

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

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Date of mailing
(day/month/year)

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Applicant's or agent's file reference
140336-564602

FOR FURTHER ACTION

See paragraph 2 below

International application No.

PCT/US2022/038815

International filing date (day/month/year)

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International Patent Classification (IPC) or both national classification and IPC

IPC(8) - INV. - H05K 7/20 (2022.01)

ADD. - F24F 1/0007; F24F 5/00; F24F 12/00; F28D 15/02 (2022.01)

CPC - INV. - H05K 7/20827; H05K 7/20836 (2022.08)

ADD. - F24F 1/0007; F24F 5/0035; F24F 12/002; F24F 2012/005; F28D 15/02 (2022.08)

Applicant MUNTERS CORPORATION

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

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Date of completion of this opinion

28 September 2022

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Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:

- ☒ the international application in the language in which it was filed.
☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(b)).

3. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:

- a. ☐ forming part of the international application as filed.
b. ☐ furnished subsequent to the international filing date for the purposes of international search (Rule 13*ter*.1(a)),
☐ accompanied by a statement to the effect that the sequence listing does not go beyond the disclosure in the international application as filed.

4. ☐ With regard to any nucleotide and/or amino acid sequence disclosed in the international application, this opinion has been established to the extent that a meaningful opinion could be formed without a WIPO Standard ST.26 compliant sequence listing.

5. Additional comments:

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Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-24	YES
	Claims	None	NO
Inventive step (IS)	Claims	1-24	YES
	Claims	None	NO
Industrial applicability (IA)	Claims	1-24	YES
	Claims	None	NO

2. Citations and explanations:

Claims 1-24 meet the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest:

Regarding claim 1, the prior art of record, individually or in combination, does not teach or fairly suggest a cooling system comprising: an evaporator containing a primary cooling medium, the evaporator being configured to receive a process fluid and, when receiving the process fluid, to change the phase of the primary cooling medium from liquid to gas; a passive condenser having an outer surface and being fluidly coupled to the evaporator, the passive condenser being configured to have an airstream directed over the outer surface thereof, wherein, when the airstream is directed over the outer surface of the passive condenser, the passive condenser is configured (i) to receive the primary cooling medium in the gas phase from the evaporator, (ii) to transfer heat from the primary cooling medium, (iii) to change the phase of the primary cooling medium from gas to liquid, and (iv) to supply the primary cooling medium in the liquid phase to the evaporator; a heat exchanger fluidly coupled to the evaporator and configured to have a secondary cooling medium selectively provided thereto such that: (a) when the secondary cooling medium is provided to the heat exchanger, at least some of the primary cooling medium in the gas phase switches from being received by the passive condenser to the heat exchanger without operating any valves located between the evaporator and the passive condenser and between the evaporator and the heat exchanger and the heat exchanger is configured (i) to receive the primary cooling medium in the gas phase from the evaporator, (ii) to transfer heat from the primary cooling medium, (iii) to change the phase of the primary cooling medium from gas to liquid, and (iv) to supply the primary cooling medium in the liquid phase to the evaporator; and (b) when the secondary cooling medium is not provided to the heat exchanger, the heat exchanger does not supply the primary cooling medium in the liquid phase to the evaporator; and a flow control valve positioned in the flow path between the heat exchanger and the evaporator and in the flow path between the passive condenser and the evaporator, the flow control valve having a plurality of open positions and configured to control the flow of the primary cooling medium in the liquid phase into the evaporator, wherein the primary cooling medium circulates between the evaporator and the passive condenser and between the evaporator and the heat exchanger by natural circulation and gravity without a pump in the flow path of the primary cooling medium between the heat exchanger and the evaporator and between the passive condenser and the evaporator to circulate the primary cooling medium.

Claims 2-17 depend from claim 1, and therefore meet the criteria set out in PCT Article 33(2)-(3) for at least the same reasons as claim 1.

