IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application. No.: 17/303,907 : Confirmation No.: 2943

First Inventor: Raymond L. Senf JR. : Group Art Unit: 3763

Filed: June 10, 2021 : Examiner: MOORE, DEVON TYLEN

Docket No.: 127357US02

For: INTEGRATED COOLING SYSTEM AND METHOD FOR TRANSPORTION REFRIGERATION UNIT

VIA ELECTRONIC FILING SYSTEM
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

RESPONSE

Commissioner:

Applicant respectfully requests entry of the following amendment and remarks contained herein in response to the Non-Final Office Action mailed November 7, 2023. A petition for a one-month extension of time and associated fee are submitted herewith.

AMENDMENTS TO THE CLAIMS

This listing will replace all prior versions of claims in the present application.

1. (Currently amended) A transportation refrigeration system, comprising:

a compressor comprising a suction port and a discharge port;

a heat rejection heat exchanger operably coupled to the compressor discharge port;

a heat absorption heat exchanger [[is]] operably coupled to the compressor suction port;

a subcooler comprising a first flow path and at least a second flow path, the subcooler operably coupled to the heat rejection heat exchanger and the heat absorption heat exchanger; and

a heat transfer apparatus comprising a first portion [[and]], a second portion, and a heat sink, wherein the first portion of the heat transfer apparatus is disposed between and operably coupled to the first flow path and the at least second flow path of the subcooler, and the second portion of the heat transfer apparatus is operably coupled to a heat source, and wherein the heat transfer apparatus is configured to exchange heat between a working fluid and the heat source.

2. (Canceled)

3. (Canceled)

4. (Canceled)

5. (Currently amended) The transportation refrigeration system of claim 1, ~~wherein the heat transfer apparatus further comprises a heat sink,~~ wherein the heat sink comprises at least two plates operably coupled together in parallel forming a flow channel between adjacent plates, and is disposed between the first portion and the second portion.

6. (Original) The transportation refrigeration system of claim 1, wherein the heat source comprises a power electronics device.

7. (Original) The transportation refrigeration system of claim 6, wherein the power electronics device controls the flow of electricity between one or more of a battery, a motor, a generator, a refrigeration transportation system, and a vehicle powertrain.

8. (Original) The transportation refrigeration system of claim 6, wherein the power electronics device comprises at least one of a power semiconductor device, a converter, an inverter, a battery, and a fuel cell.

9. (Currently amended) A heat transfer apparatus comprising a first portion [[and]], at least a second portion, and a heat sink, wherein the first portion of the heat transfer apparatus is disposed between and operably coupled to a first flow path and at least one second flow path of a refrigeration flow circuit of a subcooler; and the at least second portion of the heat transfer apparatus is operably coupled to a heat source, wherein the heat transfer apparatus is configured to exchange heat between a working fluid and a heat source.

10. (Original) The heat transfer apparatus of claim 9, wherein the first portion has a channel therethrough for operably coupling the heat transfer apparatus to the subcooler refrigeration flow circuit.

11. (Currently amended) The heat transfer apparatus of claim 9, wherein [[a]] the heat sink is operably coupled to at least the first portion and the second portion of the heat transfer apparatus.

12. (Original) The heat transfer apparatus of claim 11, wherein the heat sink comprises at least two plates operably coupled together in parallel forming an air flow channel between adjacent plates.

13. (Original) The heat transfer apparatus of claim 9, wherein the heat source comprises a power electronics device.

14. (Original) The heat transfer apparatus of claim 13, wherein the power electronics device controls the flow of electricity between one or more of a battery, a motor, a generator, a refrigeration transportation system, and a vehicle powertrain.

15. (Original) The heat transfer apparatus of claim 13, wherein the power electronics device comprises at least one of a power semiconductor device, a converter, an inverter, a battery, and a fuel cell.

