



(51) International Patent Classification:

F25J 1/02 (2006.01) *E21B 36/00* (2006.01)
E21B 43/12 (2006.01) *E21B 43/01* (2006.01)

(21) International Application Number:

PCT/EP2008/059845

(22) International Filing Date:

28 July 2008 (28.07.2008)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

07113440.7 30 July 2007 (30.07.2007) EP

(71) Applicant (for all designated States except US): **SHELL INTERNATIONAL RESEARCH MAATSCHAPPIJ B.V.** [NL/NL]; Carel van Bylandtlaan 30, NL-2596 HR The Hague (NL).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **PAULUS, Peter, Marie** [NL/NL]; Badhuisweg 3, NL-1031 CM Amsterdam (NL). **RUNBALK, David, Bertil** [SE/NL]; Carel van Bylandtlaan 23, NL-2596 HR The Hague (NL).

(74) Agent: **SHELL INTERNATIONAL B.V.**; Intellectual Property Services, PO Box 384, NL-2501 CJ The Hague (NL).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ,

CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, 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))

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:

12 November 2009

(54) Title: METHOD AND APPARATUS FOR COOLING A GASEOUS HYDROCARBON STREAM

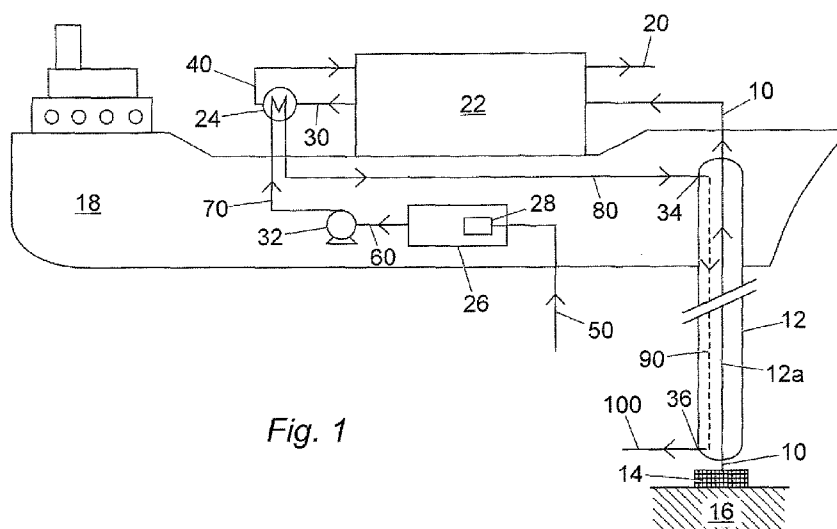


Fig. 1

(57) Abstract: A method of cooling a gaseous hydrocarbon stream (10) such as natural gas comprising at least the steps of: (a) sourcing the gaseous hydrocarbon stream (10) in an underwater pipeline (12) to a hydrocarbon facility at sea (18); (b) cooling the gaseous hydrocarbon stream (10) against one or more cooling streams (40) to remove heat from the gaseous hydrocarbon stream (10), and so provide a cooler hydrocarbon stream (20) and one or more warmer cooling streams (30); (c) using the heat of at least one warmer cooling stream (30) to heat the gaseous hydrocarbon stream (10) being sourced in the pipeline (12).

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2008/059845

A. CLASSIFICATION OF SUBJECT MATTER

INV. F25J1/02 E21B43/12 E21B36/00 E21B43/01

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)

F25J 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 practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EVA HEYMAN ET AL: "The LNG Gamechanger Technology" GASEX. GAS INFORMATION EXCHANGE CONFERENCE AND EXHIBITION, X, XX, no. 7th conf, 27 May 2002 (2002-05-27), -page 11pp, XP009096028 page 6, paragraph 6 page 7, paragraph 6 page 9, paragraph 2 page 10, paragraph 6 ----- -/--	1-14

☒ 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 document 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.
- *Z* document member of the same patent family

Date of the actual completion of the international search

12 August 2009

Date of mailing of the international search report

25/09/2009

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

Göritz, Dirk

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2008/059845

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	BERGER E ET AL: "THE SNOEHVIT PROJECT" BERICHTE AUS TECHNIK UND WISSENSCHAFT, LINDE AG. WIESBADEN, DE, no. 1, 1 January 2003 (2003-01-01), pages 12-23, XP001047549 ISSN: 0942-332X page 16, column 1, paragraph 5 page 17, column 2, paragraph 4 page 18, column 1, paragraphs 1,2 page 18, column 2, paragraph 3 figures 6,7	1-14
Y	US 6 415 866 B1 (BAUGH BENTON F [US]) 9 July 2002 (2002-07-09) column 2, line 18 - line 29 column 2, line 60 - column 3, line 5 column 4, line 15 - line 26	1-14
Y	US 2004/040716 A1 (BURSAUX GABRIEL ANDRE [US]) 4 March 2004 (2004-03-04) cited in the application paragraphs [0003], [0011], [0022], [0037]	1-14
A	JAGER M ET AL: "The key to success" 1 December 2004 (2004-12-01), INTERNATIONAL JOURNAL OF HYDROCARBON ENGINEERING, PALLADIAN PUBLICATIONS, ELSTEAD, GB, PAGE(S) 25 - 28 , XP009096888 ISSN: 1364-3177 page 26, column 2, paragraph 5	1-4,12, 13
A	AVIDAN A ET AL: "LNG LIQUEFACTION TECHNOLOGIES MOVE TOWARD GREATER EFFICIENCIES, LOWER EMISSIONS" OIL AND GAS JOURNAL, PENNWELL, HOUSTON, TX, US, vol. 100, no. 33, 19 August 2002 (2002-08-19), pages 60-68, XP001179182 ISSN: 0030-1388 page 67, column 3, last paragraph - page 68, column 1, paragraph 2	1-4,6, 12,13

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2008/059845

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6415866	B1	09-07-2002	NONE
US 2004040716	A1	04-03-2004	NONE