improving short-circuit resistance by insulating exposed metal on the anode was also known well before January 2014. *See* EX1011, ¶¶[0009], [0014].

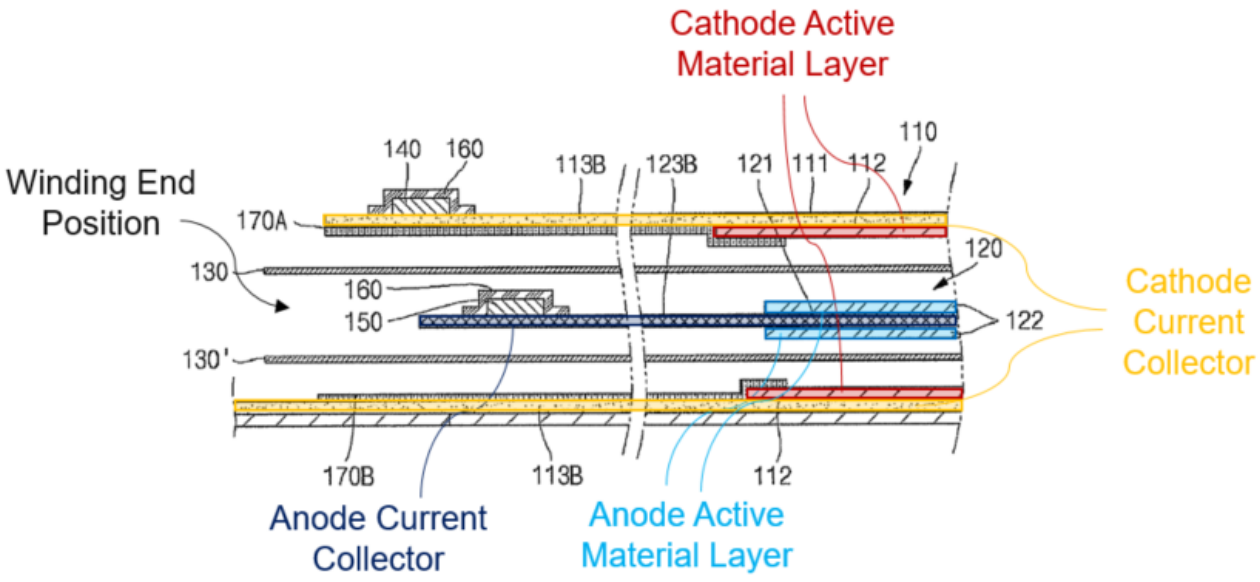
Accordingly, a POSA would have been motivated to apply insulating tapes on opposite surfaces of Takemura's modified positive plate with a winding end of Takemura's negative plate located between the tapes and the tapes extending over the winding end, as taught by Oh-144, to prevent short circuits between exposed metal on Takemura's positive and negative plates. EX1003, ¶470. Adding insulating tapes as disclosed by Oh-144 would simply have been applying a known technique (placing tapes around the winding end of the negative electrode) to improve a known device (Takemura-Oh-539-Kobayashi's battery) by preventing short-circuiting. *KSR*, 550 U.S. at 417; EX1003, ¶470.

A POSA would also have had a reasonable expectation of success combining Takemura-Oh-539-Kobayashi-Oh-144 because applying insulating tapes in coiled lithium-ion battery cells was a common solution for preventing short-circuiting. EX1006, ¶¶3, 8, 22; EX1009, ¶8; EX1010, ¶29; EX1011, ¶18; EX1003, ¶471. A POSA would have expected Oh-144's laminating tapes 170A/170B incorporated into the Takemura-Oh-539-Kobayashi battery to insulate exposed metal at the winding end of the negative electrode. *Id*.

B. Combination of Takemura, Oh-539, Kobayashi, and Oh-144

Takemura-Oh-539-Kobayashi does not explicitly disclose insulating tapes disposed on opposite surfaces of the positive plate such that a winding end of the negative plate is located between the tapes and the tapes extend over the winding end. But including these two tapes in the Takemura-Oh-539-Kobayashi battery would have been obvious in view of Oh-144. EX1003, ¶¶472-474.