16. (Currently amended) A method of operating a transportation refrigeration system comprising:

operating a heat source operably coupled to a heat transfer apparatus comprising a first portion, a second portion, and a heat sink, and to provide power, at least in part, to the transportation refrigeration system comprising a compressor and a subcooler, wherein the subcooler comprises a first flow path and at least one second flow path;

operating the compressor to direct a working fluid in a flow circuit comprising a heat rejection heat exchanger and a heat absorption heat exchanger, to the subcooler through the first flow path and the at least one second flow path;

operably coupling the heat transfer apparatus to the subcooler flow circuit to permit the working fluid to absorb heat from at least one of the heat transfer apparatus and the heat source, wherein the first portion of the heat transfer apparatus is disposed between and operably coupled to the first flow path and at least one second flow path of the subcooler, the second portion of the heat transfer apparatus is operably coupled to the heat source, and

rejecting heat from the working fluid to at least one of ambient air and the subcooler.

17. (Original) The method of operating a transportation refrigeration system of claim 16, wherein the working fluid is a high pressure, subcooled refrigerant.

18. (Original) The method of operating a transportation refrigeration system of claim 16, wherein the heat source comprises a power electronics device.

19. (Previously presented) The method of operating a transportation refrigeration system of claim 18, wherein the power electronics device controls the flow of electricity between one or more of a battery, a motor, a generator, a refrigeration transportation system, and a vehicle powertrain.

20. (Original) The method of operating a transportation refrigeration system of claim 18, wherein the power electronics device comprises at least one of a power semiconductor device, a converter, an inverter, a battery, and a fuel cell.

REMARKS

Status of Claims

Claims 1 and 5-20 are currently pending. Claims 1, 5, 9, and 16 are currently amended. Support for the amendments can be found at least in previously presented dependent claim 5, paragraph [0046] and at least in FIGs. 2 and 3 of the as-filed Specification. No claims have been newly added. Reconsideration and allowance of the claims are respectfully requested in view of the above amendments and the following remarks.

Claim Interpretation

The Office Action, on page 4, asserts "[t]his application includes one or more claim limitations that do not use the word 'means,' but are nonetheless being interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, because the claim limitation(s) uses a generic placeholder that is coupled with functional language without reciting sufficient structure to perform the recited function and the generic placeholder is not preceded by a structural modifier. Such claim limitation(s) is/are: 'power electronics device' in line 2 of claim 6, lines 1-2 of claim 13, and line 2 of claim 18. The recitations draw structure to the following recitation of the present disclosure: 'power electronics device includes at least one of a power semiconductor device, a converter, an inverter, a battery, and a fuel cell' (paragraph 16) or equivalents."

While the Office Action's interpretation of the term "power electronics device" under the provision of 35 U.S.C. § 112(f) is acknowledged, Applicant submits that the failure to address any statement or interpretation by the Office Action herein should not be interpreted as acquiesced an acquiescence or agreement with such statement. The right to set forth additional and/or alternative interpretations of the various features of the term "power electronics device" during the present prosecution or in any other future proceeding, and to rebut any statement presented by the USPTO in this or other papers during prosecution of the present application, is expressly reserved.

Further, Applicant respectfully submits that the Specification provides examples power electronics device (see, for example, Applicant's as-filed specification, at paragraphs [0046] and [0056]). Applicant further submits that these examples are not an exhaustive list. A person of ordinary skill in the art would understand from the Specification of the present application what structures, or equivalents thereof, may be included in the list of power

electronics device.

Claim Rejections – 35 U.S.C. § 103

Claims 1 and 5-20 stand rejected under 35 U.S.C. § 103 as allegedly being unpatentable over WO Publication No. 2018226649 to Burchill et al. (hereafter "Burchill") and over CN Publication No. 203797827 to Yuan et al (hereafter "Yuan"), and in view of WO Publication No. 0106184 to Rockenfeller (hereafter "Rockenfeller").

Applicant respectfully traverses these rejections. Nevertheless, without acknowledging the propriety of the rejection and solely to expedite prosecution, Applicant has amended independent claims 1, 9, and 16 to further clarify the claimed subject matter. Applicant respectfully submits that Burchill, Yuan, and Rockenfeller, either alone or in combination, fail to teach or suggest all of the features recited in amended independent claims 1, 9, and 16.

