Patents Act 1977 **Opinion Number** **21/20**

OPINION UNDER SECTION 74A

Patent	GB 2549512
Proprietor(s)	Delta Motorsport Limited
Exclusive Licensee	
Requester	Andrea Braidotti
Observer(s)	
Date Opinion issued	12 January 2021

The request

1. The comptroller has been requested to issue an opinion as to whether the invention claimed in GB 2549512 ("the patent") is novel and inventive in light of certain prior art documents.

2. Observations have been received from Withers & Rogers LLP on behalf of the proprietor and observations in reply have been received from the requester.

The patent

3. The patent was granted with effect from 22 July 2020 and remains in force.

4. Entitled "*Cell Pack Thermal Management Apparatus and Method*" the technical field of the invention is described on page 1 of the patent as follows:

"*The present invention relates to cell pack thermal management and particularly but not exclusively to cell pack thermal management devices, cell pack thermal management systems, and a method of thermally managing a cell pack.*

Cell packs are used in many modern applications. For example the energy source for a hybrid electric motor vehicle (HEV), an electric motor vehicle (EV) or any electric or hybrid sea, air or land vehicle. Cell packs are also used in or any static installations, for example a domestic household which requires a remote electrochemical energy source. Thermal management of a cell pack is often required. This includes both heating and cooling of the cell pack."

5. Various embodiments are disclosed including a first device shown in figures 2 to 7, of which figures 2, 3, 6 and 7 are shown below.

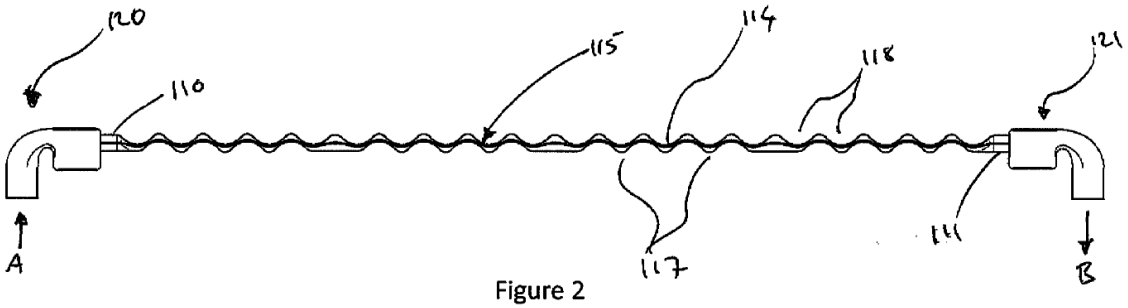

Figure 2

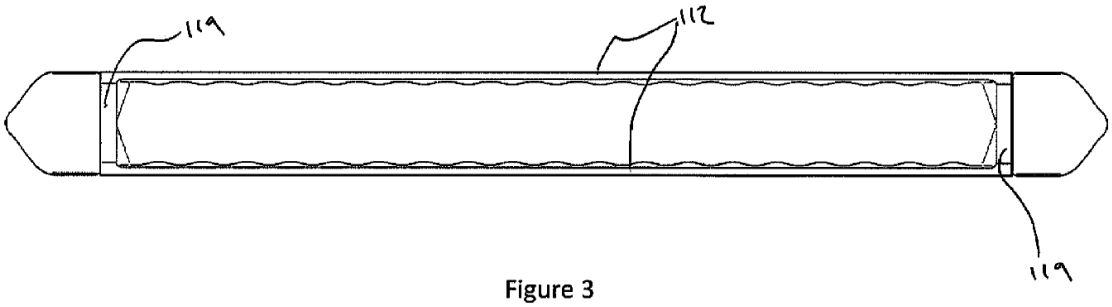

Figure 3

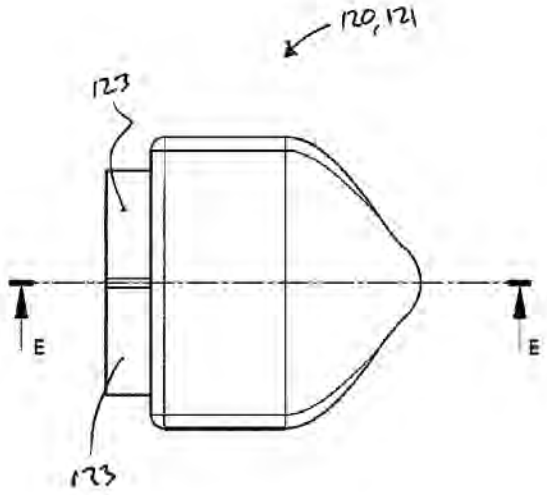

Figure 6

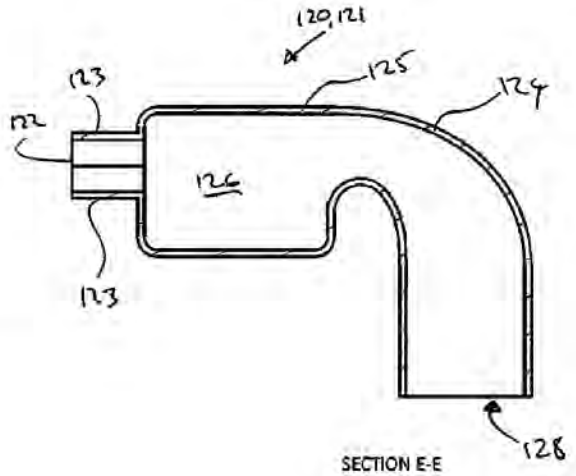

Figure 7

6. This device is described on pages 16 and 17 as follows:

With reference to Figures 2 to 7, a cell pack thermal management device, has a flexible conduit 115, an intake-side chamber 120 and an exhaust-side chamber 121.

The intake-side chamber 120 and exhaust-side chamber 121 are substantially identical. Each chamber 120, 121 is a hollow body 125 defined by a wall 124. The wall 124 defines a cavity 126. A conduit port 122 and a system port 128 are defined in the wall 124 of the body 125, providing fluid communication between the cavity 126 and external to the body 125. The conduit port 122 has four ribbed (shown as planar) surfaces 123 which are formed by the chamber wall 124.

The flexible conduit 115 is made of two sheets of polyethylene. The polyethylene sheets are joined along there longitudinal edges to provide longitudinal edge seals 112, thereby forming the flexible conduit. The two sheets are joined by welding the polyethylene sheets. Alternatively, the flexible conduit 115 is made from a single sheet of polyethylene, folded and the opposing longitudinal edges joined by welding to form longitudinal edge seal 112, thereby forming the flexible conduit.

The flexible conduit 115, has an inlet port 110, an outlet port 111, an upper surface 114 and a lower surface 116. The flexible conduit has a longitudinal edge seal 112. The upper surface 114 and the lower surface 116 of the flexible conduit 115 conform to the shape of the cells to which they are contiguous. Where there is no contact between the flexible conduit and a cell, the surface of the flexible conduit 115 expand to the limit allowed by a plate. The plate (not shown) is provided to limit the expansion of the conduit and thereby maintain correct flow distribution through the system. This is shown in Figure 4, upper surface 114.

The chambers are made of injection moulded polyethylene.

The inlet port 110 of flexible conduit 115 is adapted to connect to the conduit port 122 of intake-side chamber 120 and the outlet port 111 of flexible conduit 115 is adapted to connect to the conduit port 122 of the exhaust-side chamber 121. The flexible conduit is connected to the conduit ports on the intake-side A and exhaust-side B of the device by welding the flexible conduit 115 to the conduit ports 122 of the intake-side and exhaust-side chambers 120 and 121. When the flexible conduit 115 of the cell pack thermal management device 100 is positioned between two rows of cylindrical cells (not shown) the upper surface 114 and lower surface 116 conform to the shape of the surface of each cell. The upper and lower surfaces effectively conform to the cylindrical cells creating a large surface area for thermal exchange.