The following prior art is made of record to support and further define the reasons that claim 1 meets the criteria set out in PCT Article 33 (2)-(3):

(i) US 2018/0038660 to Munters Corporation [hereinafter Munters] is in the art of airstream cooling assemblies (abstract) and teaches a cooling system (Para. [0032], cooling system 110 at Fig. 1) comprising: an evaporator (Para. [0035], evaporator 212 at Fig. 1) containing a primary cooling medium (Para. [0035], cooling medium 202 at Fig. 3), the evaporator (evaporator 212) being configured to receive a process fluid (Para. [0032], return air 114 at Fig. 1) and, when receiving the process fluid (return air 114), to change the phase of the primary cooling medium (cooling medium 202) from liquid to gas (Para. [0035], cooling medium 202 is changed from a liquid to a gas); a passive condenser (Para. [0036], passive condenser 214 at Fig. 1) having an outer surface (Para. [0036], passive condenser 214 comprises an outer surface [unlabeled]) and being fluidly coupled to the evaporator (Para. [0008], passive condenser 214 is fluidly coupled to evaporator 212 at Fig. 1), the passive condenser (passive condenser 214) being configured to have an airstream directed over the outer surface thereof (Para. [0008], an airstream is directed over said outer surface of passive condenser 214), wherein, when the airstream is directed over the outer surface of the passive condenser (Para. [0008], an airstream is directed over said outer surface of passive condenser 214), the passive condenser (passive condenser 214) is configured (i) to receive the primary cooling medium (Para. [0008], passive condenser 214 is configured to receive cooling medium 202) in the gas phase from the evaporator (Para. [0008], in the gas phase from evaporator 212), (ii) to transfer heat from the primary cooling medium (Para. [0008], transfer heat from cooling medium 202), (iii) to change the phase of the primary cooling medium (cooling medium 202) from gas to liquid (Para. [0008], change cooling medium 202 from a gas to a liquid), and (iv) to supply the primary cooling medium (Para. [0008], supply cooling medium 202) in the liquid phase to the evaporator (Para. [0008], supply cooling medium 202 in the liquid phase to evaporator 212); a heat exchanger (Para. [0037], active condenser 216 at Fig. 1 is also referred to as a heat exchanger) fluidly coupled to the evaporator (active condenser 216 is fluidly coupled to evaporator 212 at Fig. 1) and configured to have a secondary cooling medium (Para. [0037], secondary cooling medium 208 at Fig. 4) selectively provided thereto such that: (a) when the secondary cooling medium (secondary cooling medium 208) is provided to the heat exchanger (Para. [0009], active condenser 216), at least some of the primary cooling medium (Para. [0009], cooling medium 202) in the gas phase switches from being received by the passive condenser (Para. [0009], passive condenser 214) to the heat exchanger (Para. [0009], active condenser 216) without operating any valves located between the evaporator (Para. [0009], evaporator 212) and the passive condenser (Para. [0009], passive condenser 214) and between the evaporator (Para. [0009], evaporator 212) and the heat exchanger (active condenser 216) and the heat exchanger (Para. [0009], active condenser 216) is configured (i) to receive the primary

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Supplemental Box

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Continuation of:

cooling medium (Para. [0009], cooling medium 202) in the gas phase from the evaporator (Para. [0009], evaporator 212), (ii) to transfer heat from the primary cooling medium (Para. [0009], cooling medium 202), (iii) to change the phase of the primary cooling medium (cooling medium 202) from gas to liquid (Para. [0009], change phase of cooling medium 202 from liquid to gas), and (iv) to supply the primary cooling medium (Para. [0011], cooling medium 202) in the liquid phase to the evaporator (Para. [0011], supply cooling medium 202 in liquid phase to evaporator 212).

Munters fails to explicitly disclose (b) when the secondary cooling medium is not provided to the heat exchanger, the heat exchanger does not supply the primary cooling medium in the liquid phase to the evaporator; and a flow control valve positioned in the flow path between the heat exchanger and the evaporator and in the flow path between the passive condenser and the evaporator, the flow control valve having a plurality of open positions and configured to control the flow of the primary cooling medium in the liquid phase into the evaporator, wherein the primary cooling medium circulates between the evaporator and the passive condenser and between the evaporator and the heat exchanger by natural circulation and gravity without a pump in the flow path of the primary cooling medium between the heat exchanger and the evaporator and between the passive condenser and the evaporator to circulate the primary cooling medium.

