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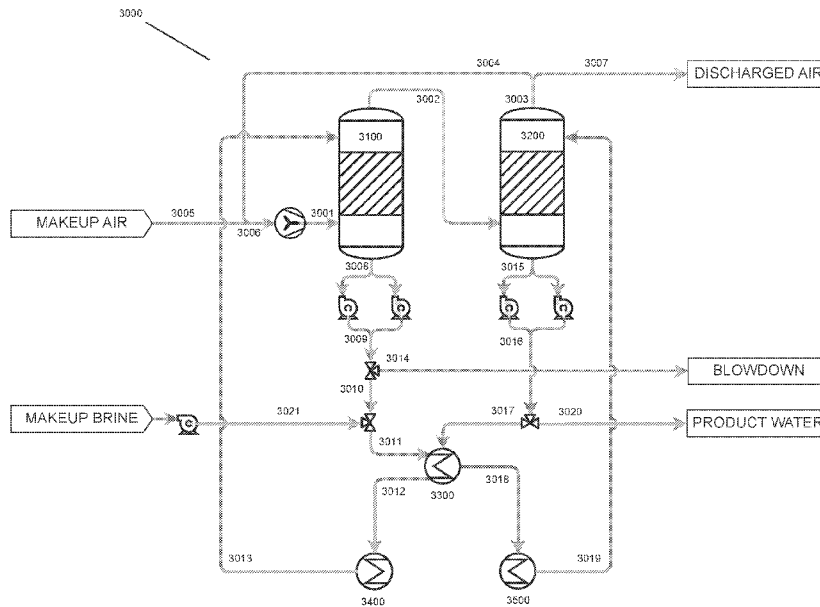
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(54) Title: METHODS AND SYSTEMS FOR DIRECT-CONTACT EVAPORATION AND CONDENSATION, AND DESALINATION METHODS AND SYSTEMS EMPLOYING THE SAME

FIG. 3



(57) Abstract: Direct-contact evaporators, suitable (for example) to humidify a stream of air, and direct-contact condensers, suitable (for example) to dehumidify a stream of air, are provided. In the disclosed direct-contact evaporators, heat and mass are transferred from a hot liquid stream to a cooler gas stream, while in the disclosed direct-contact condensers, heat and mass are transferred from a hot gas stream to a cooler liquid stream. Methods for humidifying and/or dehumidifying air and evaporating and/or condensing water using such direct-contact evaporators and condensers are also provided, as are humidification/dehumidification (HDH) water desalination systems comprising such direct-contact evaporators and condensers.

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- *with international search report (Art. 21(3))*
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INTERNATIONAL SEARCH REPORT

International application No.

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A. CLASSIFICATION OF SUBJECT MATTER

IPC - INV. B01D 5/00, C02F 1/04 (2023.01)

ADD. C02F 1/10, C02F 1/14, F24F 3/14, F24F 6/02 (2023.01)

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
See Search History document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
See Search History document

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2016/0039683 A1 (SALTWORKS TECHNOLOGIES INC.) 11 February 2016 (11.02.2016) entire document, especially Fig. 1; para [0040], [0068]-[0070]	1-4, 26-29, 45-47
A	US 2019/0344193 A1 (CEVAP TECHNOLOGY B.V.) 14 November 2019 (14.11.2019) entire document, especially Fig. 1, and 6-8; para [0024], [0065], [0066], [0068], [0074], [0090], [0102]	1-4, 26-29, 45-47
A	US 2017/0334737 A1 (GRADIANT CORPORATION) 23 November 2017 (23.11.2017) entire document, especially Fig. 1A; para [0018], [0081]-[0084]	1-4, 26-29, 45-47
A	US 3,640,850 A (SMITH, JR) 08 February 1972 (08.02.1972) entire document	1-4, 26-29, 45-47

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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"E" earlier application or patent but published on or after the international filing date	"&" document member of the same patent family
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"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 23/76864

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.: 5-25, 30-44, 48-58
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.