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[Continued on next page]

(54) **Title:** SYSTEMS AND METHODS OF USING SUBSEA FRAMES AS A HEAT EXCHANGER IN SUBSEA BOOSTING SYSTEMS

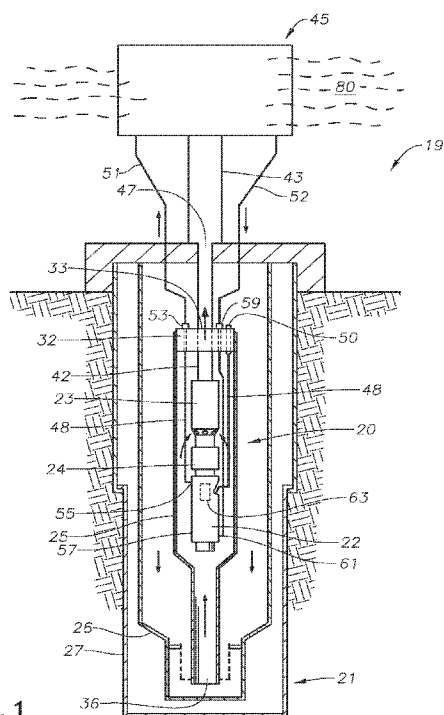


Fig. 1

(57) **Abstract:** Systems and methods of cooling a motor of an electrical submersible pump (ESP) assembly employed in an electrical submersible subsea booster pumping system, are provided. A supporting frame structure such as an ESP mounting skid or top end assembly of a caisson having structural members exposed to environmental seawater, is modified or designed to include fluid conduits within the structural members to establish lubricant pathways for lubricant to flow. A heated/hot lubricant line connects between a supporting structure lubricant inlet port and an ESP motor lubricant outlet port. A cooled lubricant line connects between a supporting structure lubricant outlet port and an ESP motor lubricant inlet port. A pump or other fluid moving device circulates lubricant from the ESP motor to the lubricant pathways within the supporting frame structure, whereby the seawater cools the lubricant contained therein, which is then circulated back into the motor to assisting cooling the motor.



TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:**Declarations under Rule 4.17:**

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- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

— *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))*

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/042042**A. CLASSIFICATION OF SUBJECT MATTER*****F04D 29/58(2006.01)i, F04D 29/06(2006.01)i, F04D 13/08(2006.01)i***

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)

F04D 29/58; E21B 7/00; F04D 13/06; F04B 49/00; H02K 9/00; E21B 36/00; H02K 5/132

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & Keywords: submersible pump, cooling, heat, transfer <or> exchange

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2010-0329908 A1 (MARTINEZ IGNACIO et al.) 30 December 2010 See paragraphs [0015]–[0016],[0018] and figure 3.	1–20
A	US 2009-0232664 A1 (QU RONGHAI et al.) 17 September 2009 See paragraph [0029] and figure 1.	1–20
A	US 2010-0300751 A1 (TAO CHEN et al.) 02 December 2010 See paragraphs [0025]–[0028] and figures 3–4.	1–20
A	US 2010-0129237 A1 (EIDE JORGEN et al.) 27 May 2010 See paragraphs [0001],[0016]–[0017] and figure 1.	1–20

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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

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"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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INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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