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(54) **THERMAL INTERFACE MATERIAL INSTALLATION WITHIN A TRACTION BATTERY PACK**

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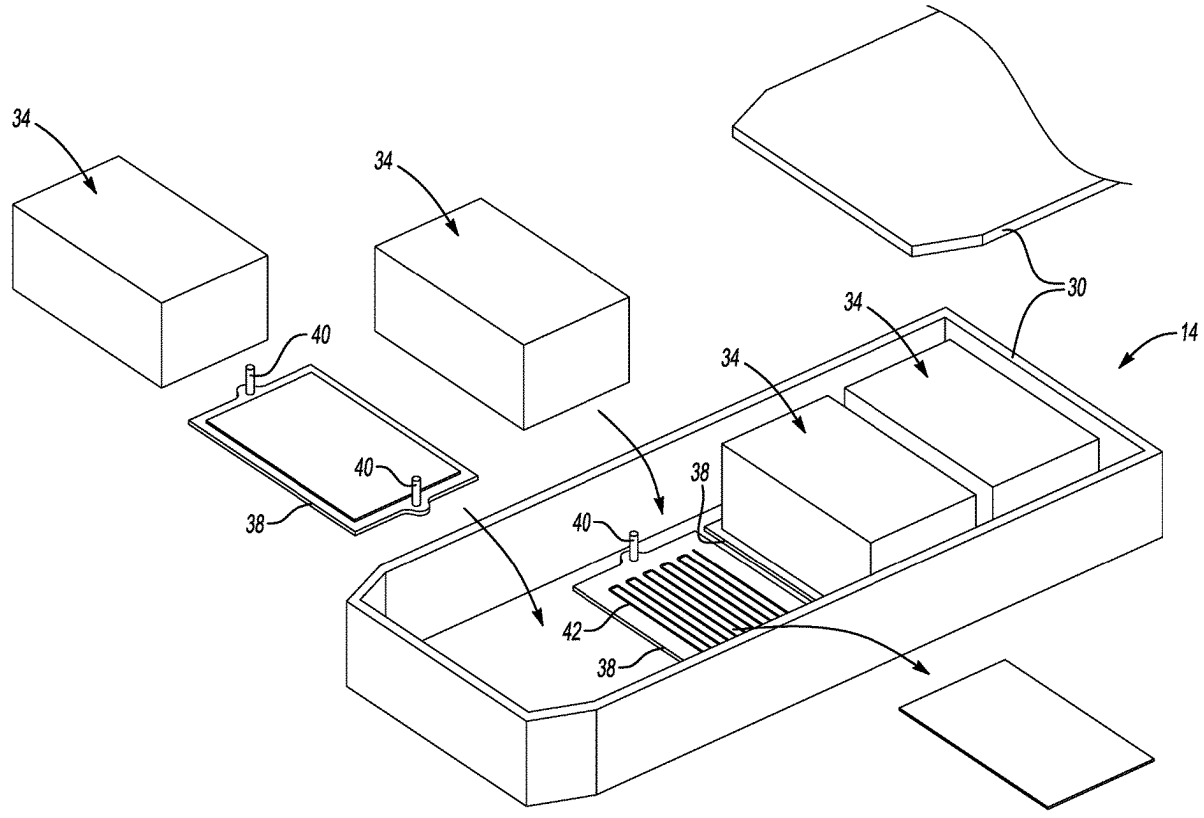
(57) **ABSTRACT**

A method of assembling components of a traction battery includes dispensing a thermal interface material onto a release sheet. While the thermal interface material remains on the release sheet, the method applies the thermal interface material to a component of a traction battery pack. The method then separates the release sheet from the thermal interface material while the thermal interface material remains on the component of the traction battery pack.



