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Datasheet for the decision of 28 April 2021

Case Number: T 2371/18 - 3.2.03

Application Number: 12155832.4

Publication Number: 2508830

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Language of the proceedings: EN

Title of invention:
Vertical heat exchanger configuration for LNG facility

Patent Proprietor:
ConocoPhillips Company

Opponent:
Linde GmbH

Headword:

Relevant legal provisions:
EPC Art. 76(1), 100(c), 111, 113
RPBA 2020 Art. 11
RPBA Art. 13(1)

Keyword:
Divisional application - subject-matter extends beyond content of earlier application (yes)
Grounds for opposition - subject-matter extends beyond content of earlier application (yes)
Appeal decision - remittal to the department of first instance (yes)
Remittal - special reasons for remittal
Late-filed auxiliary requests - justification for late filing (no) - amendments after arrangement of oral proceedings

Decisions cited:
R 0004/17, G 0007/93

Catchword:

Europäisches Patentamt
European Patent Office
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Beschwerdekammern

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Case Number: T 2371/18 - 3.2.03

D E C I S I O N
of Technical Board of Appeal 3.2.03
of 28 April 2021

Appellant: (Patent Proprietor)	ConocoPhillips Company 925 N. Eldridge Parkway Houston, Texas 77079 (US)
Representative:	Wynne-Jones IP Limited 2nd Floor, 5210 Valiant Court Gloucester Business Park Gloucester Gloucestershire GL3 4FE (GB)
Appellant: (Opponent)	Linde GmbH Dr.-Carl-von-Linde-Straße 6-14 82049 Pullach (DE)
Representative:	Imhof, Dietmar Linde GmbH Intellectual Property EMEA Dr.-Carl-von-Linde-Straße 6-14 82049 Pullach (DE)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 18 July 2018 concerning maintenance of the European Patent No. 2508830 in amended form.**

Composition of the Board:

Chairman	C. Donnelly
Members:	R. Baltanás y Jorge
	N. Obrovski

Summary of Facts and Submissions

I. European patent No. 2 508 830 ("the patent") relates to a "Vertical heat exchanger configuration for LNG facility". The patent is a divisional application of the earlier application 05807290.1 ("the parent application") in accordance with Article 76 EPC. The parent application is derived from the international patent application PCT/US2005036846.

II. An opposition was filed against the patent, which was based on Article 100(b) EPC, Article 100(c) EPC, and Article 100(a) EPC together with Articles 54 and 56 EPC.

III. In the summons to attend oral proceedings before the opposition division scheduled for 7 March 2018, the opposition division set 7 February 2018 as the final date for making written submissions and/or amendments under Rule 116(1) EPC. Both parties made written submissions shortly before the expiry of this deadline; the patent proprietor on 6 February 2018, including a new auxiliary request I, and the opponent on 7 February 2018. The opposition division notified the opponent of the patent proprietor's submission by registered letter of 12 February 2018, and the opponent stated that they took note of that submission on 13 February 2018. On 20 February 2018, the opponent requested that auxiliary request I not be admitted into the proceedings or, as an auxiliary request, that the oral proceedings before the opposition division be postponed. With communication of 28 February 2018, the opposition division informed the parties that the date fixed for oral proceedings was maintained. After having heard the parties during the oral proceedings on

whether to admit auxiliary request I, the opposition division admitted that request into the opposition proceedings.

IV. The present appeal lies from the interlocutory decision of the opposition division to maintain the patent as amended according to auxiliary request I. With regard to the patent as granted, the opposition division considered that claim 1 did not comply with Article 76(1) EPC since it comprised subject-matter which extended beyond the scope of the originally filed parent application.

Both the opponent and the patent proprietor filed an appeal against the above-mentioned interlocutory decision of the opposition division. Since both parties are simultaneously appellant and respondent, the Board refers to them as opponent and patent proprietor for the sake of simplicity.

In a communication dated 17 October 2019, pursuant to Article 15(1) of the Rules of Procedure of the Boards of Appeal 2007 (RPBA 2007), the Board indicated its preliminary opinion of the case.

Oral proceedings were held on 28 April 2021.

V. Requests

The patent proprietor requested, as a main request, that the decision under appeal be set aside and that the case be remitted to the opposition division for further prosecution in respect of the patent as granted concerning the grounds of opposition based on Articles 100(a) and (b) EPC. As an auxiliary request, the patent proprietor requested that the patent be maintained in

amended form on the basis of auxiliary requests I, II, II "new", III, IV or V.

