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US

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(81) Designated States (unless otherwise indicated, for every

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(54) Title: POWER GENERATION SYSTEM WITH ROTARY LIQUID PISTON COMPRESSOR FOR TRANSCRITICAL AND SUPERCRITICAL COMPRESSION OF FLUIDS

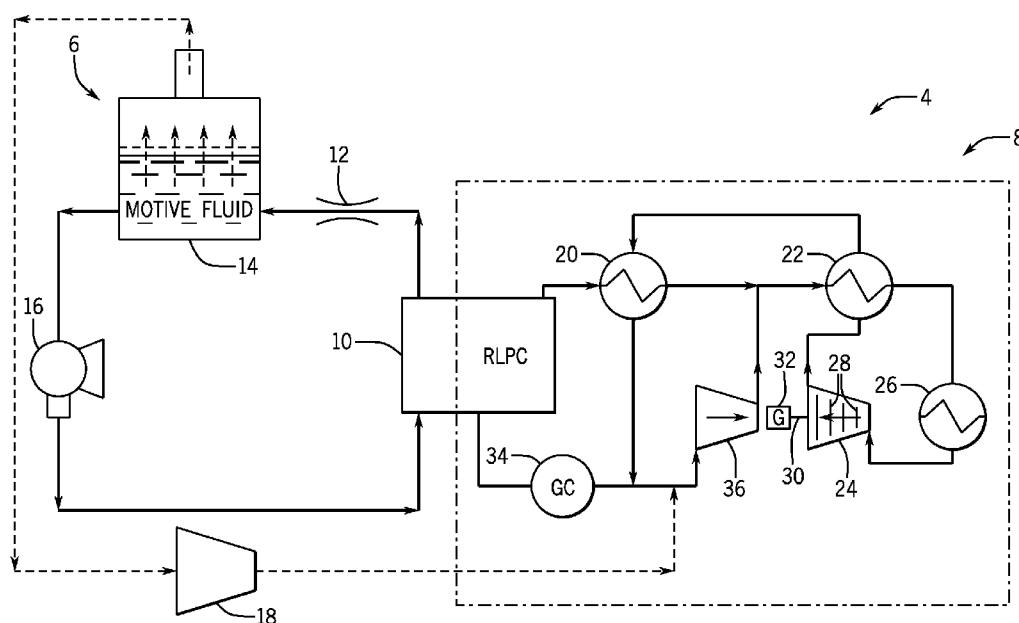


FIG. 2

(57) Abstract: A rotary liquid piston compressor and a power generation system including a first fluid loop. The first fluid loop includes a pump that circulates a liquid. A second fluid loop that generates power by circulating a supercritical fluid. The second fluid loop includes a turbine that rotates and powers a generator as the supercritical fluid flows through the turbine. A rotary liquid piston compressor fluidly coupled to the first fluid loop and the second fluid loop. The rotary liquid piston compressor exchanges pressure between the liquid circulating in the first fluid loop and the supercritical fluid circulating in the second fluid loop.

MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,  
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,  
KM, ML, MR, NE, SN, TD, TG).

**Declarations under Rule 4.17:**

- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

**Published:**

- *with international search report (Art. 21(3))*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

**(88) Date of publication of the international search report:**

13 February 2020 (13.02.2020)

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US2019/039334

## 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.:  
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:

see additional sheet

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 an 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.:

1-10

### 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.

## INTERNATIONAL SEARCH REPORT

International application No  
PCT/US2019/039334

## A. CLASSIFICATION OF SUBJECT MATTER

INV. F01K7/32 F01K25/08 F04F13/00  
ADD.

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)

F01K F04F

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

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

EPO-Internal, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                                       | Relevant to claim No. |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| A         | US 2004/250556 A1 (SIENEL TOBIAS H [US])<br>16 December 2004 (2004-12-16)<br>paragraph [0021] - paragraph [0042];<br>claims; figures<br>abstract         | 1-10                  |
| A         | US 5 336 059 A (ROWLEY C ALLEN [US])<br>9 August 1994 (1994-08-09)<br>column 3, line 46 - column 6, line 64;<br>claims; figures<br>abstract              | 1-10                  |
| A         | WO 2017/125251 A1 (LINDE AG [DE])<br>27 July 2017 (2017-07-27)<br>page 10, line 19 - page 15, line 3;<br>claims; figures; example 1; table 1<br>abstract | 1-10                  |
|           | -----<br>-/--                                                                                                                                            |                       |



Further documents are listed in the continuation of Box C.



See patent family annex.

\* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"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

"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

"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

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

21 October 2019

Date of mailing of the international search report

07/01/2020

Name and mailing address of the ISA/

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## INTERNATIONAL SEARCH REPORT

International application No

PCT/US2019/039334

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                                               | Relevant to claim No. |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| A         | US 2016/138649 A1 (ANDERSON DAVID DELOYD<br>[US] ET AL) 19 May 2016 (2016-05-19)<br>paragraph [0033] - paragraph [0073];<br>claims; figures<br>abstract<br>----- | 1-10                  |

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2019/039334

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s) | Publication<br>date       |
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| -----                                     |                     |                            |                           |

**FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210**

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-10

A power generation system with a first fluid loop and a second fluid loop

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2. claims: 11-16

A rotary liquid piston compressor with a rotor and a plurality of barriers

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3. claims: 17-20

A rotary liquid piston compressor with a rotor and a thermal management system

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