7. Another device is shown in figures 8 and 9:

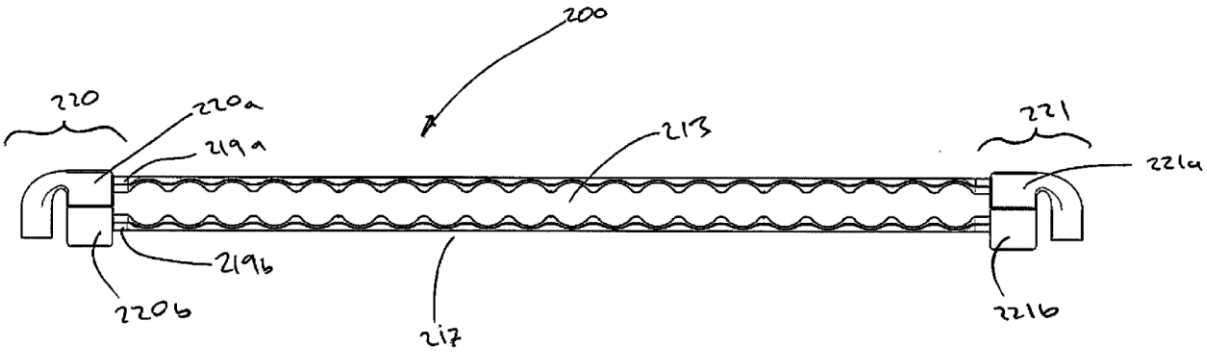

Figure 8

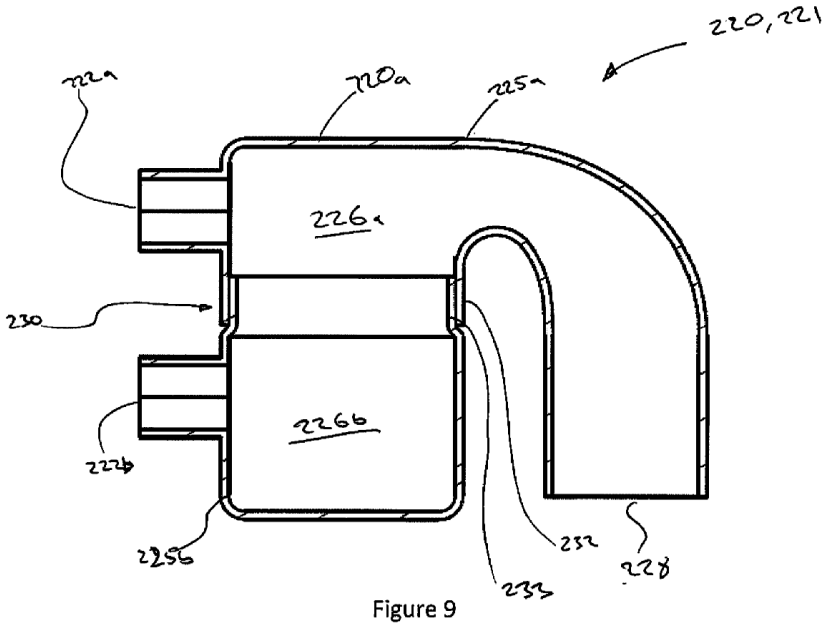

Figure 9

8. This embodiment is described on pages 18 and 19 thus:

Figure 8 shows a cell pack thermal management device 200 similar to the cell pack thermal management device 100 described with reference to Figures 2 to 7.

Cell pack thermal management device 200 differs to cell pack thermal management device 100, in that a further layer of flexible conduit is provided, as will be described in more detail below, with reference to Figures 8 and 9.

Cell pack thermal management device 200 has an intake-side manifold 220, and exhaust-side manifold 221, a first flexible conduit 215 and a second flexible conduit 217.

The intake-side manifold 220 and exhaust-side manifold 221 are substantially identical. Each manifold (see Figure 9) has a first chamber 220a and a second chamber 220b.

The first chamber 220a has a body wall 225a which defines a first cavity 226a, a first conduit port 222a, a system port 228 and a chamber connector 232.

The second chamber 220b has a body wall 225b which defines a second cavity 226b, a second conduit port 222b and a chamber connector 233.

The first cavity 226a is connected to the second cavity 226b via chamber connectors 232 and 233. The chamber connectors form a fluid tight seal and thereby create a fluid passageway between the first cavity 226a and the second cavity 2266.

First chamber 220a of intake-side manifold 220 is in fluid communication with first chamber 221a of exhaust manifold 221 via flexible conduit 215.

Second chamber 220b of intake-side manifold 220 is in fluid communication with second chamber 221h of exhaust manifold 221 via flexible conduit 217.

Flexible conduits 215 and 217 are bonded to their respective conduit ports on each manifold at interfaces 219a and 219b.

9. A further embodiment is shown in figures 12 to 23 in which a plurality of flexible conduits each pass over a row of cylindrical cells or between two rows of cells. Figures 22 and 23 show the general arrangement:

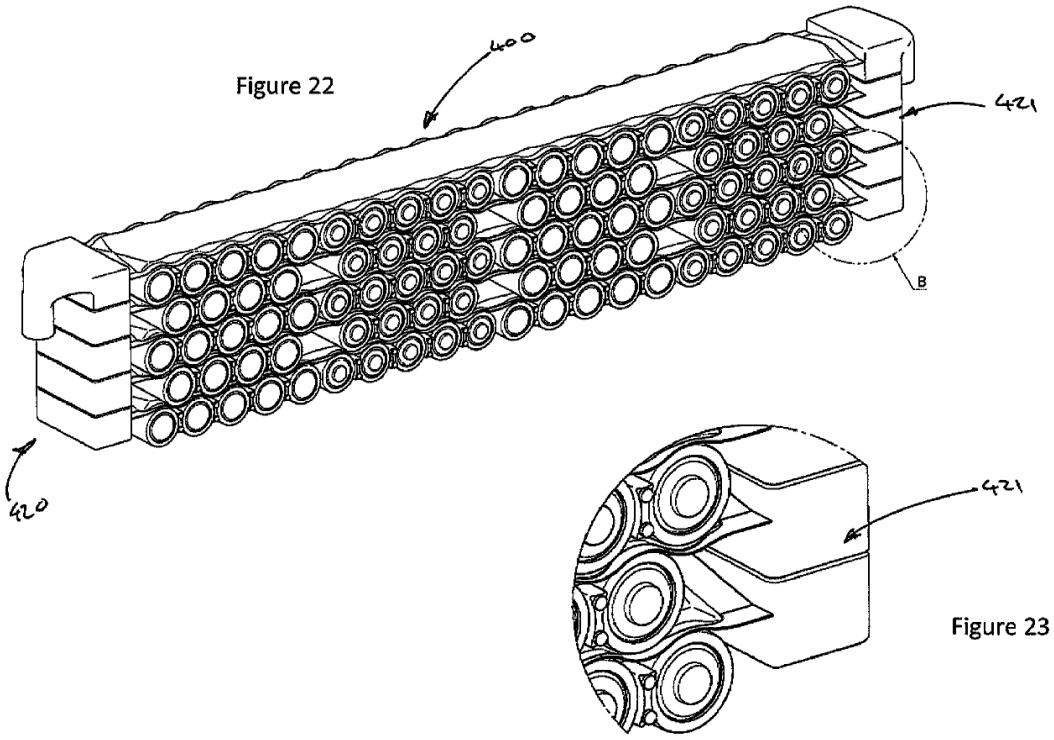

Figure 22

Figure 23

10. An alternative arrangement said to embody the invention is shown in figures 26 to 31, of which figures 26 and 31 are shown below:

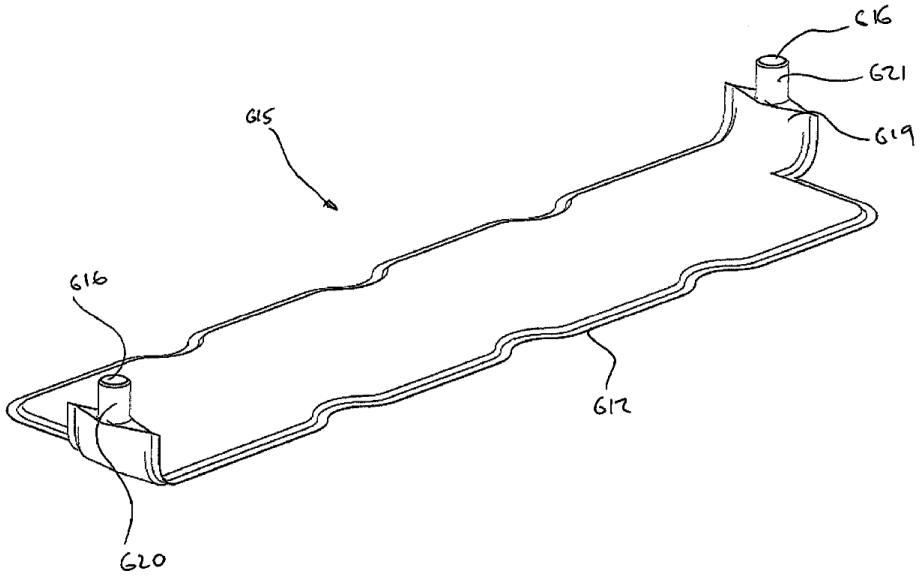

Figure 26

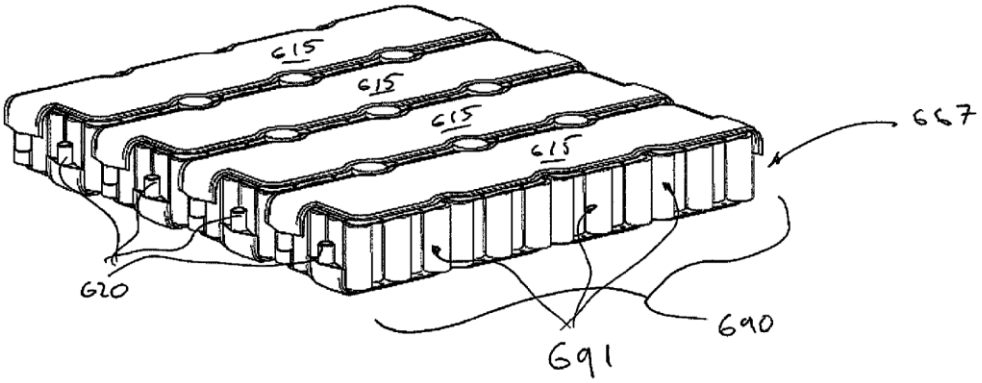

Figure 31

11. This arrangement is described on pages 23 and 24:

Figure 26 shows a flexible conduit 615 of a cell pack thermal management device. The cell pack thermal management device 615 has an intake side manifold 620 and an exhaust side manifold 621. The exhaust side manifold is sealed to the flexible conduit 615 at seal 619. Flexible conduit 615 is attached to a manifold by ports 616. Figure 27 shows a plan view of a cell plate thermal management device wherein the flexible conduits 615 are arranged contiguously with cell pack plates 691.

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Figure 31 shows an isometric view of a cell pack 667 formed of cell modules 690 being lodged and encapsulated by flexible conduits 615. The intake side port of the flexible conduits 615 are shown at 620.

Claim construction

12. Firstly I need to construe the claims of the Patent. That is to say I must interpret them in the light of the description and drawings as instructed by Section 125(1). In doing so I must interpret the claims in context through the eyes of the person skilled in the art. Ultimately the question is what the person skilled in the art would have understood the patentee to be using the language of the claims to mean.

13. Section 125(1) of the Act states that:

> *For the purposes of this Act an invention for a patent for which an application has been made or for which a patent has been granted shall, unless the context otherwise requires, be taken to be that specified in a claim of the specification of the application or patent, as the case may be, as interpreted by the description and any drawings contained in that specification, and the extent of the protection conferred by a patent or application for a patent shall be determined accordingly.*

14. Claim 1 is the main apparatus claim upon which claims 2 to 33 depend and which is incorporated by reference into apparatus claims 34 to 36. Claim 1 reads as follows:

> 1. *A cell pack thermal management device suitable for use with a cell pack*

comprising:

an intake-side chamber;

an exhaust-side chamber;

and at least one flexible conduit;

wherein the at least one flexible conduit provides a fluid communication path between the intake-side chamber and the exhaust-side chamber, and wherein further the least one flexible conduit is interlaceable between the cells of a cell pack and is expandable so as to conform to the surface contours of the cells.

15. Independent method claim 37 reads slightly differently, as follows:

37. A method of thermally managing a cell pack, the method comprises the steps of:

providing at least one flexible conduit;

providing an intake manifold;

providing an exhaust manifold;

wherein the flexible conduit is in fluid communication with the intake manifold and the exhaust manifold thereby providing a fluid passageway therebetween;

providing a pump;

providing a heat exchanger;

providing a cell pack;

providing fluid;

wherein the pump is in fluid communication with the heat exchanger and either the intake manifold or the exhaust manifold and the heat exchanger is in fluid communication with the pump and the other of the intake manifold or the exhaust manifold thereby forming a fluid circuit;

wherein the at least one flexible conduit is interlaced between the individual cells of a cell pack and configured to conform and expand to fill spaces between cells in a cell pack; and

operating the pump to circulate the fluid.

16. The request considers each element of claim 1 in turn. In the observations on behalf of the proprietor there is no discussion of construction, although some of the terms used in claim 1 are contrasted with the disclosure in the prior art documents. For my part I find much of the claim is clear and needs no interpretation. There are however several elements that seem to me to require further scrutiny.

17. The first of these is chamber, as in the intake-side chamber and the exhaust-side

chamber. The request construes the term according to the description of the first embodiment in which "*Each chamber 120, 121 is a hollow body 125 defined by a wall 124.*". In their observations in reply the requester argues that there is nothing in the patent to exclude pipes or adapters from the scope of chamber. Embodiments such as figures 8, 9 and 22 above describe manifolds each with multiple chambers, the number of which seems to correspond with the number of flexible conduits. However, in those embodiments there is little separating the chambers and the various cavities of the chambers communicate with one another to effectively form a single volume with multiple conduit ports 222, 322 each for connecting to a flexible conduit. The embodiment of figures 26 to 31 shows what are said to be manifolds 620 and 621 connected a single flexible conduit. These manifolds are not described in any detail, but seem to be bodies to which the flexible conduit is sealed and which provide ports 616 by which the flexible conduit can be attached to a manifold, presumably an additional manifold, not shown. I also note that method claim 37 requires intake and exhaust manifolds for at least one flexible conduit with no reference to chambers. It seems to me that the skilled reader would understand chamber and manifold to be used in some places interchangeably such that a manifold has at least one chamber, but may have a number of chambers. However, in light of the specification as a whole it seems to me that the skilled reader would understand each manifold or chamber to have no additional requirements beyond being suitable for providing a connection for fluid communication between a flexible conduit and additional components in a cell pack thermal management system. I agree with the requester that e.g. pipes or adapters are not excluded from the scope of chamber, nor from the scope of manifold.

18. The request interprets the requirement that the conduit should be flexible as meaning that it should bend without breaking and notes that according to lines 14 and 15 on page 5 "*The flexible nature of the flexible conduit allows the conduit to readily conform to the surface shape of any shape of cell.*". The observations on behalf of the proprietor do not separate the flexible requirement for the conduit from the requirement in claim 1 that it must be "*interlaceable between the cells of a cell pack*". The request takes this to mean suitable for being interlaced and points out that the embodiment shown in figure 26 shows a conduit that is not interlaced between cells (figure 31 above better shows this embodiment). In their observations in reply the requester also refers to statements on pages 3 and 5 in the description that "*The present invention may be used with packs, having cells of any shape.*" and "*The flexible conduit allows the thermal management of any shape cell and cell pack.*". I note that on pages 3 and 5 it is also stated that "*The flexible nature of the conduit allows the conduit to conform to the particular shape of the individual cells and maximise the individual cell surface contact area.*" and "*The flexible nature of the flexible conduit allows the conduit to readily conform to the surface shape of any shape of cell.*".

19. It seems to me that the interlaceable requirement is an attempt to qualify the flexible requirement. However, since the patent states that the device may be used with any shape of cell I feel that for the skilled reader interlaceable would place no great limitation on the flexibility in claim 1. In essence the conduit needs to be flexible enough to conform to the shape of the cells with which it is to be used, but the claim does not say anything about the shape of those cells.

20. Dependent claims 3 and 4 refer to a cell pack support plate. The claims are directed to a cell pack thermal management device rather than for example a thermally managed cell pack. It seems to me from the application as a whole that the cell pack support plate forms part of the cell pack and not part of the cell pack thermal management device. In claim 3 arguably the cell pack support plate simply provides some context for the conformability of the flexible conduit. However, claim 4 seems to introduce no requirements for the cell pack thermal management device itself.