The opponent requested that the decision under appeal be set aside and that the patent be revoked or, as an auxiliary request, that auxiliary request I not be admitted into the proceedings, that the case be remitted to the opposition division in a different composition, and that the appeal fee be reimbursed.

VI. Claim 1 as granted, including the numbering of its features as adopted by the parties (marked in bold), reads as follows:

"*A method of transferring heat from a cooled fluid to a refrigerant, said method comprising:*

(a) providing a heat exchanger (10) comprising:

a shell defining an internal volume, said internal volume having a maximum height (H) and a maximum width (W), said internal volume having a H/W ratio greater than 1; and
at least one plate-fin core (14) disposed in the internal volume, said core (18) being spaced from the top, bottom and sides of the shell,
said shell comprising a substantially cylindrical sidewall (16), a normally-upper end cap (18), and a normally-lower end cap (20), said upper and lower end caps being disposed on generally opposite ends of the sidewall,
said sidewall defining a fluid inlet (26) for receiving a shell-side fluid into the internal volume,
said normally-upper end cap defining a vapor outlet (28) for discharging gas-phase shell-side fluid

from the internal volume,
said normally-lower end cap defining a liquid outlet (30) for discharging liquid-phase shell-side fluid from the internal volume;

(b) introducing the refrigerant into said internal volume defined within said shell;

(c) introducing the cooled fluid into said plate-fin core disposed within said internal volume of said shell; and

(d)
(d1) *transferring heat from the cooled fluid in said core to the refrigerant in said shell via indirect heat exchange,*
(d2) *including vaporizing at least a portion of said refrigerant,*
(d3) *causing a thermosiphon effect in the core; and*

(e)
(e1) *maintaining the level of liquid-phase refrigerant in said shell at an elevation such that the core is partially submerged,*
(e2) *at least 50% of the height of the core being submerged in the liquid-phase refrigerant;*
(e3) *said core defining a plurality of core-side passageways (B) and a plurality of shell-side passageways (A), said core-side and shell-side passageways*
(e4) *being fluidly isolated from one another,*
(e5) *said shell-side passageways (A) presenting a normally-lower inlet and a normally-upper outlet, said shell-side (A) passageways*

extending from the normally-lower inlet to the normally-upper outlet,

(e6) *and wherein the space between the bottom of the core and the bottom of the internal volume is provided in order to ensure proper availability of the liquid shell-side fluid to the normally lower inlets of the shell-side passageways.*"

Dependent claims 2 to 12 concern preferred embodiments of the method of transferring heat of claim 1.

VII. Claim 1 of auxiliary request I (the amendments with regard to granted claim 1 have been marked in bold) reads as follows:

"*A method of transferring heat from a cooled fluid to a refrigerant, said method comprising:*

(a) providing a heat exchanger (10) comprising:

a shell ***(12)*** *defining an internal volume* ***(24) for receiving a core (14) and a shell-side fluid (A),*** *said internal volume* ***(24)*** *having a maximum height* ***(Y1),*** *and a maximum width* ***(X1),*** *said internal volume* ***(24)*** *having a* ***Y1/X1*** *ratio greater than 1; and*
at least one plate-fin core (14) disposed in the internal volume ***(24),*** *said core (1****4****) being spaced from the top, bottom, and sides of the shell, said shell* ***(12)*** *comprising a substantially cylindrical sidewall (16)* ***that extends along a central sidewall axis (22), said central sidewall axis (22) being substantially upright, wherein the maximum height (Y1) is measured parallel to the direction of extension of the central sidewall axis***

(22) in the range 2-60 ft. (0.6-18.3 m); and the maximum width (X1) measured perpendicular to the direction of extension of the central sidewall axis (22) in the range 1-30 ft. (0.3-9.2 m),
a normally-upper end cap (18), and a normally-lower end cap (20), said upper and lower end caps ***(18, 20)*** *being* ***coupled to*** *generally opposite ends of the sidewall* ***(16),***
said sidewall ***(16)*** *defining a* ***shell-side*** *fluid inlet (26) for* ***introducing*** *a shell side fluid* ***stream (Ain)*** *into the internal volume (24),*
said normally-upper end cap ***(18)*** *defining a vapor outlet (28) for discharging gas-phase shell-side fluid* ***(Av-out)*** *from the internal volume* ***(24),***
said normally-lower end cap ***(20)*** *defining a liquid outlet (30) for discharging liquid-phase shell-side fluid* ***(AL-out)*** *from the internal volume* ***(24);***