As discussed in Section XI.C.2, Oh-144 discloses a winding end (123B) of a negative plate (cathode 120) located between two insulating layers (tapes 170A-B), which extend over the winding end (123B) along the winding direction. EX1017, ¶¶[0038], [0039]; EX1003, ¶475.



EX1017, FIG. 4 (annotated).

As discussed in Section XVI.A, it would have been obvious to position Oh-144's laminating tapes 170A/170B on inner/outer surfaces of non-coated end portions

22a of the positive electrode in the Takemura-Oh-539-Kobayashi battery such that the winding end is located between two tapes, which extend over the winding end. EX1003, ¶¶476-477.

XVII. NO SECONDARY CONSIDERATIONS

Petitioner is not aware of any evidence of alleged secondary considerations of non-obviousness having nexus to the challenged claims, but reserves the right to address any evidence Patent Owner presents. EX1003, ¶¶477-478.

XVIII. NO FACTORS UNDER SECTIONS 325(D) OR 314(A) WEIGH AGAINST INSTITUTING TRIAL.

A. Section 325(d)

The Board *should not* deny institution under Section 325(d). Grounds 1-8 differ substantially from the art and arguments previously considered by the Office. The primary references, Sato and Takemura, were never before the Office. *Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6 (Feb. 13, 2020) (precedential). Grounds 1 and 4 collectively challenge half of the claims and rely on prior art never presented during prosecution. This alone shows the Board should not exercise its discretion to deny institution. *See Allgenesis Biotherapeutics Inc. v. Cloudbreaker Therapeutics, LLC*, IPR2020-01438, Paper 7, 12 (P.T.A.B. Feb. 18, 2021).

Although applications relating to Nakamura and Oh-539 were previously presented, these references are applied here as secondary references for dimensions

and locations of recesses in active material layers that were not material to the alleged patentability. *Grimco, Inc. v. Principal Lighting Grp.*, IPR2021-00968, Paper 13, 19-21 (P.T.A.B. Nov. 22, 2021). And Sato, Takemura, Kobayashi, and Oh-144 were never before the Office. Takemura, for example, discloses features—a second insulating layer located opposite to a negative lead—the Examiner (erroneously) thought were missing in the prior art. *Agrofresh Sols. Inc. v. Lytone Enter., Inc.*, IPR2021-00451, Paper 11, 12-13 (P.T.A.B. July 27, 2021) (declining to deny institution where new art addresses shortcomings of previously presented art); *Oticon Med. AB v. Cochlear Ltd.*, IPR2019-00975, Paper 15, 18-20 (P.T.A.B. Oct. 16, 2019) (precedential) (similar). Sato, Takemura, Kobayashi, and Oh-144 are also materially different than references applied during prosecution, and therefore, are not cumulative. Accordingly, *Becton* factors (a), (b) weigh heavily in favor of institution.

Because Sato, Takemura, Kobayashi, and Oh-144 were neither presented to the Office nor cumulative to previously-considered art, the applicant made no arguments during examination against the combinations applied here—relating to *Becton* factor (d). Regarding *Becton* factor (f), additional facts and evidence—including Dr. von Sacken's declaration—warrant institution and a finding of unpatentability.

B. The *Fintiv* factors favor institution.

Patent Owner asserted the '498 patent against Petitioner in related litigation filed September 6, 2024. EX1024. IPR should be instituted under *Fintiv* regardless. *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 (P.T.A.B. Mar. 20, 2020) (precedential). Petitioner files this Petition before the January 20, 2025 deadline to answer. EX1025. The parties have invested little resources. Timing remains uncertain, so this proceeding will help resolve the parties' dispute. The Petition provides compelling patentability challenges, overriding any *Fintiv* concerns. Vidal 06.21.24 Memo, 2-3. If IPR is instituted, Petitioner stipulates not to pursue in the related litigation the Grounds in this Petition or any other ground Petitioner reasonably could have raised in this Petition. *Id*., 3; *Sotera Wireless, Inc. v. Masimo Corp.*, IPR2020-01019, Paper 12 (P.T.A.B. Dec. 1, 2020) (§ II.A precedential).