(ii) US 2011/0259573 to Ezawa et al. [hereinafter Ezawa] is in the art of cooling systems (abstract) and teaches a cooling system (Para. [0027], "cooling system" unlabeled at Fig. 1) comprising: an evaporator (Para. [0028], evaporator 24 at Fig. 1) containing a primary cooling medium (Para. [0029], "refrigerant"); a passive condenser (Para. [0028], condenser 28 at Fig. 1) having an outer surface (condenser 28 comprises an outer surface [unlabeled] at Fig. 1) and being fluidly coupled to the evaporator (condenser 28 is fluidly coupled to evaporator 24 at Fig. 1).

Ezawa fails to explicitly disclose wherein the evaporator being configured to receive a process fluid and, when receiving the process fluid, to change the phase of the primary cooling medium from liquid to gas; the passive condenser being configured to have an airstream directed over the outer surface thereof, wherein, when the airstream is directed over the outer surface of the passive condenser, the passive condenser is configured (i) to receive the primary cooling medium in the gas phase from the evaporator, (ii) to transfer heat from the primary cooling medium, (iii) to change the phase of the primary cooling medium from gas to liquid, and (iv) to supply the primary cooling medium in the liquid phase to the evaporator; a heat exchanger fluidly coupled to the evaporator and configured to have a secondary cooling medium selectively provided thereto such that: (a) when the secondary cooling medium is provided to the heat exchanger, at least some of the primary cooling medium in the gas phase switches from being received by the passive condenser to the heat exchanger without operating any valves located between the evaporator and the passive condenser and between the evaporator and the heat exchanger and the heat exchanger is configured (i) to receive the primary cooling medium in the gas phase from the evaporator, (ii) to transfer heat from the primary cooling medium, (iii) to change the phase of the primary cooling medium from gas to liquid, and (iv) to supply the primary cooling medium in the liquid phase to the evaporator; and (b) when the secondary cooling medium is not provided to the heat exchanger, the heat exchanger does not supply the primary cooling medium in the liquid phase to the evaporator; and a flow control valve positioned in the flow path between the heat exchanger and the evaporator and in the flow path between the passive condenser and the evaporator, the flow control valve having a plurality of open positions and configured to control the flow of the primary cooling medium in the liquid phase into the evaporator, wherein the primary cooling medium circulates between the evaporator and the passive condenser and between the evaporator and the heat exchanger by natural circulation and gravity without a pump in the flow path of the primary cooling medium between the heat exchanger and the evaporator and between the passive condenser and the evaporator to circulate the primary cooling medium.

None of the cited prior art teaches or fairly suggests (b) when the secondary cooling medium is not provided to the heat exchanger, the heat exchanger does not supply the primary cooling medium in the liquid phase to the evaporator; and a flow control valve positioned in the flow path between the heat exchanger and the evaporator and in the flow path between the passive condenser and the evaporator, the flow control valve having a plurality of open positions and configured to control the flow of the primary cooling medium in the liquid phase into the evaporator, wherein the primary cooling medium circulates between the evaporator and the passive condenser and between the evaporator and the heat exchanger by natural circulation and gravity without a pump in the flow path of the primary cooling medium between the heat exchanger and the evaporator and between the passive condenser and the evaporator to circulate the primary cooling medium.

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of:

Regarding claim 18, the prior art of record, individually or in combination, does not teach or fairly suggest a method of cooling a process fluid, the method comprising: directing a process fluid through an evaporator to transfer heat from the process fluid to a primary cooling medium contained in the evaporator and change the primary cooling medium from a liquid phase to a gas phase; selectively utilizing at least one of a heat exchanger and a passive condenser to change the primary cooling medium from the gas phase to the liquid phase by cooling the at least one of the heat exchanger and the passive condenser, each of the heat exchanger and the passive condenser being coupled to the evaporator to receive the primary cooling medium in the gas phase from the evaporator and supply the primary cooling medium in the liquid phase to the evaporator; controlling the liquid level in the evaporator; and circulating the primary cooling medium between the evaporator and the at least one of the heat exchanger and the passive condenser by natural circulation, wherein the heat exchanger is selected by initiating cooling of the heat exchanger and without operating any valves in the coupling between the evaporator and the passive condenser and in the coupling between the evaporator and the heat exchanger.

Claims 19-24 depend from claim 18, and therefore meet the criteria set out in PCT Article 33(2)-(3) for at least the same reasons as claim 18.