Novelty – claim 1

21. The request argues that claims 1 to 8, 10 to 22, 33 to 35 and 37 are not novel in light of eight patent documents. Claim 1 is said to lack novelty over all eight documents.

22. The first of these documents is JP2014082069, which the request refers to as D1. This shows a series of heat regulation bags 3 for electrical storage apparatus 21 which are formed from flexible resin material or rubber material and which each has a flow path 35 for cooling or heating fluid between intake and exhaust ports 33, 34 connected to inlet and outlet pipes 24, 25. Various materials from which the bag may be made are mentioned in paragraph 20, LDPE, LLDPE, EVA, PVC, which may be laminated with PET, nylon. In several places such as paragraph 30 the bag is said to be filled with fluid and to fill the gap between adjacent electrical storage apparatus 21.

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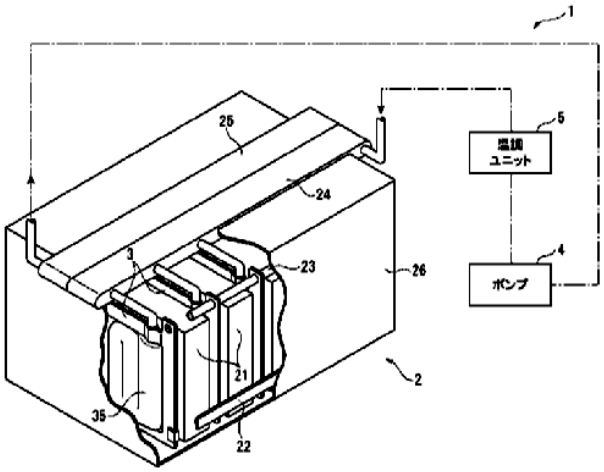

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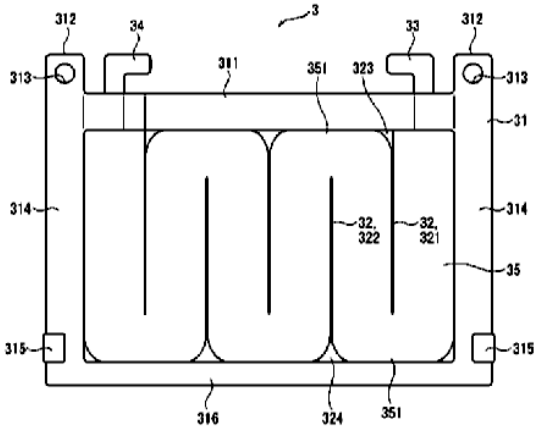


23. The proprietor argues that the bag 3 shown in JP2014082069 lacks the chambers of claim 1 and the conduit 35 is neither flexible so as to be interlaceable between cells nor expandable so as to conform to the surface contours of the cells.

24. It seems to me that the pipes 24, 25 form chambers as I have construed the term and that the bag 3 is indeed flexible and expandable. The bag is shown located between electrical storage apparatus 21 and is said to fill the gap. This seems to meet all of the requirements of claim 1 as I have construed them.

25. D2 or WO 2010/056750 shows a heat exchanger 940 interlaced between cells 930, see figure 51 below.

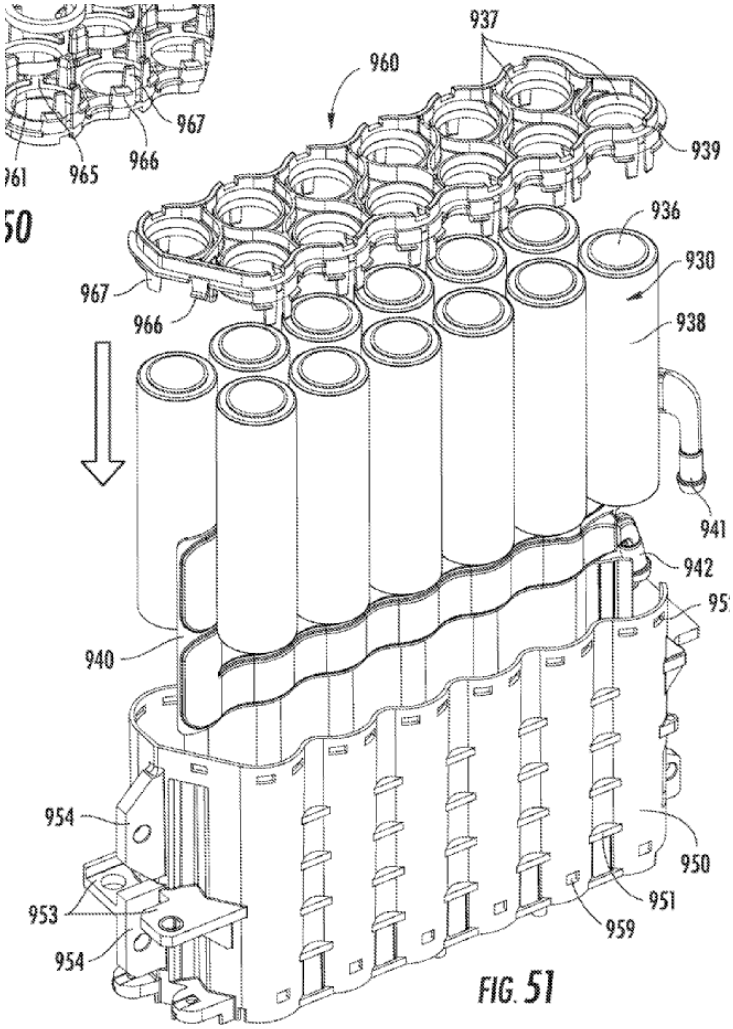


FIG. 51

26. The heat exchanger is described in paragraphs 230 and 237:

According to an exemplary embodiment, the battery module 924 also includes a heat exchanger 940 that is configured to be provided in between the rows of electrochemical cells 930 as shown in FIG. 51. As shown in FIGS. 54A-54C, the heat exchanger 940 includes a first opening 941 and a second opening 942. According to one exemplary embodiment, the first opening 941 is configured to be an inlet while the second opening 942 is configured to be an outlet. According to another exemplary embodiment, the opening 942 may be configured to be an inlet while the opening 941 may be configured to be an outlet.

…

According to an exemplary embodiment, the heat exchanger 940 may be made from a blow molding process, an injection molding process, or other suitable process. According to an exemplary embodiment, the wall thickness of the heat exchanger 940 is between approximately 0.6 millimeters and 1.0 millimeters, but may have a greater or lesser wall thickness according to other exemplary embodiments. According to one exemplary embodiment, the heat exchanger 940 is semi-flexible and configured to conform to the outside of the electrochemical cells 930. For example, the heat exchanger 940 may expand under a slight (e.g., between approximately 5-10 psi) fluid pressure such that the heat exchanger 940 expands so that the external surface 943 makes contact with and/or conforms to the external surface 938 of the electrochemical cells 930.

27. In paragraph 210 and figure 47 it is explained that "*each of the connecting members 903 connects the manifold 902 to an opening 941 of the heat exchanger and each of the connecting members 905 connects the manifold 904 to the opening 942 of the heat exchanger*".

28. Although the observations argue that the heat exchanger is semi rigid and that "*It is clear that heat exchanger is required to be pre-formed in a shape and configuration which corresponds to the cells with which it is to be used*" it is not clear to me where in WO 2010/056750 there is a basis to support this argument. It is true, as the observations point out, that other embodiments of the heat exchanger may be made of metal or ceramic or "*other suitable material*". Nevertheless in paragraph 237 the heat exchanger is described as semi-flexible and expandable.

29. All of the requirements of claim 1 as I have construed it are shown in WO 2010/056750 with manifolds 902, 904 corresponding to the chambers of claim 1.

30. Figures 1 to 3, below, of document D3 or EP0516280 show "*a heat transfer device 10 is illustrated. The heat transfer device 10 is comprised of a frame 12, a first layer of flexible film 14, a second layer of flexible film 16 and a plurality of adapters for connecting the heat transfer device 10 to a heat transfer fluid source and drain lines (not shown)*". As for the field of use for device 10 "*One specific situation is where the heat transfer device 10 is to be inserted between components, such as electrical components within a system, that are relatively fixed in position. For example, within spaces defined by an array of batteries to be cooled.*".

