

(19)



(11)

**EP 1 956 287 A3**

(12)

**EUROPEAN PATENT APPLICATION**

(88) Date of publication A3:  
**09.12.2015 Bulletin 2015/50**

(51) Int Cl.:  
**F17C 13/00 (2006.01)**

(43) Date of publication A2:  
**13.08.2008 Bulletin 2008/33**

(21) Application number: **07007423.2**

(22) Date of filing: **11.04.2007**

(84) Designated Contracting States:  
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR**  
Designated Extension States:  
**AL BA HR MK RS**

- **Han, Sung Kon**  
**Geoje-si**  
**656-777 Gyeongsangnam-do (KR)**
- **Choi, Dong Kyu**  
**Geoje-si**  
**656-757 Gyeongsangnam-do (KR)**
- **Lee, Jung Han**  
**Gyeongsangnam-do 656-714 (KR)**

(30) Priority: **12.02.2007 KR 20070014405**

(71) Applicant: **DAEWOO SHIPBUILDING & MARINE ENGINEERING CO., LTD**  
**Seoul 100-180 (KR)**

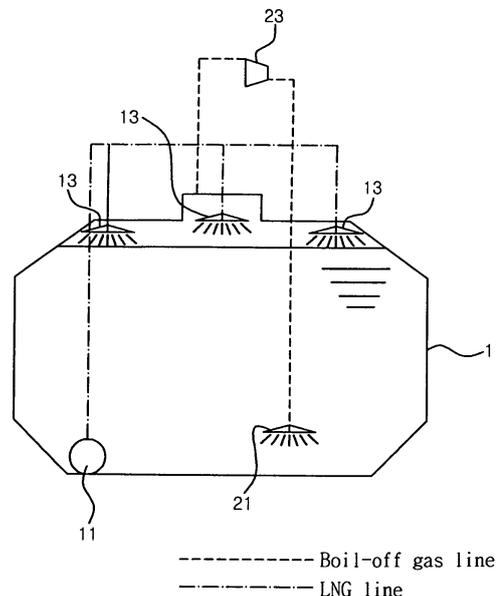
(74) Representative: **Bosch, Matthias et al**  
**Bosch Jehle**  
**Patentanwalts-gesellschaft mbH**  
**Flüggengstrasse 13**  
**80639 München (DE)**

(72) Inventors:  
• **Choi, Jung Ho**  
**Geoje-si**  
**656-220 Gyeongsangnam-do (KR)**

**(54) LNG tank and method of treating boil-off gas**

(57) An LNG storage tank and a method of treating boil-off gas using the same are disclosed. The LNG storage tank and the method of treating boil-off gas enable the pressure of the LNG storage tank to be maintained in a stable state without consuming boil-off gas generated in the LNG tank as propulsion fuel or without re-liquefying the boil-off gas. The storage tank comprises a thermal insulation wall, and has strengthened structure to permit a pressure increase resulting from heat influx to the LNG tank and boil-off gas generation. The method comprises permitting a pressure increase by the boil-off gas generation and LNG cargo temperature increase in the storage tank without treating the generated boil-off gas in the storage tank, so that the boil-off gas is accumulated without extracting or loss in the storage tank.

**Fig. 2**



**EP 1 956 287 A3**



**PARTIAL EUROPEAN SEARCH REPORT**

Application Number

under Rule 62a and/or 63 of the European Patent Convention.  
This report shall be considered, for the purposes of subsequent proceedings, as the European search report

EP 07 00 7423

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2005/183425 A1 (IMMEL RAINER [DE]) 25 August 2005 (2005-08-25) * paragraphs [0002] - [0004], [0023] - [0028], [0032] *	1-4,8,9, 11,12,14	INV. F17C13/00
X	WO 98/59164 A2 (EXXON PRODUCTION RESEARCH CO [US]) 30 December 1998 (1998-12-30) * pages 3,4; figure 3 * * pages 38,39 *	1-4,8,9, 11,12,14	
X	WO 00/58663 A1 (EXXONMOBIL UPSTREAM RES CO [US]) 5 October 2000 (2000-10-05) * page 1; figures 1-5 *	1-3,8,9, 11,12,14	
X	WO 03/053774 A1 (EXXONMOBIL UPSTREAM RES CO [US]) 3 July 2003 (2003-07-03) * paragraph [0003]; figure 1 *	1-3,8,9, 11,12,14	
X	US 3 453 836 A (KERR EMORY L) 8 July 1969 (1969-07-08) * column 2 - column 4; figures 1-3 *	1,5-7,9, 13	
	----- -/--		TECHNICAL FIELDS SEARCHED (IPC) F17C
<b>INCOMPLETE SEARCH</b>			
The Search Division considers that the present application, or one or more of its claims, does/do not comply with the EPC so that only a partial search (R.62a, 63) has been carried out.			
Claims searched completely :			
Claims searched incompletely :			
Claims not searched :			
Reason for the limitation of the search: see sheet C			
Place of search Munich		Date of completion of the search 21 October 2015	Examiner Nicol, Boris
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... & : member of the same patent family, corresponding document	

EPO FORM 1503 03.02 (P04E07)



PARTIAL EUROPEAN SEARCH REPORT

Application Number  
EP 07 00 7423

5

10

15

20

25

30

35

40

45

50

55

EPO FORM 1503 03.02 (P04C10) 2

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (IPC)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
X	US 2 790 307 A (AYRES ELWYN C) 30 April 1957 (1957-04-30) * column 1 - column 6; figures 1,5 * -----	1,5-7,9, 13	
X	WO 99/50537 A1 (EXXON PRODUCTION RESEARCH CO [US]) 7 October 1999 (1999-10-07) * pages 4-8; figures 1,2 * -----	9-20	
			TECHNICAL FIELDS SEARCHED (IPC)



**INCOMPLETE SEARCH  
SHEET C**

Application Number  
EP 07 00 7423

5

10

Claim(s) completely searchable:  
1-9, 11-20

Claim(s) not searched:  
10

15

Reason for the limitation of the search:

The search has been restricted to the subject-matter indicated by the applicant in his letter of 26-05-2015 filed in reply to the invitation pursuant to Rule 62a(1) and/or Rule 63(1) EPC.

