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Ventilation system for a vehicle battery

Abstract

A rechargeable energy storage system includes a battery having a plurality of cells. The battery pack includes a first end, a second end, a first side, and a second side, an upper surface, and a lower surface. A battery support includes a support surface supporting the plurality of cells. The support surface has a first end portion, a second end portion, a first side portion and a second side portion. A ventilation member is arranged below the battery support between the first side portion and the second side. The ventilation member includes a surface section, and a plurality of wall members that project outwardly of the surface section. The plurality of wall members define a plurality of ventilation channels.

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Background/Summary

INTRODUCTION

(1) The subject disclosure relates to the art of electric vehicles and, more particularly, to a ventilation system for a vehicle battery.

(2) Electric vehicles and hybrid vehicles that include electric power systems include a rechargeable energy storage system (RESS) that stores and provides motive power to a motor. The RESS includes a battery that is typically supported on a structural member that provides impact protection. The battery may be mounted on a thermal runaway propagation (TRP) support. The TRP support provides a ventilation pathway to promote battery cooling.

(3) That is, the TRP support includes multiple openings that allow gasses to pass from the battery. The gases passing through the TRP may pass across adjacent cells toward an outlet. Passing the gases across each cell creates heat transfers that could present as a negative impact on battery cooling. Accordingly, it is desirable to provide a system for directing gases from the TRP support in a manner that reduces cross-cell thermal heat transfer.

SUMMARY

(4) A rechargeable energy storage system, in accordance with a non-limiting example, includes a battery pack having a plurality of cells arranged in parallel rows. The battery pack includes a first end, a second end, a first side, and a second side, an upper surface, and a lower surface. A battery

support includes a support surface supporting the battery pack. The battery support includes a first end portion, a second end portion, a first side portion and a second side portion. A ventilation member is arranged below the battery support between the first side portion and the second side portion. The ventilation member includes a surface section having a first end section, a second end section, a first side section that extends along the first side portion and a second side section that extends along the second side portion, and a plurality of wall members that project outwardly of the surface section between the first end section and the second end section. The plurality of wall members define a plurality of ventilation channels.

(5) In addition to one or more of the features described herein a support housing having a first side wall, a second side wall that is opposite the first side wall, a first end wall extending between the first side wall and the second side wall and a second end wall spaced from the first end wall extending between the first side wall and the second side wall, at least one of the first end wall and the second end wall including an opening, the battery, the battery support, and the ventilation member being arranged in the support housing.

(6) In addition to one or more of the features described herein the first end portion of the battery support is spaced from the first side wall, the second end portion of the battery support is spaced from the second side wall, and the second side portion of the battery support is spaced from the second end wall, wherein a first ventilation passage extends between the first end portion and the first side wall, a second ventilation passage extends between the second end portion and the second side wall, and a third ventilation passage extends between the second side portion and the second end wall.

(7) In addition to one or more of the features described herein the opening is formed in the second end wall, the opening being exposed to the third ventilation passage.

(8) In addition to one or more of the features described herein the first ventilation passage is fluidically connected to the second ventilation passage and the third ventilation passage.

(9) In addition to one or more of the features described herein each of the plurality of wall members includes a plurality of interruptions.

(10) In addition to one or more of the features described herein the plurality of interruptions in one of the plurality of wall members align with the plurality of interruptions in each of the other plurality of wall members.

(11) In addition to one or more of the features described herein each of the first side portion and the second side portion of the battery support includes a plurality of openings.

(12) In addition to one or more of the features described herein each of the battery support and the ventilation member are formed from a metal, the ventilation member being in thermal contact with the battery support.

(13) In addition to one or more of the features described herein each of plurality of ventilation channels extends substantially parallel to a corresponding one of the plurality of cells.

(14) An electric vehicle, in accordance with a non-limiting embodiment, includes a body, a plurality of wheels supporting the body, an electric motor, and a rechargeable energy storage system (RESS) operatively connected to the electric motor. The RESS includes a battery pack having a plurality of cells arranged in parallel rows. The battery pack includes a first end, a second end, a first side, and a second side, an upper surface, and a lower surface. A battery support includes a support surface supporting the battery pack. The battery support includes a first end portion, a second end portion, a first side portion and a second side portion. A ventilation member is arranged below the battery support between the first side portion and the second side portion. The ventilation member includes a surface section having a first end section, a second end section, a first side section that extends along the first side portion, and a second side section that extends along the second side portion, and a plurality of wall members that project outwardly of the surface section between the first end portion and the second end portion. The plurality of wall members defines a plurality of ventilation channels.