31. Inlet and outlet adapters 18, 20 seem to provide the chambers required by claim 1 of the patent as I have construed it, despite an argument that they do not in the observations from the proprietor. As for flexibility and conforming "*The first and second flexible film layers 14 and 16, respectively, provide conformable external major surfaces 22 and 24 of the heat transfer device 10 which are for intimately contacting articles or components that are to be heated or cooled by the heat transfer device 10. The external major surfaces 22 and 24 are advantageously somewhat conformable to the shape of the article or component to be thermally affected by the heat transfer device 10 because they comprise the flexible film layers 14 and 16, respectively. The use of flexible film allows the external major surfaces 22 and 24 to pillow outwardly to a degree depending on the particular material chosen*

as the flexible film and the degree to which the flexible film layers 14 and 16 are affixed to the frame 12.".

32. Claim 1 is anticipated by EP 0516280 in my view.

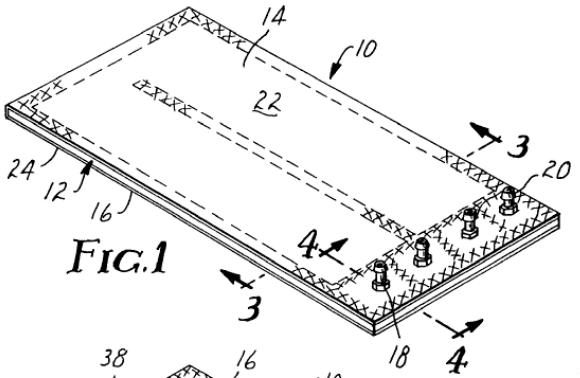


FIG.1

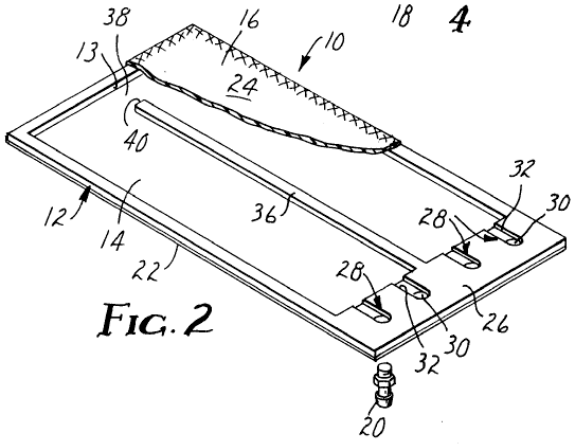


FIG. 2

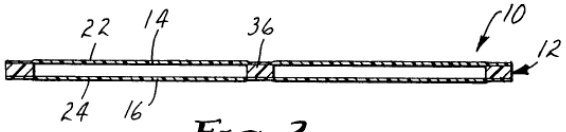


FIG.3

33. A cooling bladder 30 shown in figure 4 of document D4 or WO 03/071616 is shown fan folded into a serpentine configuration between electrochemical cells 15 in figure 3. The bladder has inlet and outlet ports 31, 33 and its material is described as deformable (page 9 line 23), conformable (page 18 line 10) and flexible (page 22 line 3). All of the requirements of claim 1 are present.

FIG. 4A

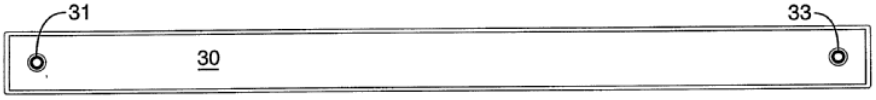


FIG. 4B

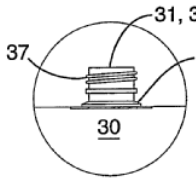


FIG. 4C

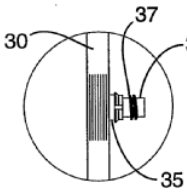


FIG. 5B

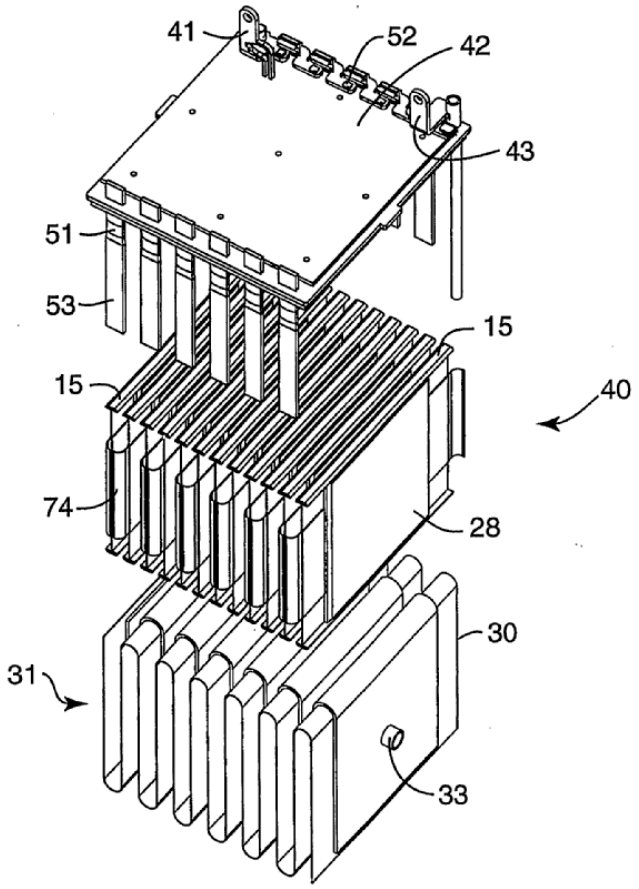
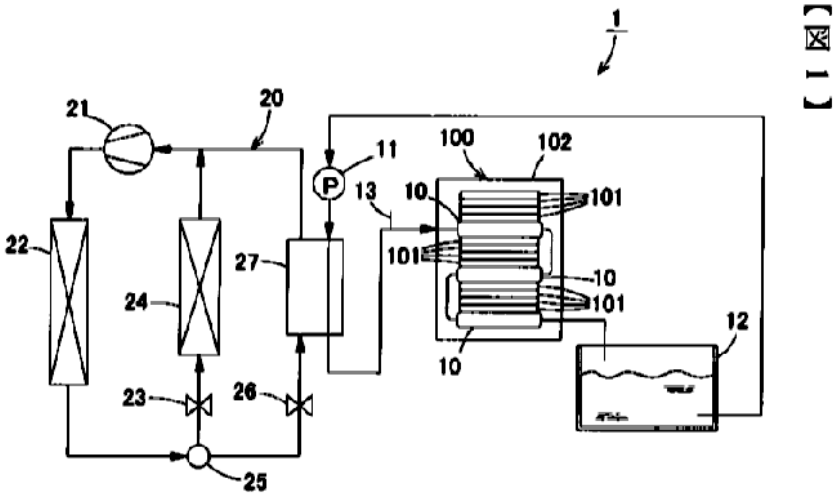


FIG. 3

34. Figures 1 and 2 of D5 or JP 2012-114030 show a battery temperature regulating apparatus with a series of bags 10 between battery cells 101. Paragraph 10 describes the bag as being elastically deformed and expanding or swelling into contact with the battery. Figure 2(a) shows the bags 10 expanded compared to figure 2(b). There is no description of the detail of the connections on each bag 10, but it is clear that the bags are connected to one another and to a fluid flow circuit including pump 11. This seems to me sufficient to say that claim 1 as I have construed it is anticipated by JP2012114030.



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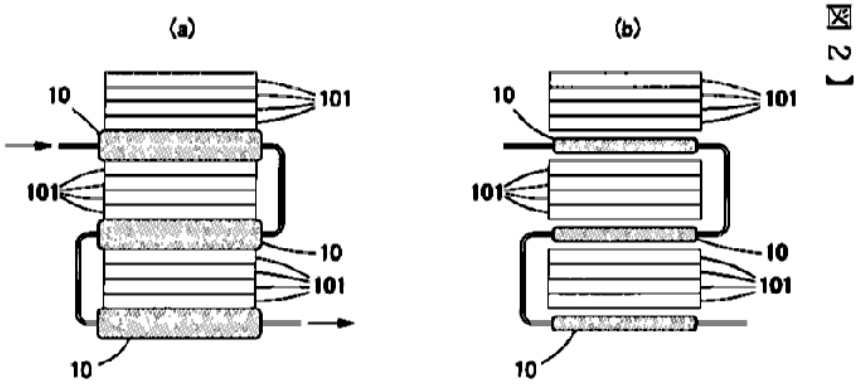

35. In figures 1 and 3 below document D6 or WO 2012/045174 shows a heat exchanger 110 located between opposing surfaces 112 and 113 of adjacent battery modules 102(1) and 102(2) whose heat exchanger contact surfaces 112 are described as not planar.