20

25

30

35

40

45

50

55



5

10

15

20

25

30

35

40

45

50

55

**CLAIMS INCURRING FEES**

The present European patent application comprised at the time of filing claims for which payment was due.

- Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):
  
- No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

**LACK OF UNITY OF INVENTION**

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

- All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.
- Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:  

1-9, 11-20
- None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

- The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).



**LACK OF UNITY OF INVENTION  
SHEET B**

Application Number

EP 07 00 7423

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-4, 8, 9, 11, 12, 14

An LNG storage tank according to claim 1, wherein the LNG storage tank is designed to withstand a certain pressure range, or wherein a reinforcing steel structure is added, and corresponding methods.

The problem to be solved is to build an LNG tank able to withstand higher pressure range.

---

2. claims: 5-7, 13

An LNG storage tank according to claim 1, wherein a temperature distribution in the LNG storage tank is uniformly maintained, or wherein boil-off gas having a higher temperature at an upper portion of the LNG storage tank is injected into a lower portion of the LNG storage tank having a lower temperature and LNG having a lower temperature at the lower portion of the LNG storage tank is sprayed into the upper portion of the LNG storage tank having a higher temperature, and corresponding method.

The problem to be solved is to reduce boil-off generation within the storage tank by homogenising the temperature.

---

3. claims: 15-20

A method of treating the boil-off gas according to claim 9, wherein the boil-off gas accumulated in the LNG storage tank (of claim 1), which is specified as an LNG carrier is treated at an unloading terminal after the LNG carrier arrives at a destination, and details of treating the boil-off in the said terminal.

The problem to be solved is to unload boil-off accumulated in the LNG tank in a more efficient manner.

---

ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.

EP 07 00 7423

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
The members are as contained in the European Patent Office EDP file on  
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

10

21-10-2015

15

20

25

30

35

40

45

50

55

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2005183425 A1	25-08-2005	DE 102005007551 A1	15-09-2005
		US 2005183425 A1	25-08-2005
-----			
WO 9859164 A2	30-12-1998	AR 013106 A1	13-12-2000
		AU 733821 B2	24-05-2001
		AU 8152498 A	04-01-1999
		BR 9810203 A	05-09-2000
		CA 2293774 A1	30-12-1998
		CH 694326 A5	30-11-2004
		CH 694893 A5	31-08-2005
		CN 1261951 A	02-08-2000
		DE 19882491 T1	27-07-2000
		DK 179899 A	18-02-2000
		EP 0990105 A2	05-04-2000
		ES 2187228 A1	16-05-2003
		FI 992702 A	14-01-2000
		GB 2345123 A	28-06-2000
		HU 0003430 A2	28-02-2001
		ID 27349 A	05-04-2001
		IL 133333 A	28-03-2004
		JP 2001508727 A	03-07-2001
		KR 20010014037 A	26-02-2001
		NO 996357 A	21-02-2000
		NZ 502047 A	27-07-2001
		PL 339553 A1	18-12-2000
		RU 2208747 C2	20-07-2003
		SK 178399 A3	12-09-2000
		TR 9903168 T2	21-06-2000
		TW 444109 B	01-07-2001
		US 6058713 A	09-05-2000
		WO 9859164 A2	30-12-1998
-----			
WO 0058663 A1	05-10-2000	AR 023217 A1	04-09-2002
		AU 763622 B2	31-07-2003
		AU 3746400 A	16-10-2000
		CA 2366962 A1	05-10-2000
		CO 5190729 A1	29-08-2002
		EG 22634 A	31-05-2003
		GC 0000127 A	29-06-2005
		MX PA01009651 A	20-08-2002
		MY 116803 A	31-03-2004
		NO 20014723 A	30-11-2001
		OA 12039 A	02-05-2006
		PE 00952001 A1	01-03-2001
		RU 2233401 C2	27-07-2004
		TN SN00063 A1	03-04-2003

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.

EP 07 00 7423

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
The members are as contained in the European Patent Office EDP file on  
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

21-10-2015

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		TW 463022 B	11-11-2001
		US 6237347 B1	29-05-2001
		WO 0058663 A1	05-10-2000
WO 03053774	A1 03-07-2003	AU 2002353116 A1	09-07-2003
		CN 1602265 A	30-03-2005
		EP 1461240 A1	29-09-2004
		JP 2005512883 A	12-05-2005
		KR 20040064299 A	16-07-2004
		US 2003136132 A1	24-07-2003
		WO 03053774 A1	03-07-2003
US 3453836	A 08-07-1969	NONE	
US 2790307	A 30-04-1957	NONE	
WO 9950537	A1 07-10-1999	AU 3203499 A	18-10-1999
		BR 9909114 A	12-12-2000
		CN 1295646 A	16-05-2001
		EP 1075588 A1	14-02-2001
		HR P20000631 A2	30-04-2001
		ID 26796 A	08-02-2001
		IL 138470 A	23-11-2003
		JP 2002510011 A	02-04-2002
		TR 200002792 T2	21-02-2001
		TW 432192 B	01-05-2001
		US 6089028 A	18-07-2000
		WO 9950537 A1	07-10-1999

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82