(b) introducing the refrigerant ***(A)*** *into* ***the*** *internal volume****(24)*** *defined within said shell (12);*

(c) introducing the cooled fluid ***(B)*** *into said plate-fin core* ***(14)*** *disposed within* ***the*** *internal volume* ***(24)*** *of* ***the*** *shell* ***(12);*** *and*

(d) transferring heat from the cooled fluid ***(B)*** *in said core* ***(14)*** *to the refrigerant* ***(A)*** *in said shell* ***(12)*** *via indirect heat exchange, including vaporizing at least a portion of said refrigerant* ***(A),*** *causing a thermosiphon effect in the core* ***(14);*** *and*

(e) maintaining the level ***(46)*** *of liquid-phase refrigerant* ***(A)*** *in said shell* ***(12)*** *at an elevation such that the core* ***(14)*** *is partially submerged,*
wherein the ratio of the height (Y6) of the core (14) submerged in the liquid-phase refrigerant (A)

to the maximum height (Y2) of the core (14) is in the range 0.5-0.98; *said core* ***(14) comprising a plurality of spaced-apart plate/fin dividers 40*** *defining a plurality of* ***alternating*** *core-side passageways* ***(42a,b)*** *and* ***[a plurality of]*** *shell-side passageways* ***(44a,b) that extend in a direction that is substantially parallel to the direction of extension of the central sidewall axis (22), said core-side and shell-side passageways (42,44)*** *being fluidly isolated from one another, said shell-side passageways* ***(44) including opposite open ends that provide for fluid communication with the internal volume (24), and*** *presenting a normally-lower inlet and a normally-upper outlet, said shell side passageways* ***(44)*** *extending from the normally-lower inlet to the normally-upper outlet, and* ***wherein the maximum*** *space* ***(Y3) measured parallel to the direction of extension of the central sidewall axis (22)*** *between the bottom of the core* ***(14)*** *and the bottom of the internal volume* ***(24)*** *is* ***[provided] greater than 2 ft. (0.6 m), and the ratio Y3/Y1 is greater than 0.15*** *in order to ensure proper availability of the liquid shell-side fluid* ***(A)*** *to the normally lower inlets of the shell side passageways* ***(44),***

wherein:

the core (14) has a maximum height (Y2) measured parallel to the direction of extension of the central sidewall axis (22) in the range 1-40 ft. (0.3-12.2 m), and a minimum width (X2) measured perpendicular to the direction of extension of the central sidewall axis (22) in the range 0.5-20 ft. (0.15-6.1 m), and having a Y2/X2 ratio in the range

0.25-4, a Y2/X1 ratio of less than 0.95, and a Y2/Y1 ratio of less than 0.75;
a core-side fluid inlet (32) extending through the sidewall (16) is fluidly coupled to an inlet header (34) to provide for introduction of a core-side fluid feed stream (Bin), and a core side fluid outlet (36) is fluidly coupled to an outlet header (38) and extends through the sidewall (16) to provide for discharge of the core-side fluid (Bout), the core-side passageways (42) receiving the core-side fluid (B) from the inlet header (36) and discharge core-side fluid into the outlet header (38); and
the maximum space (Y4) measured parallel to the direction of extension of the central sidewall axis (22) between the top of the core (14) and the top of the internal volume (24) is greater than 2 ft. (0.6 m), and the ratio Y4/Y1 is greater than 0.15 in order to ensure proper disengagement of the entrained liquid-phase shell-side fluid in the gaseous shell-side fluid exiting the vapor outlet (28)."

VIII. Claim 1 of auxiliary request II "new" (the amendments with regard to claim 1 of auxiliary request I have been marked in bold) reads as follows:

"*A method of transferring heat from a cooled fluid to a refrigerant, said method comprising:*