For example, amended independent claim 1 recites, *inter alia*, the following features, which are not described in Burchill, Yuan, and Rockenfeller:

> "A transportation refrigeration system, comprising … a heat transfer apparatus comprising a first portion, a second portion, and a heat sink, wherein the first portion of the heat transfer apparatus is disposed between and operably coupled to the first flow path and the at least second flow path of the subcooler and the second portion of the heat transfer apparatus is operably coupled to a heat source, and wherein the heat transfer apparatus is configured to provide a heat exchange between a working fluid and the heat source associated with the heat transfer apparatus."

Amended independent claims 9 and 16 recite similar features.

For an obviousness rejection to be proper, the Examiner must meet the burden of establishing that all elements of the invention are disclosed in the prior art; that the prior art relied upon, coupled with knowledge generally available in the art at the time of the invention, must contain some suggestion or incentive that would have motivated the skilled artisan to modify a reference or combined references; and that the proposed modification of the prior art must have had a reasonable expectation of success, determined from the vantage point of the skilled artisan at the time the invention was made. *In re Fine*, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988); *In Re Wilson*, 165 U.S.P.Q. 494, 496 (C.C.P.A. 1970).

With respect to previously presented independent claim 1, the Office Action, on page

6, refers to Burchill for allegedly teaching a heat transfer apparatus comprising a first portion and a second portion, and refers to Figure 3 of Burchill for the same. Applicant respectfully traverses the above contention of the Examiner.

Burchill describes that a transport refrigeration system 26 includes supply and return refrigerant tubes 108, 110, each extending between an energy storage device (ESD) 46 and a Transport Refrigeration Unit (TRU) 44. The ESD 46 includes at least one energy storage unit 112 (e.g., battery or bank of batteries), an evaporator subsystem 114, a generally enclosed outer housing 116, and an enclosed casing 118. (Refer e.g., paragraph [0040] of Burchill).

Further, Burchill, in paragraph [0041], describes:

> "[t]he battery cooling, or evaporator, subsystem 114 may **include a fan assembly 120**, a heat exchanger 122, a temperature sensor 124 that may be located, or exposed to temperatures, in the casing 118, **an air duct 126 for the recirculation of air** (see arrow 128 in FIG. 3), a refrigerant-to-refrigerant heat exchanger 129, a thermostatic expansion valve 131, and a thermostatic expansion valve bulb sensor 133. **The fan assembly 120 is adapted to flow air across the heat exchanger 122The air flow through an inlet opening 130 communicating through the casing 118, circulate about the batteries 112, and flow out of the casing 118 via an outlet opening 132**. From the outlet opening 132, the air 128 may flow through the air duct 126, and back to the fan assembly 120 for recirculation. In general, the **batteries may thus be cooled primarily via thermal convection**. (Refer e.g., paragraph [0041] of Burchill)."

The Office Action, on page 6, presumably equates the claimed "heat transfer apparatus" with "energy storage device (ESD) (46)," as shown in FIG. 2 of Burchill (reproduced below). Further, the Office Action presumably equates the claimed "first portion" of heat transfer apparatus with "heat exchanger 122" of Burchill and the claimed "second portion" of heat transfer apparatus with "casing 118" of Burchill, as shown in FIG. 3 of Burchill (reproduced below).