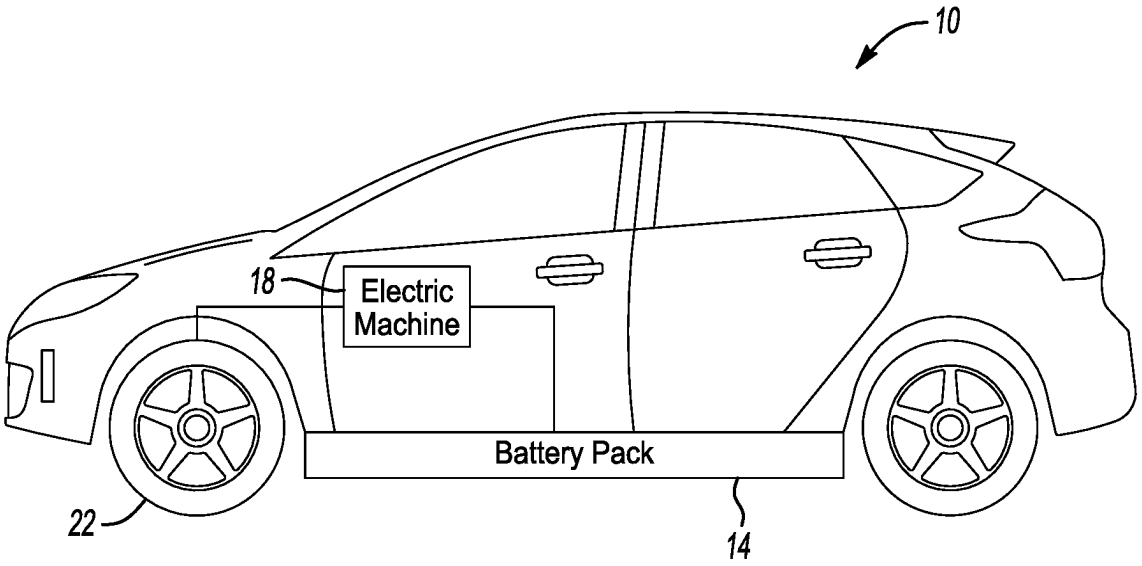


Fig-1

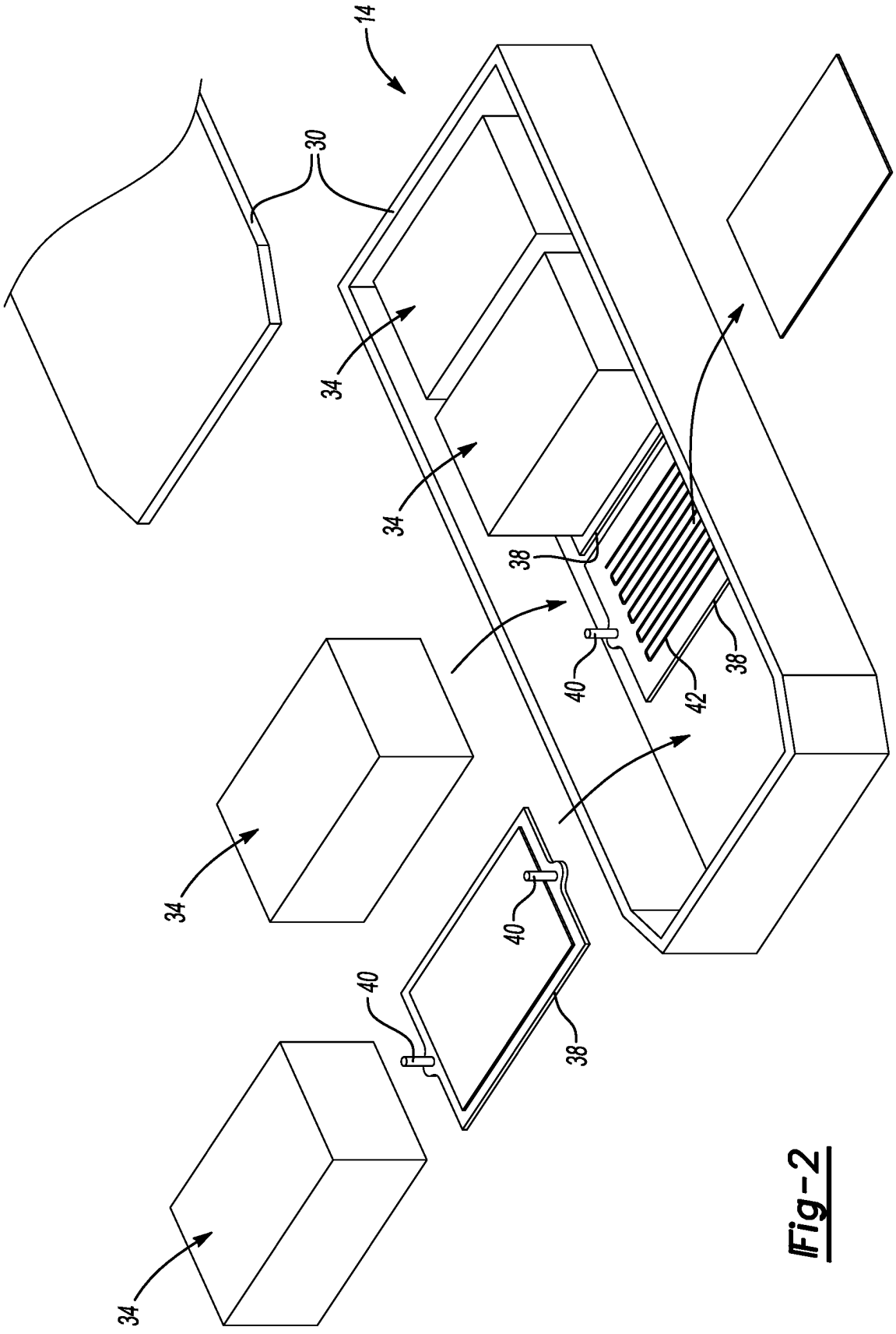


Fig-2

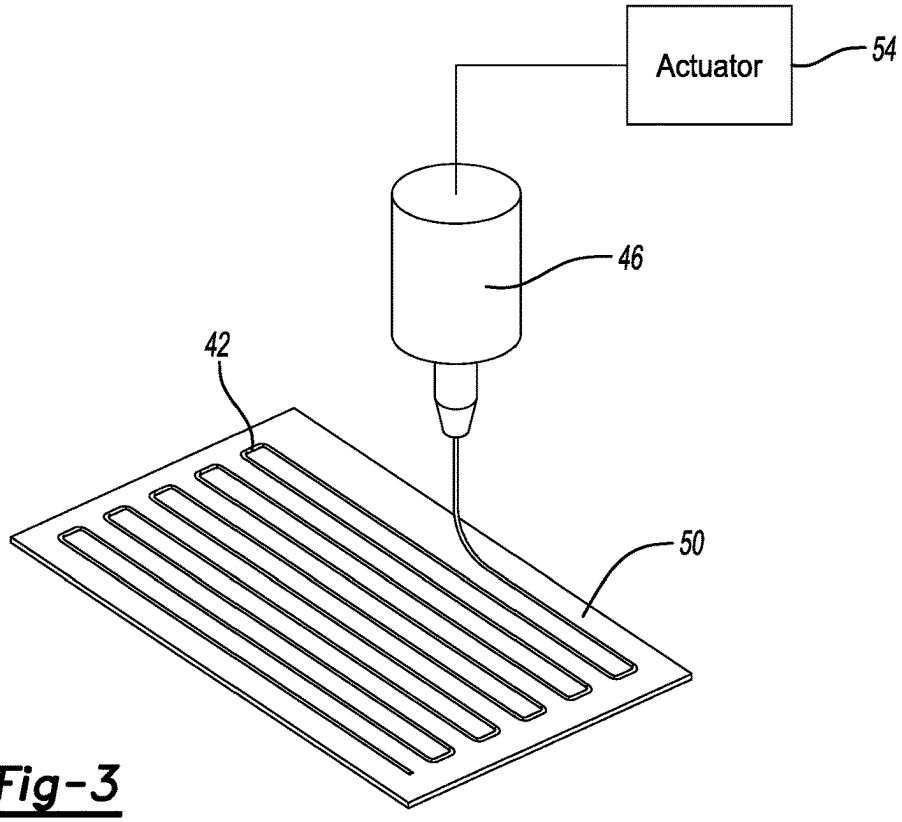


Fig-3

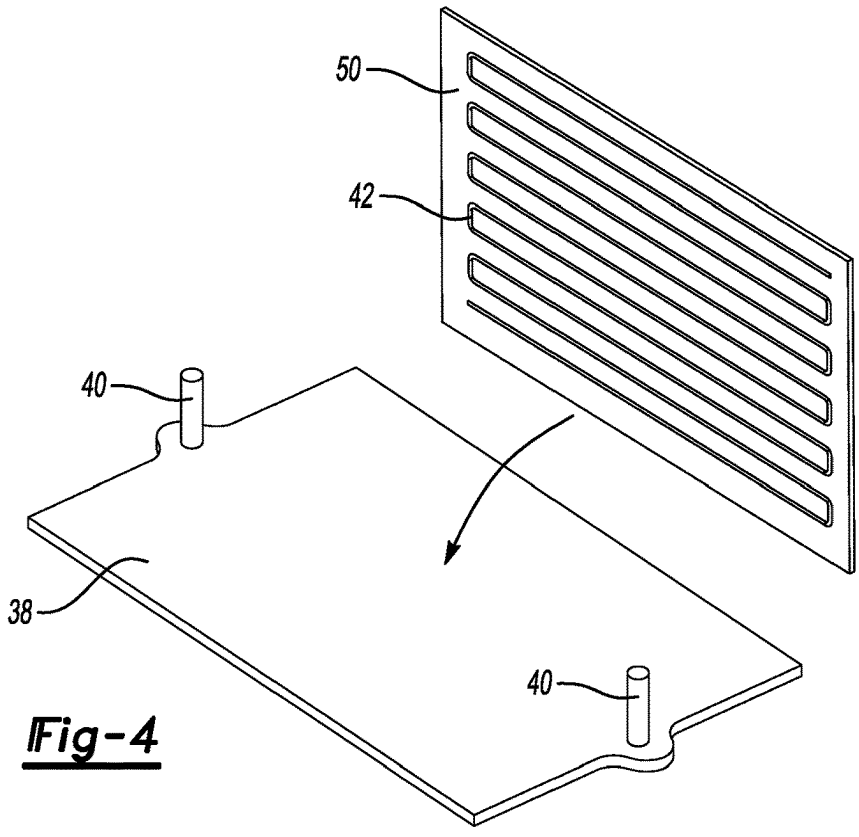


Fig-4

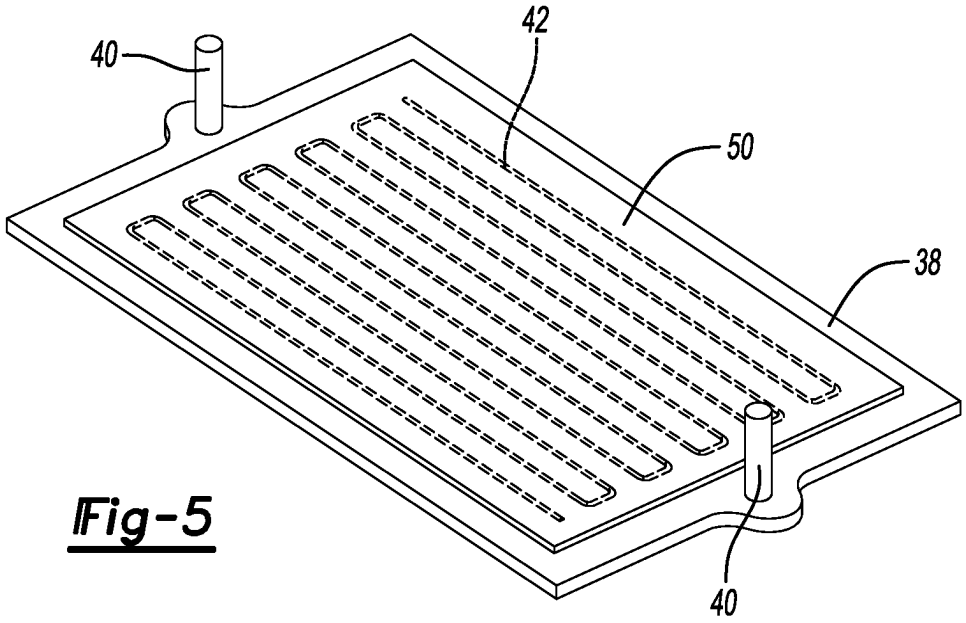


Fig-5

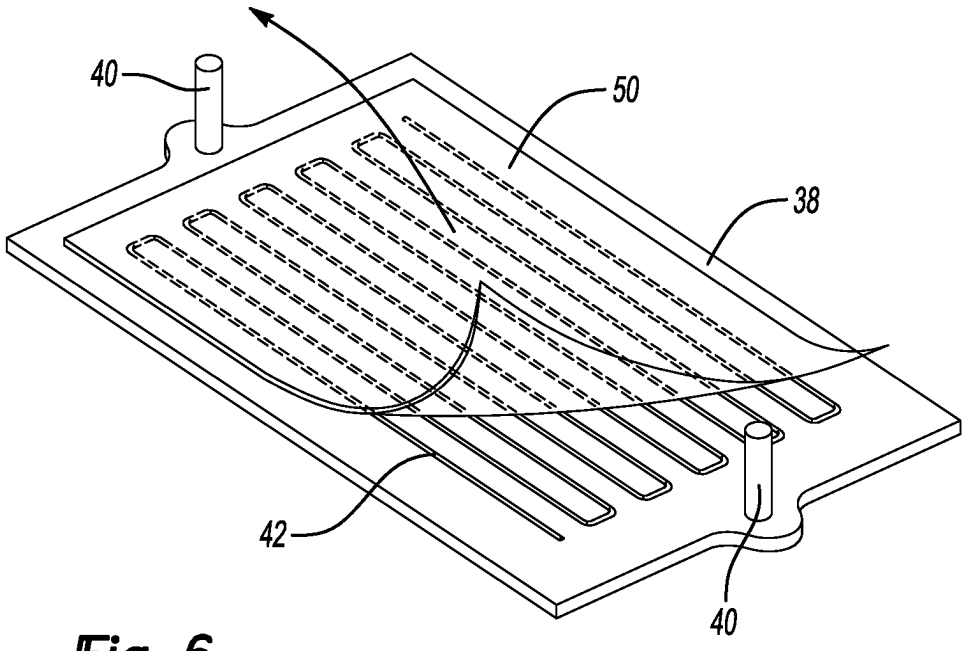


Fig-6

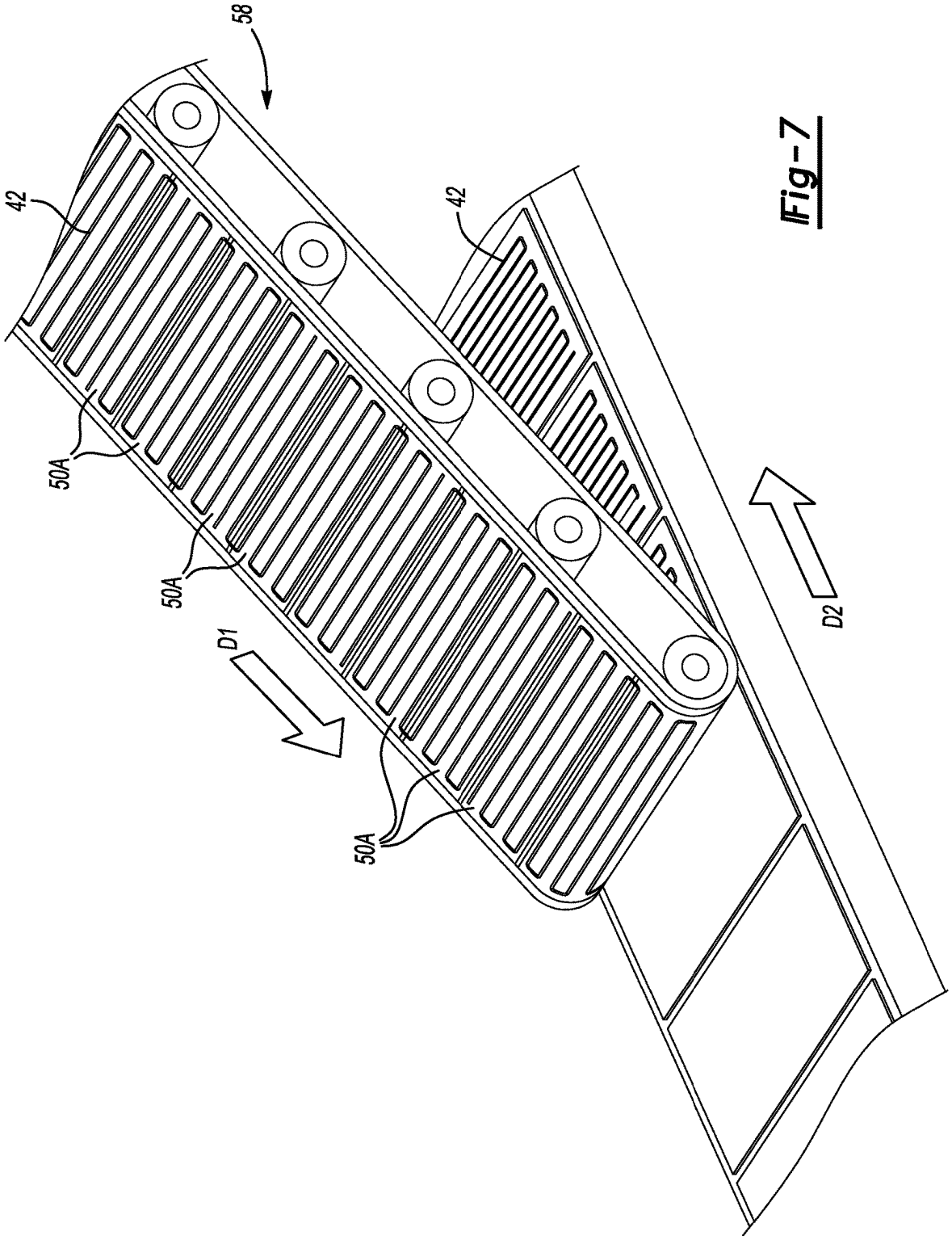


Fig-7

THERMAL INTERFACE MATERIAL INSTALLATION WITHIN A TRACTION BATTERY PACK

TECHNICAL FIELD

[0001] This disclosure relates generally to a traction battery pack and, more particularly, to how thermal interface material (TIM) is installed within the traction battery pack.

BACKGROUND

[0002] Electrified vehicles differ from conventional motor vehicles because electrified vehicles can be selectively driven by one or more electric machines that are powered by a traction battery pack. The electric machines can propel the electrified vehicles instead of, or in combination with, an internal combustion engine. Thermal interface materials can be used in various areas of traction battery packs to facilitate management of thermal energy.

SUMMARY

[0003] In some aspects, the techniques described herein relate to a method of assembling components of a traction battery, including: dispensing a thermal interface material onto a release sheet; while the thermal interface material remains on the release sheet, applying the thermal interface material to a component of a traction battery pack; and separating the release sheet from the thermal interface material while the thermal interface material remains on the component of the traction battery pack.

[0004] In some aspects, the techniques described herein relate to a method, wherein the component is a thermal exchange plate.

[0005] In some aspects, the techniques described herein relate to a method, further including, after the separating, sandwiching the thermal interface material between the thermal exchange plate and a battery array.

[0006] In some aspects, the techniques described herein relate to a method, further including communicating a liquid coolant through coolant channels of the thermal exchange plate.