XIX. MANDATORY NOTICES (37 C.F.R. § 42.8(A)(1)

REAL PARTY IN INTEREST: The real party-in-interest is Petitioner Zhuhai CosMX Battery Co., Ltd.

RELATED MATTERS: The '498 patent is currently at issue in *Ningde Amperex Technology Ltd. V. Zhuhai CosMX Battery Co., Ltd.*, Case No. 2:24-cv-00728 (E.D. Tex.), filed September 6, 2024.

Petitioner has also filed the following petitions for *inter partes* review of patents also at issue in the above-listed litigation:

Proceeding No.	U.S. Patent No.
IPR2025-00405	11,769,910
IPR2025-00432	11,575,148

LEAD AND BACKUP COUNSEL: Under 37 C.F.R. §§ 42.8(b)(3) and 42.10(a), Petitioner appoints **Jason A. Fitzsimmons** (Reg. No. 65,367) as lead counsel, and **Jason D. Eisenberg** (Reg. No. 43,447), **Charles D. Hammond** (Reg. No. 73,287), and **John D. Higgins** (Reg. No. 74,992) as back-up counsel, all at the address: STERNE, KESSLER, GOLDSTEIN & FOX P.L.L.C., 1101 K Street, N.W., 10th Floor, Washington, D.C., 20005, phone (202) 371-2600, and facsimile (202) 371-2540, and **James D. Stein** (Reg. No. 63,782) at the address: LEE & HAYES, P.C., 75 14th Street NE, Suite 2500, Atlanta Georgia 30309 and **Kevin Yao** (Limited Recognition No. L0790) at the address: LEE & HAYES, P.C., 701 Pike Street, Suite 1600, Seattle, WA 98101.

SERVICE INFORMATION: Petitioner consents to electronic service by email at: **jfitzsimmons-PTAB@sternekessler.com**; **jasone-PTAB@sternekessler.com**; **chammond-PTAB@sternekessler.com**; **jhiggins-PTAB@sternekessler.com**; **PTAB@sternekessler.com**; **james.stein@leehayes.com**; and **kevin.yao@leehayes.com**.

XX. CONCLUSION

The Board should institute review of claims 1-22 because the merits are strong and discretionary considerations are not present.

Respectfully submitted,

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XXI. APPENDIX A: CHALLENGED CLAIMS

A. Comparison of Independent Claims

Claim Element	Independent Claim 1		Independent Claim 9		Independent Claim 17
[1.P]	A lithium-ion battery, comprising:	[9.P]	A lithium-ion battery, comprising:	[17.P]	A lithium-ion battery, comprising:
[1.A]	a positive electrode comprising a positive current collector and a positive electrode active material layer **containing LiCoO2**, wherein the positive electrode active material layer is formed on the positive current collector	[9.A]	a positive electrode, comprising a positive current collector and a positive electrode active material layer being formed on the positive current collector,	[17.A]	a positive electrode, comprising a positive current collector and a positive electrode active material layer being formed on the positive current collector,
[1.B]	the positive electrode active material layer being provided with a first recess accommodating a positive lead being coupled with the positive current collector;	[9.B]	the positive electrode active material layer being provided with a first recess accommodating a positive lead being coupled with the positive current collector;	[17.B]	the positive electrode active material layer being provided with a first recess accommodating a positive lead being coupled with the positive current collector;
[1.C]	a negative electrode comprising a	[9.C]	a negative electrode, comprising a	[17.C]	a negative electrode, comprising a