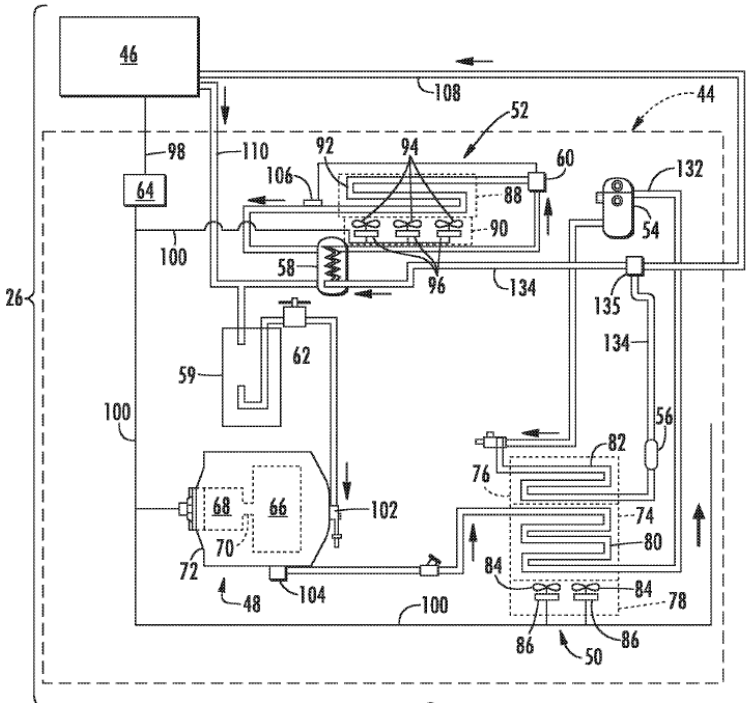

FIG. 2 of Burchill

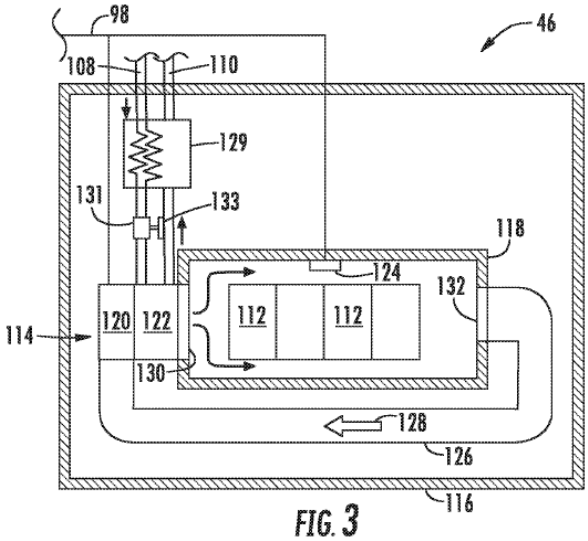

FIG. 3

FIG. 3 of Burchill

Applicant respectfully submits that there exists a fundamental difference in transportation refrigeration system comprising "heat transfer apparatus," as claimed in amended independent claim 1 and the transport refrigeration system comprising the "energy storage device" (ESD)" of Burchill. Burchill describes an energy storage device (ESD) that

comprises an evaporator fan assembly designed and positioned to **propel air across the evaporator heat exchanger**. Air discharged from the heat exchanger (122) may enter through an inlet aperture (130) within the casing (118), circulate around the batteries (112), and exit the casing (118) via an outlet aperture (132). Subsequently, the air (128) from the outlet aperture (132) may traverse the air duct (126) and return to the fan assembly (120) for re-circulation. Therefore, Burchill describes utilizing **air** to circulate around the batteries to dissipate heat from the batteries. In contrast, amended independent claim 1 describes utilizing a **working fluid** to absorb heat from at least one of the heat transfer apparatus and the heat source.

Further, amended independent claim 1 specifies that the heat transfer apparatus comprises distinct portions (i.e., first portion and a second portion) and a heat sink. Applicant respectfully submits that Burchill, in paragraph [0041], teaches that battery cooling system 114 includes a fan assembly 120, a heat exchanger 122, an air duct, refrigerant-refrigerant heat exchanger 129, and valves and sensors, which facilitate **airflow for heat dissipation**.

In other words, the system, as described amended independent claim 1 relies on a **refrigerant** to absorb heat from the heat transfer apparatus and the heat source (i.e., liquid cooling). In contrast, Burchill describes air-cooled system to dissipate heat primarily through convection facilitated by a fan. This distinction in cooling mechanisms fundamentally alters the operational dynamics and thermal management capabilities of each system.

Furthermore, the specific technical challenges addressed by the present invention, such as the mitigation of condensation risks posed by forced air circulation (Burchill teaches cooling aided by forced air convection) over the PEP and the improvement of heat management for PEPs (Refer e.g., paragraph [0006] of the as-filed Specification). These technical objectives highlight the unique problem-solving capabilities of the system described in amended independent claim 1, which cannot be addressed or resolved by Burchill's air-cooled system.

Therefore, Applicant respectfully submits that the "energy storage device (ESD) 46" of Burchill cannot be considered equivalent to "heat transfer apparatus" of amended independent claim 1.