[0007] In some aspects, the techniques described herein relate to a method, further including, after the separating, supporting at least one battery array on the component.

[0008] In some aspects, the techniques described herein relate to a method, further including, during the applying of the thermal interface material to the component, compressing the thermal interface material against the component.

[0009] In some aspects, the techniques described herein relate to a method, further including dispensing the thermal interface material as a bead.

[0010] In some aspects, the techniques described herein relate to a method, wherein the thermal interface material is silicone-based.

[0011] In some aspects, the techniques described herein relate to a method, further including, after the dispensing, heating the release sheet to heat the thermal interface material.

[0012] In some aspects, the techniques described herein relate to a method, after the dispensing, transporting the thermal interface material on the release sheet using a conveyer assembly to a position closer to the component.

[0013] In some aspects, the techniques described herein relate to a method, further including gripping peripheral edges of the release sheet with the conveyer assembly.

[0014] In some aspects, the techniques described herein relate to a method, further including applying the thermal interface material by operating the conveyer assembly.

[0015] In some aspects, the techniques described herein relate to a method, wherein the release sheet is a first release sheet and further including dispensing a bead of the thermal interface material on the first release sheet and a second release sheet.

[0016] In some aspects, the techniques described herein relate to a method, wherein the first release sheet and the second release sheet are conveyor slats.

[0017] In some aspects, the techniques described herein relate to a traction battery assembly, including: a release sheet; and a thermal interface material deposited on the release sheet, the release sheet configured to be separated from the thermal interface material after applying the thermal interface material to a traction battery component.

[0018] In some aspects, the techniques described herein relate to a traction battery assembly, wherein the traction battery component is a thermal exchange plate.

[0019] In some aspects, the techniques described herein relate to a traction battery assembly, wherein the release sheet is a heated release sheet configured to heat the thermal interface material deposited on the heated release sheet.

[0020] In some aspects, the techniques described herein relate to a traction battery assembly, further including a conveyer assembly that grips the release sheet, the conveyer assembly configured to move the release sheet and the thermal interface material closer to the component.

[0021] In some aspects, the techniques described herein relate to a traction battery assembly, wherein the release sheet is a first release sheet, and wherein the thermal interface material is a bead of thermal interface material that is deposited on the first release sheet and a second release sheet.

[0022] In some aspects, the techniques described herein relate to a traction battery assembly, wherein the release sheet is a conveyor slat.

[0023] The embodiments, examples and alternatives of the preceding paragraphs, the claims, or the following description and drawings, including any of their various aspects or respective individual features, may be taken independently or in any combination. Features described in connection with one embodiment are applicable to all embodiments, unless such features are incompatible.

BRIEF DESCRIPTION OF THE FIGURES

[0024] The various features and advantages of the disclosed examples will become apparent to those skilled in the art from the detailed description. The figures that accompany the detailed description can be briefly described as follows:

[0025] FIG. **1** illustrates a side view of an electrified vehicle according to an exemplary aspect of the present disclosure.

[0026] FIG. **2** illustrates an expanded view of a battery pack from the electrified vehicle of FIG. **1**.

[0027] FIG. **3** illustrates a thermal interface material being dispensed on a release sheet.

[0028] FIG. **4** illustrates the thermal interface material being applied to a component of the battery pack of FIG. **2**.

[0029] FIG. **5** illustrates the thermal interface material after being applied to a component of the battery pack of FIG. **2**.

[0030] FIG. **6** illustrates the release sheet being removed from the thermal interface material.

[0031] FIG. **7** illustrates a system of applying the thermal interface material to the release sheet and then to the component according to another exemplary embodiment of the present disclosure.

DETAILED DESCRIPTION

[0032] A traction battery pack can include a thermal interface material (TIM) in many areas. For example, TIM can be applied between a two components of the traction battery pack to facilitate thermal energy exchange between the two components.

[0033] With reference to FIG. **1**, an electrified vehicle **10**, in an exemplary non-limiting embodiment, includes a traction battery pack **14** that powers an electric machine **18**. The electrified vehicle **10** further includes wheels **22** driven by the electric machine **18**. The battery pack **14** can power the electric machine **18**, which converts electric power to torque to drive the wheels **22**.

[0034] The battery pack **14** is, in the exemplary embodiment, secured to an underbody **26** of the electrified vehicle **10**. The battery pack **14** could be located elsewhere on the electrified vehicle **10** in other examples. The battery pack **14** can be secured to the underbody **26** using straps and mechanical fasteners, for example.

[0035] The electrified vehicle **10** is an all-electric vehicle. In other examples, the electrified vehicle **10** is a hybrid electric vehicle, which can selectively drive wheels using torque provided by an internal combustion engine instead, or in addition to, an electric machine. Generally, the electrified vehicle **10** could be any type of vehicle having a traction battery pack.

