

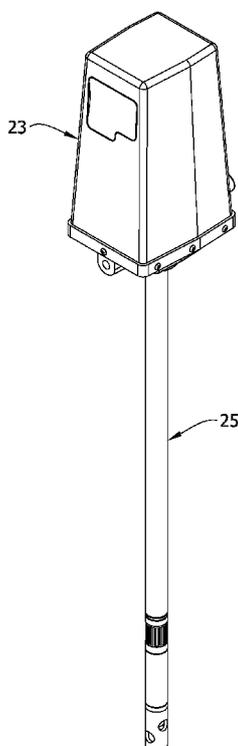


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[Continued on next page]

(54) Title: LANCE PUMP HAVING VERTICALLY MOUNTED STEPPER MOTOR

FIG. 1



(57) Abstract: A pump includes a pump body and an elongate tube. The pump includes an elongate core slidably received in the tube, a stepper motor having a selectively rotatable output shaft extending vertically and a transmission for effecting relative reciprocating motion between the core and the tube. The pump includes an inlet check valve mounted inside the core defining with the core an expansible and contractible lower pump chamber. The inlet check valve is oriented to open during each upward pumping stroke. The pump includes an annular upper chamber above the lower pump chamber and a lateral passage connecting the lower pump chamber to the annular upper chamber. The lateral passage has a check valve oriented to open during each downward pumping stroke. The pump includes an outlet passage connected to the annular upper chamber permitting viscous liquid to flow to the outlet passage on each upward and downward pumping stroke.



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, ML, MR, NE, SN, TD, TG).

Published:

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))*

- *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:

12 December 2013

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2013/030464

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - F04B 15/02 (2013.01)

USPC - 417/399

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)

IPC(8) - F04B 9/00, 13/00, 15/02, 17/00, 23/02, 53/00, 53/10, 53/12; F16N 13/00, 13/02, 13/06 (2013.01)

USPC - 91/281, 304, 313; 137/565.01, 565.17; 222/63, 251, 333, 372, 384, 385; 417/1, 399, 437

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
CPC- F04B 9/00, 13/00, 15/02, 17/00, 23/02, 53/00, 53/10, 53/12; F16N 13/00, 13/02, 13/06 (2013.01)

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

PatBase, Google Patents, Google, ProQuest

C. DOCUMENTS CONSIDERED TO BE RELEVANT.

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2008/0240944 A1 (ARENS) 02 October 2008 (02.10.2008) entire document	1-5, 7, 8, 13-16
Y	DE 196 23 537 A1 (MENTROP et al) 18 December 1997 (18.12.1997) entire document	1-5, 7, 8, 13-16
Y	US 4,718,824 A (CHOLET et al) 12 January 1988 (12.01.1988) entire document	2-5, 7, 8, 15, 16

 Further documents are listed in the continuation of Box C.

* 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

25 April 2013

Date of mailing of the international search report

27 SEP 2013

Name and mailing address of the ISA/US

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2013/030464

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.: 6, 9-12, 17-22
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.