With respect to previously presented independent claim 5, the Office Action, on page 7, concedes "Burchill as modified does not disclose wherein the heat transfer apparatus further comprises a heat sink," and refers to Yuan for the same. Specifically, the Office Action, on page 7 alleges "Fig. 2 of Yuan discloses the heat sink to be attached to the

electronics element 13; this teaching would place the heat sink of Yuan on the energy storage unit (112) of Burchill when modified by one of ordinary skill in the art, ultimately placing the heat sink between the first and second portions of Burchill)."

The Examiner's assertion appears to propose various modifications to Burchill's configuration, including placing the heat sink either between the fan and the heat exchanger 122 or in direct contact with the batteries. However, these suggestions raise significant technical and operational concerns. Further, the Examiner's rationale for combining the teachings of Burchill and Yuan appear to hinge on the assumption that adding a heat sink would inherently enhance the refrigeration effect of Burchill. Applicant respectfully requests reconsideration.

First, if the heat sink of Yuan were placed between the fan and the heat exchanger of Burchill, the airflow over the heat sink may disrupt the intended airflow over the heat exchanger, potentially diminishing the effectiveness of the cooling process of Burchill, thereby rendering the intended purpose of Burchill as inoperable. Moreover, integrating a heat sink, as suggested, may necessitate altering the design of the energy storage device, potentially leading to increased complexity and manufacturing costs.

Second, if the heat sink of Yuan were added in direct contact with the batteries of Burchill, the modified configuration may interfere with the air flow path, potentially requiring the removal or redesign of the heat exchanger. Further, integrating the heat sink in direct contact with the batteries may introduce challenges related to thermal conductivity, as variations in battery structure and composition could impact the uniformity of heat dissipation.

In view of the above, Applicant respectfully submits that an ordinary person skilled in the art would not modify the teachings of Burchill, as suggested, without any direction to do so. It is submitted that it not sufficient to suggest that a person skilled in the art reading Burchill could modify the arrangement disclosed in Burchill, but rather it is necessary for there to be a clear motivation as to why a person skilled in the art would actually modify the arrangement disclosed in Burchill without the benefit of hindsight (i.e. the skilled person needs motivation to look to some other undisclosed teaching, and needs to find a clear identification of a problem and a solution therein). Accordingly, it appears as though the Examiner is impermissibly taking an ex post facto approach when assessing the combination of the references.

Therefore, Burchill and Yuan, alone or in combination, fail to teach or suggest the above-mentioned features of amended independent claim 1. Further, Rockenfeller fails to cure the deficiencies of Burchill and Yuan, and the Office Action does not allege otherwise. Accordingly, Burchill, Yuan, and Rockenfeller, alone or in combination, fail to teach or suggest the above-mentioned features of amended independent claim 1. Amended independent claims 9 and 16 recite some or all subject matter similar to amended independent claim 1, and therefore, Applicant respectfully submits that all the remarks made for amended independent claim 1 above, apply equally to amended independent claims 9 and 16.

For at least these reasons, Applicant respectfully requests that the rejection of independent claims 1, 9, and 16 under 35 U.S.C. § 103 be withdrawn.

In addition, dependent claims 5-8, 10-15, and 17-20 are also allowable at least by virtue of their dependency on respective amended independent claims 1, 9, and 16, which have been shown to be allowable above, and as well as for their additional claimed features.

For at least these reasons, Applicant respectfully requests that the rejection of dependent claims 5-8, 10-15, and 17-20 under 35 U.S.C. § 103 be withdrawn.

It is respectfully submitted that Applicant may not have addressed each rejection of dependent claims. However, any rejection of a dependent claim not specifically addressed is not to be construed as an admission by Applicant of the correctness of that rejection. Rather, Applicant believes that independent claims are patentably distinguishable over the cited references for the reasons noted above, so that the rejection of dependent claims need not be addressed at this time. Applicant reserves the right to address the rejection of any dependent claim at a later time should that become warranted.

CONCLUSION

The Commissioner is hereby authorized to charge any fee required under 37 C.F.R. §§ 1.16 or other applicable rule to Deposit Account 030835.

Date: March XX, 2024,

Respectfully submitted,

By: _____