(a) providing a heat exchanger (10) comprising:

a shell (12) defining an internal volume (24) for receiving a core (14) and a shell-side fluid (A), said internal volume (24) having a maximum height (Y1), and a maximum width (X1), said internal

volume (24) having a Y1/X1 ratio greater than 1; and
at least one plate-fin core (14) disposed in the internal volume (24), said core (14) being spaced from the top, bottom, and sides of the shell,
said shell (12) comprising a substantially cylindrical sidewall (16) that extends along a central sidewall axis (22), said central sidewall axis (22) being substantially upright, wherein the maximum height (Y1) is measured parallel to the direction of extension of the central sidewall axis (22) in the range 2-60 ft. (0.6-18.3 m); and the maximum width (X1) measured perpendicular to the direction of extension of the central sidewall axis (22) in the range 1-30 ft. (0.3-9.2 m),
a normally-upper end cap (18), and a normally-lower end cap (20), said upper and lower end caps (18, 20) being coupled to generally opposite ends of the sidewall (16),
said sidewall (16) defining a shell-side fluid inlet (26) for introducing a shell side fluid stream (Ain) into the internal volume (24),
said normally-upper end cap (18) defining a vapor outlet (28) for discharging gas-phase shell-side fluid (Av-out) from the internal volume (24),
said normally-lower end cap (20) defining a liquid outlet (30) for discharging liquid-phase shell-side fluid (AL-out) from the internal volume (24);

(b) *introducing the refrigerant (A) into the internal volume(24) defined within said shell (12);*

(c) *introducing the cooled fluid (B) into said plate-fin core (14) disposed within the internal volume (24) of the shell (12); and*

(d) transferring heat from the cooled fluid (B) in said core (14) to the refrigerant (A) in said shell (12) via indirect heat exchange, including vaporizing at least a portion of said refrigerant (A), causing a thermosiphon effect in the core (14); and

(e) maintaining the level (46) of liquid-phase refrigerant (A) in said shell (12) at an elevation such that the core (14) is partially submerged, wherein the ratio of the height (Y6) of the core (14) submerged in the liquid-phase refrigerant (A) to the maximum height (Y2) of the core (14) is in the range 0.5-0.98; said core (14) comprising a plurality of spaced-apart plate/fin dividers 40 defining a plurality of alternating core-side passageways (42a,b) and [a plurality of] shell-side passageways (44a,b) that extend in a direction that is substantially parallel to the direction of extension of the central sidewall axis (22), said core-side and shell-side passageways (42,44) being fluidly isolated from one another, said shell-side passageways (44) including opposite open ends that provide for fluid communication with the internal volume (24), and presenting a normally-lower inlet and a normally-upper outlet, said shell side passageways (44) extending from the normally-lower inlet to the normally-upper outlet, and wherein the maximum space (Y3) measured parallel to the direction of extension of the central sidewall axis (22) between the bottom of the core (14) and the bottom of the internal volume (24) is [provided] greater than 2 ft. (0.6 m), and the ratio Y3/Y1 is greater than 0.15 in order to ensure proper availability of the liquid shell-side fluid (A) to the normally lower inlets of the shell side passageways (44),

wherein:

the core (14) has a maximum height (Y2) measured parallel to the direction of extension of the central sidewall axis (22) in the range 1-40 ft. (0.3-12.2 m), and a minimum width (X2) measured perpendicular to the direction of extension of the central sidewall axis (22) in the range 0.5-20 ft. (0.15-6.1 m), and having a Y2/X2 ratio in the range 0.25-4, a Y2/X1 ratio of less than 0.95, and a Y2/Y1 ratio of less than 0.75;
a core-side fluid inlet (32) extending through the sidewall (16) is fluidly coupled to an inlet header (34) to provide for introduction of a core-side fluid feed stream (Bin), and a core side fluid outlet (36) is fluidly coupled to an outlet header (38) and extends through the sidewall (16) to provide for discharge of the core-side fluid (Bout), the core-side passageways (42) receiving the core-side fluid (B) from the inlet header (36) and discharge core-side fluid into the outlet header (38); and
the maximum space (Y4) measured parallel to the direction of extension of the central sidewall axis (22) between the top of the core (14) and the top of the internal volume (24) is greater than 2 ft. (0.6 m), and the ratio Y4/Y1 is greater than 0.15 in order to ensure proper disengagement of the entrained liquid-phase shell-side fluid in the gaseous shell-side fluid exiting the vapor outlet (28); ***and wherein the ratio of the height Y5 of the fluid inlet (26) from the bottom of the core 14 to the maximum height Y2 of the core is 0.5-1.***"

IX. Claim 1 of auxiliary request II "old" (the amendments with regard to granted claim 1 have been marked in bold) reads as follows:

"*A method of transferring heat from a cooled fluid to a refrigerant* ***in a process for liquefying a natural gas stream,*** *said method comprising:*