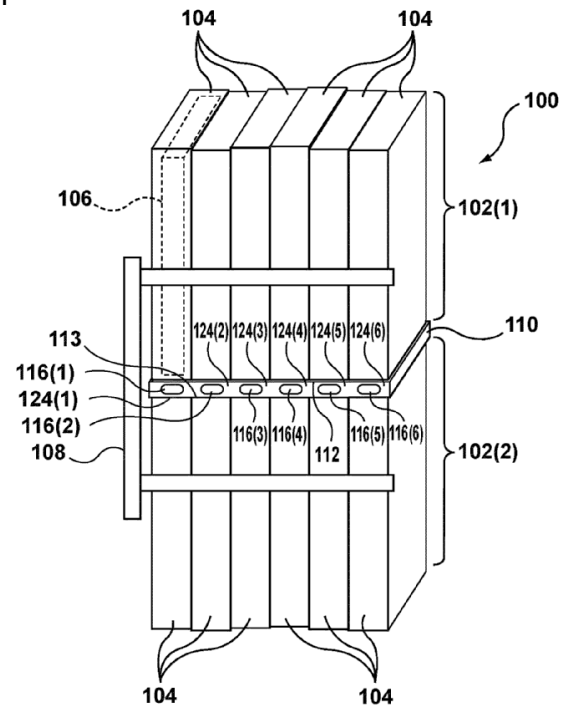

FIG. 1

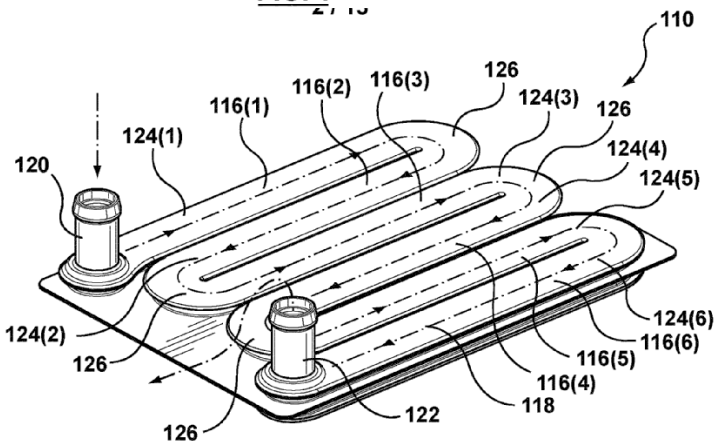

FIG. 3

36. The heat exchanger 110 has inlet and outlet fixtures 120, 122 and is said to be dimensionally compliant to maintain contact with battery cells with conformable regions 124 that can flex. This document also anticipates claim 1 of the patent as I have construed it.

37. Figures 6 and 7 of document D7 or WO 2011/088997 show a battery cell arrangement without the cells themselves shown. The assembly includes two distribution units 6, 7 with feed and discharge openings 6', 7' for a coolant. The distribution units are joined by hose sections S, the spaces between which form pockets 10 for battery cells. The hose sections are said to be made of an elastomeric plastic material and are able to expand against the battery cells located in the receiving pockets, and an intimate physical and thermal contact is established between the battery cells and the cooling medium. Claim 1 as I have construed it is also anticipated by WO 2011/088997.

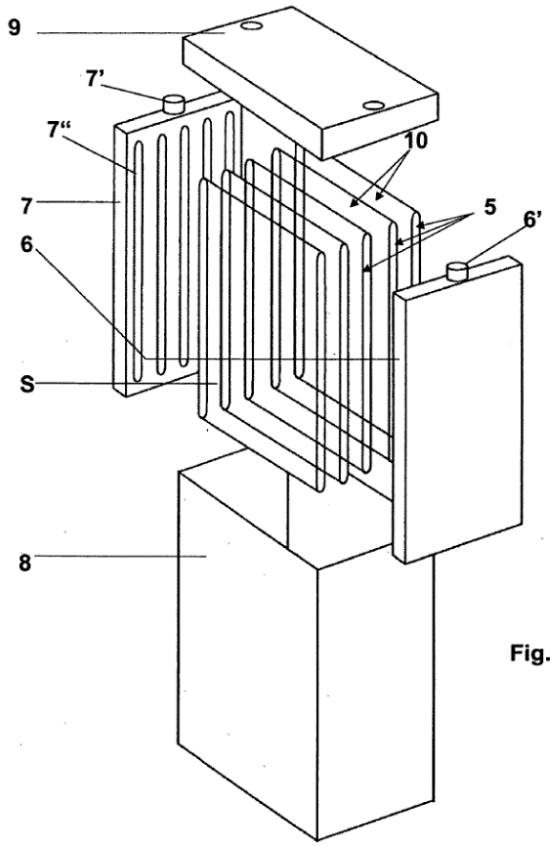

Fig. 6

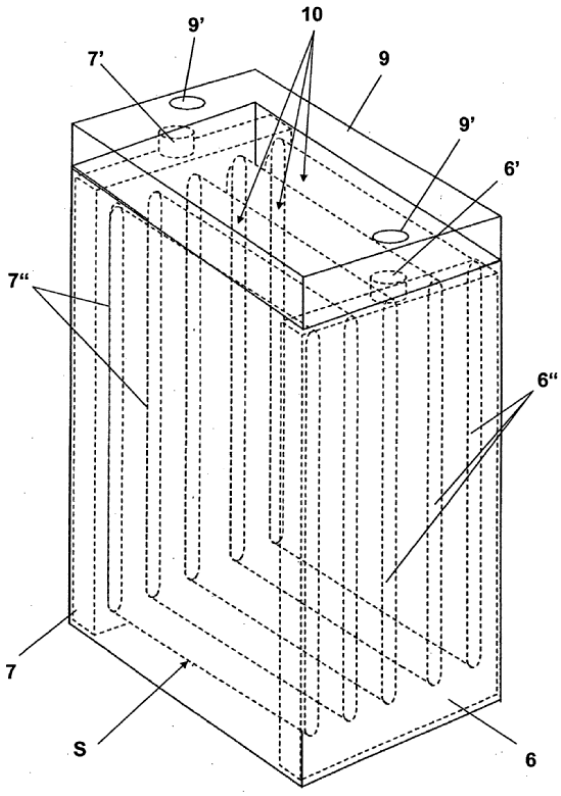

Fig. 7

38. Document D8 or US 2007/037050 describes and shows in figures 1 and 2 below a device designed to control the temperature of a plurality of chambers, which chambers may be made up of the casings of the electrochemical cells of a battery. This device comprises a flexible pouch of a parallelepiped shape (1), two conduits (2) and (3) for the inlet and the outlet of a heat transfer fluid, and a plurality of partitions that are approximately parallel (4, 4', 4'', 4''', etc.) delimiting a circulation path for the heat transfer fluid which is pumped. The flexibility of the pouch and its thinness allow the pouch to conform closely to the format and arrangement of the chambers 5. I think it is implicit in conforming closely that that the pouch is "*expandable so as to conform*" in the manner of the flexible conduit of claim 1.

Although the conduits are not shown in any detail I think they fall within the scope of the manifolds of claim 1 of the patent as I have construed it. US 2007/037050 anticipates claim 1 of the patent.