	negative current collector and a negative electrode active material layer **containing graphite or silicon**, wherein the negative electrode active material layer is formed on the negative current collector,		negative current collector and a negative electrode active material layer being formed on the negative current collector		negative current collector and a negative electrode active material layer being formed on the negative current collector,
[1.D]	the negative electrode active material layer being provided with a second recess accommodating a negative lead being coupled with the negative current collector;	[9.D]	the negative electrode active material layer being provided with a second recess accommodating a negative lead being coupled with the negative current collector;	[17.D]	the negative electrode active material layer being provided with a second recess accommodating a negative lead being coupled with the negative current collector;
[1.E]	a separator disposed between the positive electrode and the negative electrode; and	[9.E]	a separator disposed between the positive electrode and the negative electrode; and	[17.E]	a separator disposed between the positive electrode and the negative electrode; and
[1.F]	an electrolyte,	[9.F]	an electrolyte;	[17.F]	an electrolyte,
[1.G]	wherein a top surface of the positive lead is provided with a first insulating glue layer,	[9.G]	wherein, **a first location of** a top surface of the positive lead is provided with a	[17.G]	wherein, a first location of a top surface of the positive lead is provided with a

			first insulating glue layer;		first insulating glue layer;
[1.H]	a surface of the positive electrode active material layer opposite to the second recess across the separator in a thickness direction of the positive plate and the negative plate is pasted with a second insulating glue layer,	[9.H]	**a second location of** a surface of the positive electrode active material layer opposite to the second recess across the separator in a thickness direction of the positive plate and the negative plate is pasted with a second insulating glue layer;	[17.H]	a second location of a surface of the positive electrode active material layer opposite to the second recess across the separator in a thickness direction of the positive plate and the negative plate is pasted with a second insulating glue layer;
		[9.I.1]	a third location of a surface of the positive current collector opposite to the surface of the positive current collector where the positive lead is covered with another first insulating glue layer		
[1.I]	the second insulating glue layer has a width larger than a width of the second recess, and the second	[9.I.2]	the second insulating glue layer has a width larger than a width of the second recess, and the second	[17.I]	the second insulating glue layer has a width larger than a width of the second recess, and the second

	insulating glue layer has a length larger than a length of the second recess.		insulating glue layer has a length larger than a length of the second recess		insulating glue layer has a length larger than a length of the second recess

B. Groupings of Substantively Similar Dependent Claims

- 2/10
- 3/11
- 4/12
- 5/13
- 6/14
- 7/15/18
- 8/16/19
- 20/21/22

C. Listing of All Challenged Claims

1. **[1.P]** A lithium-ion battery, comprising:

[1.A] a positive electrode comprising a positive current collector and a positive electrode active material layer containing LiCoO2, wherein the positive electrode active material layer is formed on the positive current collector

[1.B] the positive electrode active material layer being provided with a first recess accommodating a positive lead being coupled with the positive current collector;

[1.C] a negative electrode comprising a negative current collector and a negative electrode active material layer containing graphite or silicon, wherein the negative electrode active material layer is formed on the negative current collector,

[1.D] the negative electrode active material layer being provided with a second recess accommodating a negative lead being coupled with the negative current collector;

[1.E] a separator disposed between the positive electrode and the negative electrode; and

[1.F] an electrolyte,

[1.G] wherein a top surface of the positive lead is provided with a first insulating glue layer,

[1.H] a surface of the positive electrode active material layer opposite to the second recess across the separator in a thickness direction of the positive plate and the negative plate is pasted with a second insulating glue layer,

[1.I] the second insulating glue layer has a width larger than a width of the second recess, and the second insulating glue layer has a length larger than a length of the second recess.

2. The lithium-ion battery of claim 1, wherein a distance between a center of the first recess and one end of the positive electrode active material layer is ¼-¾ of a length of the positive electrode active material layer; and a distance between a center of the second recess and one end of the negative electrode active material layer is ¼-¾ of a length of the negative electrode active material layer.

3. The lithium-ion battery of claim 2, wherein, the distance between the center of the first recess and the one end of the positive electrode active material layer is half of the length of the positive electrode active material layer; and the distance between the center of the second recess and the one end of the negative electrode active material layer is half of the length of the negative electrode active material layer.

4. The lithium-ion battery of claim 3, wherein the first recess has a length of 1-100 mm less than a length of the positive lead, the first recess has a width of 1-10 mm larger than a width of the positive lead, the second recess has a length of 1-100 mm less than a length of the negative lead, and the second recess has a width of 1-10 mm larger than a width of the negative lead.