- (15) In addition to one or more of the features described herein a support housing has a first side wall, a second side wall that is opposite the first side wall, a first end wall extending between the first side wall and the second side wall and a second end wall spaced from the first end wall extending between the first side wall and the second side wall, at least one of the first end wall and the second end wall including an opening, the battery, the battery support, and the ventilation member being arranged in the support housing.
- (16) In addition to one or more of the features described herein the first end portion of the battery support is spaced from the first side wall, the second end portion of the battery support is spaced from the second side wall, and the second side portion of the battery support is spaced from the second end wall, wherein a first ventilation passage extends between the first end portion and the first side wall, a second ventilation passage extends between the second end portion and the second side wall, and a third ventilation passage extends between the second side portion and the second end wall.
- (17) In addition to one or more of the features described herein the opening is formed in the second end wall, the opening being exposed to the third ventilation passage.
- (18) In addition to one or more of the features described herein the first ventilation passage is fluidically connected to the second ventilation passage and the third ventilation passage.
- (19) In addition to one or more of the features described herein each of the plurality of wall members includes a plurality of interruptions.
- (20) In addition to one or more of the features described herein the plurality of interruptions in one of the plurality of wall members align with the plurality of interruptions in each of the other plurality of wall members.
- (21) In addition to one or more of the features described herein each of the first side portion and the second side portion of the battery support includes a plurality of openings.
- (22) In addition to one or more of the features described herein each of the battery support and the ventilation member are formed from a metal, the ventilation member being in thermal contact with the battery support.
- (23) In addition to one or more of the features described herein each of plurality of ventilation channels extends substantially parallel to a corresponding one of the plurality of cells.
- (24) The above features and advantages, and other features and advantages of the disclosure are readily apparent from the following detailed description when taken in connection with the accompanying drawings.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

- (1) Other features, advantages and details appear, by way of example only, in the following detailed description, the detailed description referring to the drawings in which:
- (2) FIG. 1 is a side view of a vehicle including a rechargeable energy storage system (RESS) having a ventilation system, in accordance with a non-limiting example;
- (3) FIG. 2 is a partially disassembled view of a thermal runaway propagation support (TRP) and a ventilation member, in accordance with a non-limiting example;
- (4) FIG. 3 is a bottom cross-sectional plan view of the RESS, in accordance with a non-limiting example; and
- (5) FIG. 4 is a side view of the RESS and the ventilation system, in accordance with a non-limiting example.

DETAILED DESCRIPTION

- (6) The following description is merely exemplary in nature and is not intended to limit the present disclosure, its application or uses. It should be understood that throughout the drawings,

corresponding reference numerals indicate like or corresponding parts and features.

(7) An electric vehicle (EV), in accordance with a non-limiting example, is indicated generally at **10** in FIG. 1. Vehicle **10** includes a body **12** supported on a frame (not shown) and a plurality of wheels, two of which are indicated at **16**. Body **12** includes a passenger compartment **20** that includes at least one driver's seat **22** and at least one rear passenger seat **24**. Vehicle **10** includes a charge port **30** that serves as an interface between an external charging device (not shown) and a rechargeable energy storage system (RESS) **34**. RESS **34** is operatively connected to an electric motor **38** that provides motive power to vehicle **10**.

(8) In a non-limiting example shown in FIGS. 2 and 3, RESS **34** includes a battery pack **44** that rests upon a ventilation system **48**. Ventilation system **48** directs gases from battery pack **44** outward to promote cooling. Ventilation system **48** includes a battery support **52** and a ventilation member **58**. Ventilation member **58** is disposed below battery support **52** and, as will be discussed herein, functions to guide gases from RESS **34**. In a non-limiting example, battery pack **44**, battery support **52**, and ventilation member **58** are arranged in a support housing **60** (FIG. 3) which may take the form of a thermal runaway propagation (TRP) system. Support housing **60** provides protection to battery pack **44**.