[0036] Referring now to FIG. **2**, the battery pack **14** includes an enclosure **30** that encloses a plurality of battery arrays **34** each having an associated thermal exchange plate **38**. In other examples, a single thermal exchange plate **38** is associated with more than one of the battery arrays **34**. The battery arrays **34** include, among other things, a plurality of battery cells.

[0037] To manage thermal energy levels within the battery arrays **34** and other areas of the traction battery pack **14**, coolant can be circulated between the coolant supply and the coolant channels within the thermal exchange plate **38**. The coolant can be a liquid coolant. The thermal exchange plate **38**, often referred to as a "cold plate," can be used to dissipate thermal energy. The thermal exchange plates **38** each include conduits **40** that provide inlets for the coolant to the thermal exchange plate **38** and outlets from the thermal exchange plate **38** for the coolant. Other conduits communicate coolant back and forth between conduits and the coolant supply. These conduits are omitted in FIG. **2**.

[0038] In this example, a thermal interface material (TIM) **42** can be used to facilitate thermal conductivity between the battery arrays **34** and the respective thermal exchange plate **38**. In the past, during assembly of the battery pack **14**, a bead of the TIM **42** was typically dispensed from a TIM dispenser directly onto the thermal exchange plate **38** in a desired pattern, which contributed toward cycle times.

[0039] With reference to FIG. **3**, in an exemplary process of this disclosure, the TIM **42** is dispensed from a TIM dispenser **46** onto a release sheet **50**. The TIM **42** is dispensed as a bead of TIM **42**. The TIM **42** is dispensed into a desired pattern-here a circuitous pattern. An actuator **54**, such as a three-axis linear actuator, can be used to move the TIM dispenser **46** relative to the release sheet **50** to dispense the TIM **42** in a desired pattern. The TIM **42** can be silicone-based.

[0040] Next, as shown in FIG. **4**, the release sheet **50** and the TIM **42** are moved closer to a component of the traction battery pack **14** of FIG. **2**. In this example, the component is one of the thermal exchange plates **38** from the battery pack **14**. The release sheet **50** with the TIM **42** in a bead form is rotated so that the TIM **42** can be applied directly to the thermal exchange plate **38**. When the TIM **42** is initially applied to the thermal exchange plate **38**, the bead of the TIM **42** is sandwiched between the release sheet **50** and the thermal exchange plate **38**. The release sheet **50** with the TIM **42** are flipped to move to the position of FIG. **4**.

[0041] In some examples, when the TIM **42** is applied to the thermal exchange plate **38**, the TIM **42** and the release sheet **50** may be compressed into the thermal exchange plate **38**. The moving of the TIM **42** and the release sheet **50** toward the component of the battery pack **14** can be an automated movement that utilizes a vacuum assist and release mechanism.

[0042] As shown in FIG. **5**, when the TIM **42** is initially applied to the thermal exchange plate **38**, the bead of TIM **42** is sandwiched between the release sheet **50** and the thermal exchange plate **38**.

[0043] Next, with reference to FIG. **6**, the release sheet **50** is then peeled away from the TIM **42** while the TIM **42** remains applied to the thermal exchange plate **38**. The TIM **42**, release sheet **50**, and thermal exchange plate **38** can be designed so that a bond between the TIM **42** and the thermal exchange plate **38** is stronger than a bond between the TIM **42** and the release sheet **50**. This can facilitate maintaining the TIM **42** on the thermal exchange plate **38** as the release sheet **50** is removed.

[0044] As shown in FIG. **2**, one of the battery arrays **34** is then positioned atop the thermal exchange plate **38** and the TIM **42** such that the TIM **42** is sandwiched between the thermal exchange plate **38** and the battery array **34**. The TIM **42** is compressed by the battery array **34** into a thin layer of TIM **42**. The battery array **34** is then supported on the thermal exchange plate **38** with the TIM **42** sandwiched therebetween. The TIM **42** facilitates thermal transfer between the battery array **34** and the thermal exchange plate **38**.

[0045] In some examples, the release sheet **50** is polytetrafluoroethylene (PTFE) or similar type of material.

[0046] In some examples, the release sheet **50** is a heated release sheet that includes heating embedded or imprinted wires. Heating the release sheet **50** heats the TIM **42**, which in some examples can ensure thermal energy levels in the TIM **42** are at levels appropriate for application to the thermal exchange plate **38**.

[0047] The dispensing of the TIM **42** on the release sheets **50** and subsequent transfer to the thermal exchange plate **38** can shorten the manufacturing process as waiting for a dispensing of the TIM **42** on the thermal exchange plate **38** is not adding to an overall cycle time. Multiple beads of TIM **42** can be dispensed on respective release sheets **50** and staged for application to the thermal exchange plate **38**. The multiple beads of TIM **42** can be dispensed simultaneously

if required such that the dispensing time of the TIM **42** does not substantially contribute to overall cycle time.