5. The lithium-ion battery of claim 1, wherein the first recess has a length of 1-100 mm less than a width of the positive electrode active material layer, and the second recess has a length of 1-100 mm less than a width of the negative electrode active material layer.

6. The lithium-ion battery of claim 1, wherein the first recess has a depth of 0.005-0.1 mm larger than a thickness of the positive lead, and the second recess has a depth of 0.005-0.1 mm larger than a thickness of the negative lead.

7. The lithium-ion battery of claim 1, wherein a length of a portion of the positive lead in the first recess is less than a width of a remaining portion of the positive electrode active material layer from an edge of the

first insulating glue layer covering the positive electrode active material layer to an edge of the positive electrode active material layer opposite to the first recess.

8. The lithium-ion battery of claim 1, wherein a width of a portion of the positive lead in the first recess is greater than a width of a remaining portion of the first recess not occupied by the positive lead located on one side of the positive lead.

9. **[9.P]** A lithium-ion battery, comprising:

[9.A] a positive electrode, comprising a positive current collector and a positive electrode active material layer being formed on the positive current collector,

[9.B] the positive electrode active material layer being provided with a first recess accommodating a positive lead being coupled with the positive current collector;

[9.C] a negative electrode, comprising a negative current collector and a negative electrode active material layer being formed on the negative current collector,

[9.D] the negative electrode active material layer being provided with a second recess accommodating a negative lead being coupled with the negative current collector;

[9.E] a separator disposed between the positive electrode and the negative electrode; and

[9.F] an electrolyte,

[9.G] wherein, a first location of a top surface of the positive lead is provided with a first insulating glue layer;

[9.H] a second location of a surface of the positive electrode active material layer opposite to the second recess across the separator in a thickness direction of the positive plate and the negative plate is pasted with a second insulating glue layer;

[9.I.1] a third location of a surface of the positive current collector opposite to the surface of the positive current collector where the positive lead is covered with another first insulating glue layer;

[9.I.2] the second insulating glue layer has a width larger than a width of the second recess, and the second insulating glue layer has a length larger than a length of the second recess.

10. The lithium-ion battery of claim 9, wherein a distance between a center of the first recess and one end of the positive electrode active material layer is ¼-¾ of a length of the positive electrode active material layer, and a distance between a center of the second recess and one end of the negative electrode active material layer is ¼-¾ of a length of the negative electrode active material layer.

11. The lithium-ion battery of claim 9, wherein a distance between a center of the first recess and one end of the positive electrode active material layer is half of a length of the positive electrode active material layer, and a distance between a center of the second recess and one end of the negative electrode active material layer is half of a length of the negative electrode active material layer.

12. The lithium-ion battery of claim 9, wherein the first recess has a length of 1-100 mm less than a length of the positive lead, the first recess has a width of 1-10 mm larger than a width of the positive lead, the second recess has a length of 1-100 mm less than a length of the negative lead, and the second recess has a width of 1-10 mm larger than a width of the negative lead.

13. The lithium-ion battery of claim 9, wherein the first recess has a length of 1-100 mm less than a width of the positive electrode active material layer, and the second recess has a length of 1-100 mm less than a width of the negative electrode active material layer.

14. The lithium-ion battery of claim 9, wherein the first recess has a depth of 0.005-0.1 mm larger than a thickness of the positive lead, and the second recess has a depth of 0.005-0.1 mm larger than a thickness of the negative lead.

15. The lithium-ion battery of claim 9, wherein a length of a portion of the positive lead in the first recess is less than a width of a remaining portion of the positive electrode active material layer from an edge of the first insulating glue layer covering the positive electrode active material layer to an edge of the positive electrode active material layer opposite to the first recess.

16. The lithium-ion battery of claim 9, wherein a width of a portion of the positive lead in the first recess is greater than a width of a

remaining portion of the first recess not occupied by the positive lead located on one side of the positive lead.