The following prior art is made of record to support and further define the reasons that claim 18 meets the criteria set out in PCT Article 33 (2)-(3):

(i) Munters is in the art of airstream cooling assemblies (abstract) and teaches a method of cooling a process fluid (Para. [0032], return air 114 at Fig. 1), the method comprising: directing a process fluid (return air 114) through an evaporator (Para. [0035], return air 114 is directed through evaporator 212 at Fig. 1) to transfer heat from the process fluid (return air 114) to a primary cooling medium (Para. [0035], cooling medium 202 at Fig. 3) contained in the evaporator (evaporator 212) and change the primary cooling medium (Para. [0035], cooling medium 202) from a liquid phase to a gas phase (Para. [0035], cooling medium 202 is changed from a liquid phase to a gas phase); selectively utilizing at least one of a heat exchanger (Para. [0037], active condenser 216 at Fig. 1 is also referred to as a heat exchanger) and a passive condenser (Para. [0036], passive condenser 214 at Fig. 1) to change the primary cooling medium (cooling medium 202) from the gas phase to the liquid phase (Para. [0036];[0037], active condenser 216 and passive condenser 214 change cooling medium 202 from the gas phase to the liquid phase) by cooling the at least one of the heat exchanger (active condenser 216) and the passive condenser (Para. [0036];[0037], passive condenser 214), each of the heat exchanger (active condenser 216) and the passive condenser (passive condenser 214) being coupled to the evaporator (active condenser 216 and passive condenser 214 are coupled to evaporator 212 at Fig. 1) to receive the primary cooling medium (Para. [0008], passive condenser 214 is configured to receive cooling medium 202) in the gas phase from the evaporator (Para. [0008], in the gas phase from evaporator 212) and supply the primary cooling medium (Para. [0008], supply cooling medium 202) in the liquid phase to the evaporator (Para. [0008], supply cooling medium 202 in the liquid phase to evaporator 212).

Munters fails to explicitly disclose the method of controlling the liquid level in the evaporator; and circulating the primary cooling medium between the evaporator and the at least one of the heat exchanger and the passive condenser by natural circulation, wherein the heat exchanger is selected by initiating cooling of the heat exchanger and without operating any valves in the coupling between the evaporator and the passive condenser and in the coupling between the evaporator and the heat exchanger.

(ii) Ezawa is in the art of cooling systems (abstract) and teaches a method of cooling (Para. [0027], "cooling system" unlabeled at Fig. 1), the method comprising: an evaporator (Para. [0028], evaporator 24 at Fig. 1) to transfer heat from a primary cooling medium (Para. [0029], "refrigerant"); selectively utilizing at least one of a heat exchanger (heat exchanger 30 at Fig. 1) and a passive condenser (Para. [0028], condenser 28 at Fig. 1).

Ezawa fails to explicitly disclose the method of cooling a process fluid, the method comprising: directing a process fluid through an evaporator to transfer heat from the process fluid to a primary cooling medium contained in the evaporator and change the primary cooling medium from a liquid phase to a gas phase; selectively utilizing at least one of a heat exchanger and a passive condenser to change the primary cooling medium from the gas phase to the liquid phase by cooling the at least one of the heat exchanger and the passive condenser, each of the heat exchanger and the passive condenser being coupled to the evaporator to receive the primary cooling medium in the gas phase from the evaporator and supply the primary cooling medium in the liquid phase to the evaporator; controlling the liquid level in the evaporator; and circulating the primary cooling medium between the evaporator and the at least one of the heat exchanger and the passive condenser by natural circulation, wherein the heat exchanger is selected by initiating cooling of the heat exchanger and without operating any valves in the coupling between the evaporator and the passive condenser and in the coupling between the evaporator and the heat exchanger.

None of the cited prior art teaches or fairly suggests the method of controlling the liquid level in the evaporator; and circulating the primary cooling medium between the evaporator and the at least one of the heat exchanger and the passive condenser by natural circulation, wherein the heat exchanger is selected by initiating cooling of the heat exchanger and without operating any valves in the coupling between the evaporator and the passive condenser and in the coupling between the evaporator and the heat exchanger.

Claims 1-24 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed can be made or used in industry.