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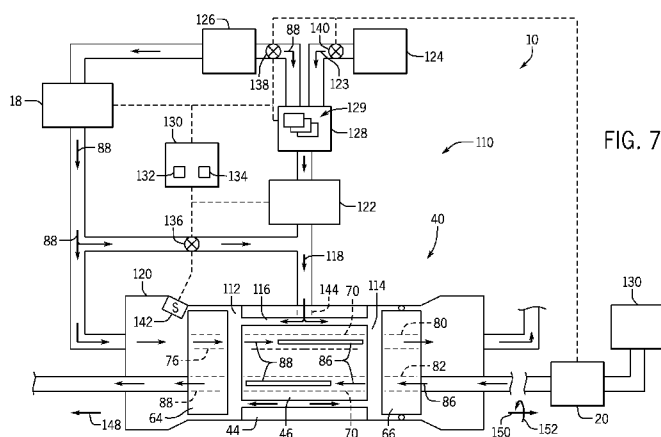
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(54) **Title:** ROTARY ISOBARIC PRESSURE EXCHANGER SYSTEM WITH LUBRICATION SYSTEM



(57) **Abstract:** A system including a frac system with a rotary isobaric pressure exchanger configured to exchange pressures between a first fluid and a second fluid, and a lubrication system configured to lubricate the rotary isobaric pressure exchanger.

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2014/073021

A. CLASSIFICATION OF SUBJECT MATTER
INV. F04F13/00 E21B43/26
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)

F04F E21B C09K E21C

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)

EP0-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.
Y	US 4 363 518 A (NAKAMURA JOJI ET AL) 14 December 1982 (1982-12-14) column 5, line 44 - column 7, line 23; figures 1,7	1-10
Y	----- US 2007/137170 A1 (BROSS STEPHAN [DE] ET AL) 21 June 2007 (2007-06-21) paragraphs [0005] - [0019], [0033] - [0039], [0046]; figures 1-5,10	1-10
Y	----- WO 96/17176 A1 (HAUGE LEIF J [NO]) 6 June 1996 (1996-06-06)	1-4,7,9
A	page 3, line 3 - line 23; figures 1,2 -----	5,6,8,10

☐

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

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Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/073021

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

Information on patent family members

International application No

PCT/US2014/073021

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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			WO 9617176 A1	06-06-1996

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 system, comprising:
a frac system, comprising:
a rotary isobaric pressure exchanger configured to exchange pressures between a first fluid and a second fluid; and
a lubrication system configured to lubricate the rotary isobaric pressure exchanger.

2. claims: 11-20

A system, comprising:
a lubrication system, comprising:
a pump configured to pump a fluid into a rotary isobaric pressure exchanger to lubricate an intermediate region between a rotor and a stator;
a sensor configured to detect whether the rotor is rotating with a speed within a threshold range; and
a controller in communication with the sensor and configured to control the pump in response to feedback from the sensor.
A method for lubricating the rotatory isobaric pressure exchanger as a function of the speed of the rotor.