17. **[17.P]** A lithium-ion battery, comprising:

[17.A] a positive electrode, comprising a positive current collector and a positive electrode active material layer being formed on the positive current collector,

[17.B] the positive electrode active material layer being provided with a first recess accommodating a positive lead being coupled with the positive current collector;

[17.C] a negative electrode, comprising a negative current collector and a negative electrode active material layer being formed on the negative current collector,

[17.D] the negative electrode active material layer being provided with a second recess accommodating a negative lead being coupled with the negative current collector; a separator disposed between the positive electrode and the negative electrode; and

[17.E] a separator disposed between the positive electrode and the negative electrode; and

[17.F] an electrolyte,

[17.G] wherein, a first location of a top surface of the positive lead is provided with a first insulating glue layer;

[17.H] a second location of a surface of the positive electrode active material layer opposite to the second recess across the separator in a thickness direction of the positive plate and the negative plate is pasted with a second insulating glue layer;

[17.I] the second insulating glue layer has a width larger than a width of the second recess, and the second insulating glue layer has a length larger than a length of the second recess.

18. The lithium-ion battery of claim 17, wherein a length of a portion of the first lead in the first recess is less than a width of a remaining portion of a first film from an edge of the first insulating glue layer covering the first film to an edge of the first film opposite to the first recess.

19. The lithium-ion battery of claim 17, wherein a width of a portion of the first lead in the first recess is greater than a width of a remaining portion of the first recess not occupied by the first lead located on one side of the first lead.

20. The lithium-ion battery of claim 1, wherein two insulating layers are disposed on two opposite surfaces of the positive plate, and a winding end of the negative plate is located between the two insulating layers; and the two insulating layers extend over the winding end of the negative plate along the winding direction.

21. The lithium-ion battery of claim 9, wherein two insulating layers are disposed on two opposite surfaces of the positive plate, and a winding end of the negative plate is located between the two insulating layers; and the two insulating layers extend over the winding end of the negative plate along the winding direction.

22. The lithium-ion battery of claim 17, wherein two insulating layers are disposed on two opposite surfaces of the positive plate, and a winding end of the negative plate is located between the two insulating layers; and the two insulating layers extend over the winding end of the negative plate along the winding direction.

D. Comparison of Dependent Claims

Claim Element	Independent Claim 1 set		Independent Claim 9 set		Independent Claim 17 set
[2]	The lithium-ion battery of claim 1, wherein a distance between a center of the first recess and one end of the positive electrode active material layer is ¼-¾ of a length of the positive electrode active material layer; and a distance between a center of the second recess and one end of the negative electrode active material layer is ¼-¾ of a length of the negative electrode active material layer.	[10]	The lithium-ion battery of claim 9, wherein a distance between a center of the first recess and one end of the positive electrode active material layer is ¼-¾ of a length of the positive electrode active material layer, and a distance between a center of the second recess and one end of the negative electrode active material layer is ¼-¾ of a length of the negative electrode active material layer.		
[3]	The lithium-ion battery of claim 2, wherein, the distance between the center of the first recess and the one end of the positive electrode active material layer is half of the length of the positive electrode	[11]	The lithium-ion battery of claim 9, wherein a distance between a center of the first recess and one end of the positive electrode active material layer is half of a length of the positive electrode active material		

	active material layer; and the distance between the center of the second recess and the one end of the negative electrode active material layer is half of the length of the negative electrode active material layer.		layer, and a distance between a center of the second recess and one end of the negative electrode active material layer is half of a length of the negative electrode active material layer.		
[4]	The lithium-ion battery of claim 3, wherein the first recess has a length of 1-100 mm less than a length of the positive lead, the first recess has a width of 1-10 mm larger than a width of the positive lead, the second recess has a length of 1-100 mm less than a length of the negative lead, and the second recess has a width of 1-10 mm larger than a width of the negative lead.	[12]	The lithium-ion battery of claim 9, wherein the first recess has a length of 1-100 mm less than a length of the positive lead, the first recess has a width of 1-10 mm larger than a width of the positive lead, the second recess has a length of 1-100 mm less than a length of the negative lead, and the second recess has a width of 1-10 mm larger than a width of the negative lead.		
[5]	The lithium-ion battery of claim 1, wherein the first recess has a	[13]	The lithium-ion battery of claim 9, wherein the first recess has a		