(a) providing a heat exchanger comprising:

a shell defining an internal volume, said internal volume having a maximum height (H) and a maximum width (W), said internal volume having a H/W ratio greater than 1; and
at least one plate-fin core disposed in the internal volume, said core being spaced from the top, bottom, and sides of the shell,
said shell comprising a substantially cylindrical sidewall, a normally-upper end cap, and a normally-lower end cap, said upper and lower end caps being disposed on generally opposite ends of the sidewall,
said sidewall defining a fluid inlet for receiving a shell-side fluid into the internal volume,
said normally-upper end cap defining a vapor outlet for discharging gas-phase shell-side fluid from the internal volume,
said normally-lower end cap defining a liquid outlet for discharging liquid phase shell-side fluid from the internal volume

(b) introducing the refrigerant into an internal volume defined within said shell;

(c) introducing the cooled fluid into said plate-fin core disposed within the internal volume of the shell; and

(d) transferring heat from the cooled fluid in said core to the refrigerant in said shell via indirect heat exchange, including vaporizing at least a portion of said refrigerant, causing a thermosiphon effect in the core; and

(e) *maintaining the level of liquid-phase refrigerant in said shell at an elevation such that the core is partially submerged, at least 50% of the height of the core is submerged in the liquid-phase refrigerant; said core defining a plurality of core-side passageways and a plurality of shell-side passageways, said core-side and shell-side passageways are fluidly isolated from one another, said shell-side passageways present a normally-lower inlet and a normally-upper outlet, said shell-side passageways extending from the normally-lower inlet to the normally-upper outlet, and wherein the space between the bottom of the core and the bottom of the internal volume is provided in order to ensure proper availability of the liquid shell-side fluid to the normally lower inlets of the shell side passageways.*"

X. Claim 1 of auxiliary request III (the amendments with regard to granted claim 1 have been marked in bold) reads as follows:

"*A method of transferring heat from a cooled fluid to a refrigerant* ***in a process for liquefying a natural gas stream****, said method comprising:*

(a) providing a heat exchanger comprising:

a shell defining an internal volume, said internal volume having a maximum height (H) and a maximum width (W), said internal volume having a H/W ratio greater than 1; and
at least one plate-fin core disposed in the internal volume, said core being spaced from the top, bottom, and sides of the shell,
said shell comprising a substantially cylindrical sidewall, a normally-upper end cap, and a normally-lower end cap, said upper and lower end caps being disposed on generally opposite ends of the sidewall,
said sidewall defining a fluid inlet for receiving a shell-side fluid into the internal volume,
said normally-upper end cap defining a vapor outlet for discharging gas-phase shell-side fluid from the internal volume,
said normally-lower end cap defining a liquid outlet for discharging liquid phase shell-side fluid from the internal volume

(b) introducing the refrigerant into an internal volume defined within said shell;

(c) introducing the cooled fluid into said plate-fin core disposed within the internal volume of the shell; and

(d) transferring heat from the cooled fluid in said core to the refrigerant in said shell via indirect heat exchange, including vaporizing at least a portion of said refrigerant, causing a thermosiphon effect in the core; and

(e) maintaining the level of liquid-phase refrigerant in said shell at an elevation such that the core is partially submerged, at least ~~***50***~~ ***75-95****% of the height of the core is submerged in the liquid-phase refrigerant,* ***step (b) including introducing said refrigerant into the internal volume at a location above the level of the liquid-phase refrigerant in the shell;***

said core defining a plurality of core-side passageways and a plurality of shell-side passageways, said core-side and shell-side passageways are fluidly isolated from one another, said shell-side passageways present a normally-lower inlet and a normally-upper outlet, said shell-side passageways extending from the normally-lower inlet to the normally-upper outlet, and wherein the space between the bottom of the core and the bottom of the internal volume is provided in order to ensure proper availability of the liquid shell-side fluid to the normally lower inlets of the shell side passageways."

XI. The patent proprietor's arguments can be summarised as follows.

(a) Main request, Article 100(c) EPC

In order to check if granted claim 1 defines an extension of the originally disclosed subject-matter, the full original disclosure must be taken into account, and not only the originally filed claims. All features of granted claim 1 find a basis in the original disclosure considered as a whole.

(b) Auxiliary request I, Article 123(2) EPC

The originally disclosed embodiment does not discuss the effect of the dimension Y5 or the ratio Y5/Y2. The skilled person thus understands that this is not a critical parameter of the embodiment, and that its precise value can be excluded from the invention.