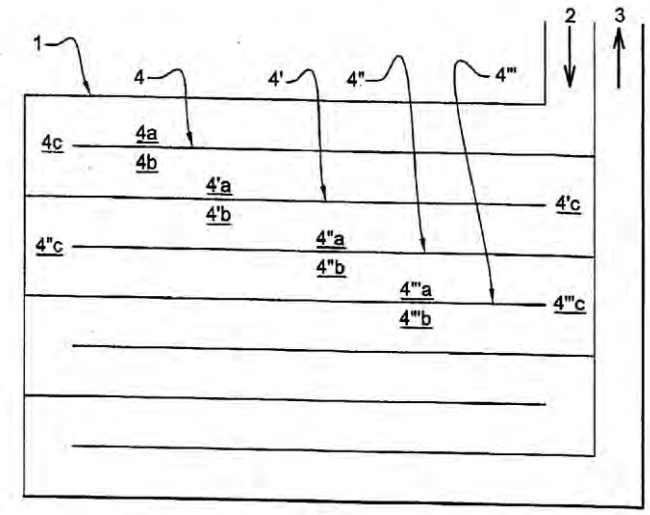

Fig. 1

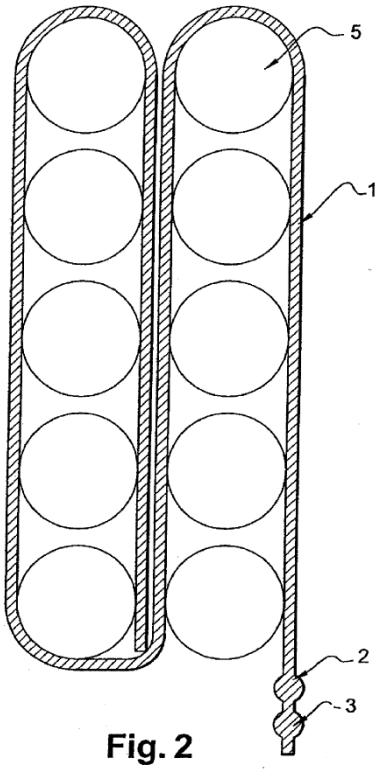

Fig. 2

39. In my view the invention of claim1 is anticipated by all of documents D1 to D8 in the request.

Novelty – claim 37

40. Method claim 37 includes all of the requirements of the flexible conduit found in claim 1. I have already considered the difference between the chambers in claim 1 and the manifolds in claim 37 and concluded that the terms are used interchangeably. I also came to the view that the skilled reader would understand each manifold or chamber to have no additional requirements beyond being suitable for providing a connection for fluid communication between a flexible conduit and additional components in a cell pack thermal management system. Pipes or adapters are not excluded from the scope of chamber or manifold.

41. Claim 37 adds further requirements of a pump, a heat exchanger, a cell pack and fluid, interlacing and expanding the conduit or conduit between the cells and that the components should be connected together to form a fluid circuit within which the pump operates to circulate the fluid.

42. According to the request documents D1, D2, D5 and D8 all anticipate claim 37.

43. In addition to the requirements of claim 1 discussed above, D1 shows a pump 4, heat exchanger 5, cells 21 and fluid, the bags 3 being interlaced and expanded.

This seems to me sufficient to anticipate claim 37.

44. D2 shows a complete battery system in figures 60 to 64 which has a thermal management system. This includes a pump 1130 and radiator 1140 and paragraph 268 discusses routing cooling fluid between cells. This embodiment does not however show a flexible conduit interlaced between the cells of a cell pack along with the pump etc. I noted above that the heat exchanger 940 shown in figure 51 forms such a flexible conduit, but figure 51 refers to a separate arrangement.

45. D5 shows a pump 11 and a heat exchanger 27 and cell packs 101 between which the bags 10 are interlaced and expanded such that claim 37 is anticipated.

46. D8 describes a system using a pump, although it is not shown in the figures. Also referred to is "*a thermostatic bath*" to which the thermal control device may be connected "*in order to control the temperature of the heat transfer fluid*". I think this must amount to the heat exchanger of claim 37. Thus D8 anticipates claim 37.

Novelty – dependent claims

47. The request argues that claims 2 to 22 and 33 to 35 lack novelty over various of the documents D1 to D8.

48. Claim 2 requires a plurality of flexible conduits providing a plurality of fluid communication paths between the intake-side and exhaust-side chambers. In D1 the plurality of bags 3 seem to provide such plural conduits and plural fluid communication paths between pipes 24 and 25. Figure 47 in D2 shows a plurality of heat exchangers providing plural conduits and plural fluid communication paths between manifolds 902 and 904. Although document D3 refers in passing to a combination of plural heat transfer devices I do not think there is enough to say that there is a disclosure of plural flexible conduits connecting an intake-side chamber and an exhaust-side chamber. In D4 figure 10 is a partial view of an embodiment of the cooling bladder 30 formed from multiple flow channels in the form of a bank of tubes. Whilst the ends of the bladder are not shown and the arrangement is somewhat different to the embodiments in the patent, this arrangement seems to meet the requirements of claim 2. The arrangement illustrated in D5 shows a number of bags connected in series and hence providing only a single fluid communication path. However, paragraph 21 mentions that the bags may be connected in parallel. Whilst there is no detail of such an arrangement, I think there is enough to say that claim 2 is anticipated by document D5, unlike document D3. Figure 6 in D7 clearly shows multiple hose sections S connecting distribution units 6 and 7. I agree with the requester than claim 2 is anticipated by documents D1, D2, D4, D5 and D7.

49. It seems to me that if the flexible conduit of claim 1 is to be able to conform to the surface contours of cells it is also "*conformable so as to be contiguous with a cell pack support plate*" in the manner required by claim 3. It follows therefore that documents D1 to D8 anticipate claim 3.

50. I said above that claim 4 seems to me to impose no requirements on the cell pack thermal management device. The request points out that figure 3 of document D4

shows a circuit board connecting electrically the cells 15 in a cell stack assembly. It seems that irrespective of what requirements, if any, claim 4 imposes on the cell pack thermal management device, document D4 anticipates claim 4.

51. The flexible conduits shown in documents D1, D2 and D7 each have inlet and outlet ports adapted to be connected to the intake-side and exhaust-side chambers in the manner of claims 5 and 6.

52. A wall thickness range within the ranges of claims 7 and 8 is disclosed in paragraphs 21 and 22 of document D8. In paragraph 237 of document D2 a wall thickness range is mentioned that is within the range of claim 7.

53. Claim 10 requires that the flexible conduit comprises two sheets sealed along their opposing longitudinal edges. This is shown in documents D1 (see paragraph 20 and peripheral weld 31), D4 (see figures 4 and 5) and D8 (see paragraph 11).

54. I have some sympathy with the requester's argument that claim 11 is a product by process by claim and should be construed as the product *per se*. Leaving aside the extrusion requirement the claim does at least however require the flexible conduit to be a tube. The term is not discussed further in the patent, but tubes seem to be shown by at least the hose sections S of document D7 and possibly the bladder 30 in document D4.

55. The welding of claim 12 is disclosed in documents D1 and D8.

56. The materials required by claims 13 to 17 are disclosed respectively in documents D1 to D4 and D8, documents D1 and D3, documents D1 and D3, documents D1, D3 and D4 and documents D1, D3 and D4.

57. Claim 18 requires the intake and exhaust chamber to communicate with a plurality of conduits. This is shown in documents D1 (see chambers or tubes 24, 25), D2 (see chambers of manifold 902, 904 in figure 47), D5 (the bags 10 may be arranged in parallel according to paragraph 21) and D7 (see figure 6).

58. In the figures of documents D1 to D8 the intake and exhaust chambers are apparently substantially identical, as required by claim 19.

59. In claims 20 to 22 plural intake and exhaust chambers are required to communicate and define together an intake manifold. I noted above that the manifolds can take the form of a common volume, described as formed from plural chambers, with plural conduit ports. Unless they depend upon claim 2, claims 20 to 22 do not necessarily require plural flexible conduits or conduit ports. Consequently claims 20 to 22 as I construe them amount to manifolds or chambers that are divided into plural, communicating chambers or can notionally be divided into such chambers. Such an arrangement is provided by the pipes 24 and 25 in document D1, the manifolds 902, 904 in D2 and distribution units 6, 7 in D7.

60. Claim 33 requires the chambers to be suitable for use with a working fluid such as ethylene glycol. No other examples of such fluids are given in the patent and there is little discussion in the patent as what might be required of a fluid for it to be used as a working fluid, apart from being typically a liquid. It seems that the fluid must be

suitable to be used in a cell pack thermal management device and it is implicit that it could be used for thermal transfer. Documents D1 to D8 are all concerned with systems intended to employ working fluids and hence necessarily comprise components suitable for use with such fluids. In any event document D2 refers to glycol and D4 to ethylene glycol and this seems to me sufficient to anticipate claim 33.