(9) Battery pack **44** includes a plurality of cells **64** that are electrically connected one, to another, to store and provide power to motor **38**. The particular type of cell format may vary and could include a cylindrical cells arranged in rows such as shown at **66** or the cell format may take the form of a prismatic cell arrangement. Battery pack **44** includes a first end **68**, a second end **70** that is opposite to first end **68**, a first side **72**, and a second side **74** that is opposite first side **72**. Battery pack **44** also includes an upper surface **78** and a lower surface **80**. Battery pack **44** is supported on battery support **52** (FIG. 2) in support housing **60**.

(10) Battery support **52** is formed from a metal and includes a first end portion **84**, a second end portion **86** that is opposite first end portion **84**, a first side portion **88**, and a second side portion **90** that is opposite first side portion **88**. First side portion **88** and second side portion **90** extend between and connect with first end portion **84** and second end portion **86**. Battery support **52** includes a support surface **92** that supports battery pack **44** and a lower surface **94**. Support surface **92** may include a plurality openings **96** that allow gasses to flow from the plurality of cells **64** toward ventilation member **58**.

(11) In a non-limiting example, ventilation member **58** is formed from a metal and includes a surface section **130** including a first end section **132** and a second end section **134** that is opposite to first end section **132**. A first side section **136** extends between first end section **132** and second end section **134** and a second side section **138** that opposes first side section **136** and also extends between first end section **132** and second end section **134**. A plurality of wall members **140** project outwardly from surface section **130** and form rows (not separately labeled) that extend between first end section **132** and second end section **134**. Each of the plurality of wall members **140** include a plurality of interruptions **142**. The plurality of wall members **140** is formed in rows (not separately labeled) that extend between first end section **132** and second end section **134** and define a plurality of ventilation channels **144**.

(12) In a non-limiting example, support housing **60** includes a base surface (not shown) that is bounded by a first side wall **148**, a second side wall **149**, a first end wall **152** and a second end wall **154** (FIG. 3). Ventilation member **58** is set on the base surface. Battery support **52** is positioned over ventilation member **58** with first side portion **88** being arranged outwardly of and substantially parallel to first side section **136** and second side portion **90** being arranged outwardly of and substantially parallel to second side section **138**. Battery pack **44** is situated on support surface **92** such that the plurality of cells **64** are arranged substantially parallel to the plurality of ventilation channels **144** as shown in FIG. 4.

(13) Ventilation member **58** is positioned on the base surface (not shown) of support housing **50** with first end section **132** being spaced from first end wall **152** forming a first ventilation passage

160 (FIG. 3). Second end section **134** is spaced from second end wall **154** forming a second ventilation passage **162**. A third ventilation passage **164** is defined along second side wall **149**. In a non-limiting example, first ventilation passage **160** is fluidically connected with second ventilation passage **162** and third ventilation passage **164**. Second side wall **149** includes an opening or a gas exit **168**.

(14) With this arrangement, gasses developed in a battery pack **44** may pass through battery support **52** and into ventilation member **58** via openings **96**. The gases flowing into ventilation member **58** pass outwardly away from battery pack **44** along ventilation channels **144** into first ventilation passage **160** and second ventilation passage **162**. The gas passes from first and second ventilation passages **160** and **162** into third ventilation passage **164** and from there out from support housing **60** via opening **168**. In this manner, gas build up near battery pack **44** is reduced so as to lower battery pack temperatures. In addition to removing gases, heat is removed via conduction. That is, a heat transfer may pass from battery support **52** into ventilation member **58** and pass into support housing **60**.

(15) While the above disclosure has been described with reference to exemplary embodiments, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from its scope. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the disclosure without departing from the essential scope thereof. Therefore, it is intended that the present disclosure not be limited to the particular embodiments disclosed, but will include all embodiments falling within the scope thereof