	length of 1-100 mm less than a width of the positive electrode active material layer, and the second recess has a length of 1-100 mm less than a width of the negative electrode active material layer.		length of 1-100 mm less than a width of the positive electrode active material layer, and the second recess has a length of 1-100 mm less than a width of the negative electrode active material layer.		
[6]	The lithium-ion battery of claim 1, wherein the first recess has a depth of 0.005-0.1 mm larger than a thickness of the positive lead, and the second recess has a depth of 0.005-0.1 mm larger than a thickness of the negative lead.	[14]	The lithium-ion battery of claim 9, wherein the first recess has a depth of 0.005-0.1 mm larger than a thickness of the positive lead, and the second recess has a depth of 0.005-0.1 mm larger than a thickness of the negative lead.		
[7]	The lithium-ion battery of claim 1, wherein a length of a portion of the positive lead in the first recess is less than a width of a remaining portion of the positive electrode active material layer from an edge of the first	[15]	The lithium-ion battery of claim 9, wherein a length of a portion of the positive lead in the first recess is less than a width of a remaining portion of the positive electrode active material layer from an edge of the first	[18]	The lithium-ion battery of claim 17, wherein a length of a portion of the first lead in the first recess is less than a width of a remaining portion of a first film from an edge of the first insulating glue layer covering the

	insulating glue layer covering the positive electrode active material layer to an edge of the positive electrode active material layer opposite to the first recess.		insulating glue layer covering the positive electrode active material layer to an edge of the positive electrode active material layer opposite to the first recess.		first film to an edge of the first film opposite to the first recess.
[8]	The lithium-ion battery of claim 1, wherein a width of a portion of the positive lead in the first recess is greater than a width of a remaining portion of the first recess not occupied by the positive lead located on one side of the positive lead.	[16]	The lithium-ion battery of claim 9, wherein a width of a portion of the positive lead in the first recess is greater than a width of a remaining portion of the first recess not occupied by the positive lead located on one side of the positive lead.	[19]	The lithium-ion battery of claim 17, wherein a width of a portion of the first lead in the first recess is greater than a width of a remaining portion of the first recess not occupied by the first lead located on one side of the first lead.
[20]	The lithium-ion battery of claim 1, wherein two insulating layers are disposed on two opposite surfaces of the positive plate, and a winding end of the negative plate is located between the two insulating layers; and the two insulating layers extend over	[21]	The lithium-ion battery of claim 9, wherein two insulating layers are disposed on two opposite surfaces of the positive plate, and a winding end of the negative plate is located between the two insulating layers; and the two insulating layers extend over	[22]	The lithium-ion battery of claim 17, wherein two insulating layers are disposed on two opposite surfaces of the positive plate, and a winding end of the negative plate is located between the two insulating layers; and the two insulating layers extend over

	the winding end of the negative plate along the winding direction.		the winding end of the negative plate along the winding direction.		the winding end of the negative plate along the winding direction.

CERTIFICATE OF COMPLIANCE WITH TYPE-VOLUME LIMITATION, TYPEFACE REQUIREMENTS, AND TYPE STYLE REQUIREMENTS

1. This Petition complies with the type-volume limitation of 14,000 words, comprising 13,956 words, excluding the parts exempted by 37 C.F.R. § 42.24(a).

2. This Petition complies with the general format requirements of 37 C.F.R. § 42.6(a) and has been prepared using Microsoft® Word 2016 in 14-point Times New Roman.

Respectfully submitted,

STERNE, KESSLER, GOLDSTEIN & FOX PLLC

/Jason A. Fitzsimmons/

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Date: January 15, 2025

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CERTIFICATION OF SERVICE (37 C.F.R. §§ 42.6(e), 42.105(a))

The undersigned hereby certifies that on January 15, 2025, true and correct copies of the foregoing **PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 11,923,498** and all associated exhibits were served in their entireties on the following party via FedEx Express®:

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1400 Page Mill Road
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Patent Owner's Correspondence Address of Record for U.S. Patent No. 11,923,498

Respectfully submitted,

STERNE, KESSLER, GOLDSTEIN & FOX PLLC

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