61. Claim 34 defines a system which adds a pump and a heat exchanger to the device of claims 1 to 33. Documents D1, D5 and D8 disclose systems with pumps and heat exchangers and anticipate claim 34. They also anticipate claim 35 which adds a plurality of cells to the system of claim 34 and passes the flexible conduit between cells arranged in a matrix.

The Inventive step

62. The request seeks an opinion as to whether claims 9, 23 to 32 and 36 are inventive given documents D1, D2, D4 and D8 and common general knowledge. The request also argues that claims 20 to 31 relate to a collocation of two known integers devoid of any technical synergy. I will consider this question separately. The observations on behalf of the proprietor include no observations on questions of inventive step, although they do make brief observations regarding collocation.

63. To determine whether or not an invention defined in a particular claim is inventive over the prior art, I will rely on the principles established in *Pozzoli SPA v BDMO SA [2007] EWCA Civ 588*, in which the well-known Windsurfing steps were reformulated:

> *(1)(a) Identify the notional "person skilled in the art";*
> *(1)(b) Identify the relevant common general knowledge of that person;*
> *(2) Identify the inventive concept of the claim in question or if that cannot readily be done, construe it;*
> *(3) Identify what, if any, differences exist between the matter cited as forming part of the "state of the art" and the inventive concept of the claim or the claim as construed;*
> *(4) Viewed without any knowledge of the alleged invention as claimed, determine whether those differences constitute steps which would have been obvious to the person skilled in the art.*

64. The request does not discuss the skilled person beyond arguing that their common general knowledge would include that a flexible conduit can be formed from a single sheet using a central fold and one edge seal.

65. It seems to me that the skilled person would in fact be a team concerned with cell pack thermal management systems which would require *inter alia* knowledge of materials and methods for producing the components found in such systems.

66. Claim 9 depends on any preceding claim and requires the flexible conduit or conduits should comprise "*a single sheet sealed at a longitudinal edge to define the flexible conduit with a longitudinal edge seal*". The request says nothing about the second Windsurfing/Pozzoli step and argues that the difference between D1 and

claim 9 lies in the bag of D1 being formed from two sheets with two longitudinal edge seals rather than one sheet and one seal. I agree with the requester that this difference would have been obvious to the person skilled in the art.

67. The request also asserts that claim 9 is not inventive in light of document D2 and common general knowledge although there is no explanation of the basis for this argument, such as the difference between D2 and claim 9. Paragraphs 237 and 238 of D2 disclose that the heat exchanger 940 "*may be made from a blow molding process, an injection molding process, or other suitable process*" and "*may be made of a polymeric material (e.g., polypropylene) or other suitable material*". It seems to me that the difference between D2 and claim 9 lies in forming the heat exchanger or flexible from a single sheet and a single edge seal rather than moulding. In my view this difference would have been obvious to the skilled person.

68. According to the request, claims 23 to 31 are obvious in light of document D2, when those claims do not depend on claim 9. The request describes these claims as relating to modular manifolds formed from interconnected modules and acknowledges that manifolds 902, 904 in document D2 do not appear to be modular. I take it that it is the view of the requester that this modular construction is the difference between the inventive concept of claims 23 to 31 and D2. Although the claims in question do not refer to modular construction in those terms, this strikes me as an accurate reflection of the difference.

69. The request goes on to argue that manifolds of this kind are well known in the present art and are shown in patent documents D12 to D15. It is not entirely clear to me whether the requester intends to use documents D12 to D15 to exemplify the common general knowledge of the skilled person or if the argument is that a combination of D2 with any of documents D12 to D15 show the inventive concepts in claims 23 to 31 to be obvious. In the request there is no reference to common general knowledge in this context and documents D12 to D15 are described as "*lying in the road for the skilled person to use*".

70. Document D15 is distinct from D12 to D14 in that it discloses a vehicle exhaust gas manifold whereas D12 to D14 show battery thermal management systems. I struggle to see how D15 could be lying in the road for the skilled person in the field of cell pack thermal management systems and I will not consider the document further.

71. Quite why documents D12 to D14 would be lying in the road for the skilled person to use is not explained in the request. As I have said it is not argued that the documents exemplify common general knowledge, nor is it shown that the individual documents themselves are so well known that it could be taken as read that the skilled person would be aware of them.

72. The request points out that the thermal management system as a whole in D2 is said to be modular "*in that it may be scaled up or down dependent upon the requirements of the application*" and that there are plural battery modules in a common housing shown in D2. It seems that this is to suggest that the skilled person would be motivated to apply a principle of modular construction based on a scalable system and multiple battery modules.

73. I could accept that with the benefit of hindsight it would not be difficult to conceive modular first and second chambers for the cell pack thermal management system shown in document D2. However, I do not see any evidence in the request to suggest that this difference would have been obvious to the skilled person.

74. Claim 36 is directed to a cell pack comprising a thermal management system and a plurality of cells that are "*arranged with a cell pack support plate*" and in which the flexible conduit passes over the cell pack support plate rather than between cells arranged in a matrix as in claim 35. As the claim explains the contact between the flexible conduit and cell pack plate is "*to provide a maximum contact area for thermal energy exchange*". The cell pack of claim 36 seems to be embodied in figures 24 to 31 of the patent in which "*Cell pack plate 680 is shown sandwiched between the flexible conduit 615 and cell modules 660*" as lines 3 and 4 on page 24 explain. It seems clear to me that the support plate of claim 36 provides a path for thermal energy exchange between the cells and the flexible conduit.

75. According to the request document D4 shows a cell pack support plate formed by housing lid 32 and circuit board 42 and the only difference between D4 and claim 36 is found in claims 34, upon which claims 36 depends. This difference is the absence of system ports connecting the chambers to a pump and heat exchanger.

76. For my part I think there are more significant differences between claim 36 and document D4. There is no suggestion that the housing lid 32 contacts or in any way supports the cells, still less provides for thermal energy exchange. The lid is not a cell pack support plate of the kind required by claim 36. Circuit board 42 is electrically connected to the individual cells although it seems to play no role in thermal energy exchange between the cells and the cooling bladder. It would require significant modification to the arrangement in D4 for the cooling bladder to pass over the circuit board and provide a contact area for thermal energy exchange. I can see no evidence that this would be obvious to the skilled person.

77. In my view the invention of claim 9 would have been obvious to the person skilled in the art in view of documents D1 and D2. However, I believe that claims 23 to 32 and 36 are inventive in view of the prior art referred to in the request.

Collocation

78. The request alleges that claims 20 to 31 are not patentable as they relate to a collocation of two known integers devoid of any technical synergy. The first integer is said to be the cell pack thermal management device of claim 1, upon which claims 20 to 31 depend, and the second integer is the manifold comprising a plurality of chambers in fluid communication with one another.

79. I have some difficulty with this separation of integers. Claim 1 requires intake and exhaust chambers and claims 20 to 22 as I have already construed them above simply amount to manifolds or chambers that are divided into plural, communicating chambers or can notionally be divided into such chambers. This makes it difficult for me to see in claims 20 to 31 the two integers seen by the requester.

80. The request quotes the EPO Technical Board of Appeal decision in T 1054/05:

"*Two features interact synergistically if their functions are interrelated and lead to an additional effect that goes beyond the sum of the effects of each feature taken in isolation. It is not enough that the features solve the same technical problem or that their effects are of the same kind and add up to an increased but otherwise unchanged effect.*"

81. What the requester does not explain is the function of the two integers they have identified and what is the effect of each integer taken in isolation.

82. I have already come to a view that the requirements of claims 20 to 22 as I have construed them are shown in the prior art. I do not believe that the requester has shown that those claims, or by extension claims 23 to 31, are a collocation of two known integers devoid of any technical synergy.

Conclusion

83. It is my opinion that claims 1 to 8, 10 to 22, 33 to 35 and 37 are anticipated by the prior art documents detailed above.

84. It is also my opinion that claim 9 is not inventive in light of documents D1 and D2.

Application for review

85. Under section 74B and rule 98, the proprietor may, within three months of the date of issue of this opinion, apply to the comptroller for a review of the opinion.

Karl Whitfield
Examiner

NOTE

This opinion is not based on the outcome of fully litigated proceedings. Rather, it is based on whatever material the persons requesting the opinion and filing observations have chosen to put before the Office.