Claims

1. A rechargeable energy storage system (RESS) comprising: a battery pack including a plurality of cells arranged in parallel rows, the battery pack including a first end, a second end, a first side, and a second side extending between the first end and the second end, an upper surface, and a lower surface; a battery support including a support surface supports the plurality of cells, the battery support includes a first end portion, a second end portion, a first side portion, and a second side portion; and a ventilation member arranged below the battery support between the first side portion and the second side portion, the ventilation member including a surface section having a first end section, a second end section, a first side section that extends along the first side portion, and a second side section that extends along the second side portion, and a plurality of wall members that project outwardly of the surface section between the first end section and the second end section, the plurality of wall members defining a plurality of ventilation channels.
2. The RESS according to claim 1, further comprising a support housing having a first side wall, a second side wall that is opposite the first side wall, a first end wall extending between the first side wall and the second side wall and a second end wall spaced from the first end wall extending between the first side wall and the second side wall, at least one of the first end wall and the second end wall including an opening, the battery, the battery support, and the ventilation member being arranged in the support housing.
3. The RESS according to claim 2, wherein the first end portion of the battery support is spaced from the first side wall, the second end portion of the battery support is spaced from the second side wall, and the second side portion of the battery support is spaced from the second end wall, wherein a first ventilation passage extends between the first end portion and the first side wall, a second ventilation passage extends between the second end portion and the second side wall, and a third ventilation passage extends between the second side portion and the second end wall.
4. The RESS according to claim 3, wherein the opening is formed in the second end wall, the opening being exposed to the third ventilation passage.
5. The RESS according to claim 4, wherein the first ventilation passage is fluidically connected to

the second ventilation passage and the third ventilation passage.

6. The RES S according to claim 1, wherein each of the plurality of wall members includes a plurality of interruptions.

7. The RES S according to claim 6, wherein the plurality of interruptions in one of the plurality of wall members align with the plurality of interruptions in each of the other plurality of wall members.

8. The RESS according to claim 7, wherein each of the first side portion and the second side portion of the battery support includes a plurality of openings.

9. The RESS according to claim 1, wherein each of the battery support and the ventilation member are formed from a metal, the ventilation member being in thermal contact with the battery support.

10. The RESS according to claim 1, wherein each of plurality of ventilation channels extends substantially parallel to a corresponding one of the plurality of cells.

11. An electric vehicle comprising: a body; an electric motor; and a rechargeable energy storage system (RESS) operatively connected to the electric motor, the RESS including: a battery pack including a plurality of cells arranged in parallel rows, the battery pack including a first end, a second end, a first side, and a second side extending between the first end and the second end, an upper surface, and a lower surface; a battery support including a support surface supports the plurality of cells, the battery support includes a first end portion, a second end portion, a first side portion, and a second side portion; and a ventilation member arranged below the battery support between the first side portion and the second side portion, the ventilation member including a surface section having a first end section, a second end section, a first side section that extends along the first side portion, and a second side section that extends along the second side portion, and a plurality of wall members that project outwardly of the surface section between the first end section and the second end section, the plurality of wall members defining a plurality of ventilation channels.

12. The electric vehicle according to claim 11, further comprising a support housing having a first side wall, a second side wall that is opposite the first side wall, a first end wall extending between the first side wall and the second side wall and a second end wall spaced from the first end wall extending between the first side wall and the second side wall, at least one of the first end wall and the second end wall including an opening, the battery, the battery support, and the ventilation member being arranged in the support housing.

13. The electric vehicle according to claim 12, wherein the first end portion of the battery support is spaced from the first side wall, the second end portion of the battery support is spaced from the second side wall, and the second side portion of the battery support is spaced from the second end wall, wherein a first ventilation passage extends between the first end portion and the first side wall, a second ventilation passage extends between the second end portion and the second side wall, and a third ventilation passage extends between the second side portion and the second end wall.

14. The electric vehicle according to claim 13, wherein the opening is formed in the second end wall, the opening being exposed to the third ventilation passage.

15. The electric vehicle according to claim 14, wherein the first ventilation passage is fluidically connected to the second ventilation passage and the third ventilation passage.

16. The electric vehicle according to claim 11, wherein each of the plurality of wall members includes a plurality of interruptions.

17. The electric vehicle according to claim 16, wherein the plurality of interruptions in one of the plurality of wall members align with the plurality of interruptions in each of the other plurality of wall members.

18. The electric vehicle according to claim 17, wherein each of the first side portion and the second side portion of the battery support includes a plurality of openings.

19. The electric vehicle according to claim 11, wherein each of the battery support and the

ventilation member are formed from a metal, the ventilation member being in thermal contact with the battery support.

20. The electric vehicle according to claim 11, wherein each of plurality of ventilation channels extends substantially parallel to a corresponding one of the plurality of cells.