[0048] Another method of transporting the TIM **42** and the release sheet **50** to the location of the component, here the thermal exchange plate **38**, could be utilized in other examples. In the example of FIG. **7**, the release sheets **50**A are incorporated into a conveyor assembly **58**. The release sheets **50**A can be conveyor slats. The release sheets **50**A could instead or additionally rest on the conveyor assembly **58**. Peripheral edges of the release sheets **50**A can be gripped by the conveyor assembly **58**. The TIM **42** intended for application to a single component of the traction battery pack **14** can span over more than one of the slats or release sheets **50**A. As the conveyor assembly **58** is operated, the release sheets **50**A with the applied TIM **42** move in a direction D**1**.

[0049] In connection with the conveyor assembly **58**, the thermal exchange plate **38** can be moved in a direction D**2** near an end of the conveyor assembly **58**. The thermal exchange plate **38** can be moved by a conveyor. As the release sheets **50**A with the TIM **42** rotate about the end of the conveyor assembly **58**, the TIM **42** is compressed into one of the thermal exchange plate **38**. The continued rotation of the conveyor assembly **58** and movement of the thermal exchange plates **38** in the direction D**2** separates the release sheet **50**A from the TIM **42** leaving the TIM **42** applied to the thermal exchange plate **38**.

[0050] The release sheet **50**A from which the TIM **42** was removed can then be rotated back by the conveyor assembly **58** to a position near a TIM dispenser where another bead of TIM **42** can be applied to the release sheet **50**A.

[0051] This automated process can reduce overall assembly cycle time even further by automating the transfer of the TIM **42** from the release sheet **50**A to the thermal exchange plate **38**.

[0052] Features of the disclosed examples include a process of positioning a TIM within a battery pack where the TIM is dispensed on a release sheet and then moved into a position where the TIM is bonded to a desired component. Dispensing onto the release sheet can reduce overall cycling time.

[0053] The preceding description is exemplary rather than limiting in nature. Variations and modifications to the disclosed examples may become apparent to those skilled in the art that do not necessarily depart from the essence of this disclosure. Thus, the scope of protection given to this disclosure can only be determined by studying the following claims.

What is claimed is:

1. A method of assembling components of a traction battery, comprising:

dispensing a thermal interface material onto a release sheet;

while the thermal interface material remains on the release sheet, applying the thermal interface material to a component of a traction battery pack; and

separating the release sheet from the thermal interface material while the thermal interface material remains on the component of the traction battery pack.

2. The method of claim **1**, wherein the component is a thermal exchange plate.

3. The method of claim **2**, further comprising, after the separating, sandwiching the thermal interface material between the thermal exchange plate and a battery array.

4. The method of claim **3**, further comprising communicating a liquid coolant through coolant channels of the thermal exchange plate.

5. The method of claim **1**, further comprising, after the separating, supporting at least one battery array on the component.

6. The method of claim **1**, further comprising, during the applying of the thermal interface material to the component, compressing the thermal interface material against the component.

7. The method of claim **1**, further comprising dispensing the thermal interface material as a bead.

8. The method of claim **1**, wherein the thermal interface material is silicone-based.

9. The method of claim **1**, further comprising, after the dispensing, heating the release sheet to heat the thermal interface material.

10. The method of claim **1**, after the dispensing, transporting the thermal interface material on the release sheet using a conveyer assembly to a position closer to the component.

11. The method of claim **10**, further comprising gripping peripheral edges of the release sheet with the conveyer assembly.

12. The method of claim **11**, further comprising applying the thermal interface material by operating the conveyer assembly.

13. The method of claim **1**, wherein the release sheet is a first release sheet and further comprising dispensing a bead of the thermal interface material on the first release sheet and a second release sheet.

14. The method of claim **13**, wherein the first release sheet and the second release sheet are conveyor slats.

15. A traction battery assembly, comprising:

a release sheet; and

a thermal interface material deposited on the release sheet, the release sheet configured to be separated from the thermal interface material after applying the thermal interface material to a traction battery component.

16. The traction battery assembly of claim **15**, wherein the traction battery component is a thermal exchange plate.

17. The traction battery assembly of claim **15**, wherein the release sheet is a heated release sheet configured to heat the thermal interface material deposited on the heated release sheet.

18. The traction battery assembly of claim **15**, further comprising a conveyer assembly that grips the release sheet, the conveyer assembly configured to move the release sheet and the thermal interface material closer to the component.

19. The traction battery assembly of claim **15**, wherein the release sheet is a first release sheet, and wherein the thermal interface material is a bead of thermal interface material that is deposited on the first release sheet and a second release sheet.

20. The traction battery assembly of claim **15**, wherein the release sheet is a conveyor slat.

* * * * *