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(74) Agent: TBK; Bavariaring 4-6, 80336 Munich (DE).

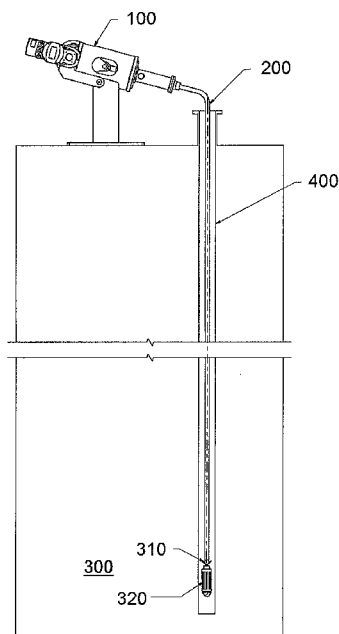
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[Continued on next page]

(54) Title: METHOD OF PUMPING FLUID

FIG. 1



(57) Abstract: Method of pumping fluid through a tubing (200) by operating a pulse generator (100) at one end of the tubing (200), the pulse generator (100) reciprocates a displacement member (30) at a frequency of less than 3 Hz to generate pressure waves in the fluid which make a pulse converter (300) at the other end of the tubing (200) permit a flow of the fluid into the tubing (200). Further, there are disclosed a pulse generator (100) for use in the pumping method, and a pump system comprising the pulse generator (100). Said pulse generator (100) comprises: a connector (10) for connecting the pulse generator (100) with a tubing (200) through which fluid is to be pumped; a reciprocally operable displacement member (30, 32, 34) for generating pressure waves in the fluid to be pumped, said displacement member (30, 32, 34) being arranged in a cavity (20); a discharge port (42) for discharging pumped fluid; and a delivery passage (40) for delivering the pumped fluid from the connector (10) to the discharge port (42); and a return passage (50) for returning fluid delivered through the delivery passage (40) to the cavity (20). The displacement member (30, 32, 34) is arranged in the cavity (20) close to the connector (10) so as to face the connector (10).



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

— *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))*

Published:

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

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2013/056686

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.:

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/EP2013/056686

A. CLASSIFICATION OF SUBJECT MATTER INV. F04B47/00 F04F7/00 E21B43/12 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 F04B E21B		
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.
X	US 2 355 618 A (BODINE JR ALBERT G) 15 August 1944 (1944-08-15) cited in the application figures 1,9	1-18
A	----- US 2009/000790 A1 (BERTANE MARK [US]) 1 January 2009 (2009-01-01) cited in the application paragraphs [0012], [0018]; figure 1 claim 20	1-18
A	----- US 4 460 320 A (BENTLEY ARTHUR P [US]) 17 July 1984 (1984-07-17) cited in the application the whole document ----- -/-	1-18
☒ 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 1 October 2013		Date of mailing of the international search report 04/11/2013
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Olona Laglera, C

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2013/056686

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2006/062413 A1 (CLAVIS IMPULSE TECHNOLOGY AS [NO]; SAGOV MAGOMET) 15 June 2006 (2006-06-15) cited in the application the whole document -----	1-18

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2013/056686

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2355618	A	15-08-1944	NONE
US 20090000790	A1	01-01-2009	NONE
US 4460320	A	17-07-1984	NONE
WO 2006062413	A1	15-06-2006	EP 1859167 A1 28-11-2007
			EP 2063123 A2 27-05-2009
			WO 2006062413 A1 15-06-2006

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

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

1. claims: 1-7

Method of pumping a fluid through a tubing by operating a pulse generator at one end of the tubing, wherein the pulse generator reciprocates a displacement member to generate pressure waves in the fluid which make a pulse converter at the other end of the tubing permit a flow of the fluid into the tubing. Said displacement member is reciprocated at a frequency of less than 3 Hz.

2. claims: 8-18

Pulse generator comprising: a connector for connecting the pulse generator with a tubing through which fluid is to be pumped; a reciprocally operable displacement member for generating pressure waves in the fluid to be pumped, said displacement member being so arranged in a cavity close to the connector as to face the connector; a discharge port for discharging pumped fluid; and a delivery passage for delivering the pumped fluid from the connector to the discharge port; and a return passage for returning fluid delivered through the delivery passage to the cavity.