(c) Auxiliary request II "new" - Article 13(1) RPBA 2007

Auxiliary request II "new", filed during the oral proceedings before the Board, should be admitted into the proceedings in spite of being late filed. The amendment is limited, clear, unambiguous, non-complex and necessary to overcome the objection on Article 123(2) EPC. The basis for it is clear in Table 1 of the originally filed description, and it does not affect the discussion on novelty and inventive step.

The request is motivated by the fact that it has become apparent through the proceedings that the particular aspect concerning the parameter Y5/Y2 was relevant for added subject-matter. This aspect is new with regard to the discussion which took place during the opposition proceedings.

XII. The opponent's arguments can be summarised as follows.

(a) Main request, Article 100(c) EPC

Features e1) and e2) of granted claim 1 are not originally disclosed in combination. The subject-matter of the claim has thus been extended in an unallowable manner.

Moreover, the combination of features has just been disclosed for the liquefaction of natural gas, a limitation which is missing in granted claim 1.

(b) Auxiliary request I, Article 123(2) EPC

Amended claim 1 should be based on the embodiment comprising the dimensions of originally filed Table 1. However, one of the parameters disclosed therein has been arbitrarily left out, namely Y5/Y2. This results in an unallowable intermediate generalisation.

The originally disclosed shape of the core and the use of the method for liquefying natural gas are also missing in claim 1.

Moreover, the intended use at the end of the claim has been isolated from other features which are originally disclosed as being necessary to achieve the intended technical effect.

(c) Auxiliary request II "new" - Article 13(1) RPBA 2007

The request should not be admitted for being late-filed. The presence of an additional feature affects the analysis of novelty and inventive step, and it necessitates a supplementary search.

The objection had already been raised in the statement setting out the grounds of appeal, and the patent proprietor decided not to file the request until the last possible moment in the appeal proceedings.

(d) Auxiliary request II "old" - Article 123(2) EPC

Since claim 1 of the auxiliary request II comprises the features e1 and e2, the same deficiencies concerning an unallowable extension of subject-matter are present in it.

(e) Auxiliary request III - Remittal

The case should be remitted to an opposition division in a different composition due to the irregularities which happened during the first instance proceedings.

(f) Right to be heard / Reimbursement of the appeal fee

Auxiliary request I was late filed and accepted within the discretionary power of the opposition division under Article 114(2) EPC. The generosity of the opposition division towards the proprietor contrasts with the hardly substantiated refusal of the opponent's request for postponement of oral proceedings, thus being in breach of the principle of neutrality. Such serious violation of a basic right of the opponent justifies a revision of the discretionary decision.

Furthermore auxiliary request I does not comply with the requirements of Rule 80 EPC, since it comprises a number of adaptations of claim 1 to the description, as acknowledged in point 15.3 of the decision, which are not caused by a ground of opposition.

Auxiliary request I was filed on 6 February 2018, but the opponent only became aware of its existence on 13 February 2018, three weeks before the scheduled date for the oral proceedings. The opponent requested an adjournment of the oral proceedings on 20 February 2018 in order to prepare its case, which was denied on 28 February 2018. The opponent did not have enough time

to prepare for the oral proceedings in view of the extensive submissions, and could not perform a search for additional prior art concerning the features which had been added or modified in claim 1 of the auxiliary request, and which were never claimed before.
The opposition division states that the opponent could have found out about auxiliary request I by inspecting the Patent Register. However, no evidence is provided concerning the date of availability of said document in the Patent Register, and anyway the EPC does not foresee this electronic tool as a means to inform the parties about submissions.

The Guidelines for Examination require the opposition division to carry out a supplementary search when amendments such as those carried out in claim 1 of auxiliary request I are present (D-VI.5). However, the opposition division did not exercise its discretion in a proper way when deciding not to carry out such additional search, which results in a prejudice for the opponent and breaches the principle of neutrality.

The principle of equal treatment was also violated by the opposition division since it transmitted the opponent's submissions of 19 February 2018 to the proprietor by telefax whereas it had forwarded auxiliary request I of 6 February 2018 to the opponent by the much slower way of registered letter. .
Moreover, the fact that the opposition division notified the opponent of auxiliary request I only by registered letter instead of in addition by fax immediately after its receipt, constitutes a substantive procedural violation of its own.

Even if each of the opposition division's actions (see point III. above) were justified on their own, they constituted a substantial procedural violation when taken together.

The decision of the opposition division is not substantiated in that it is not explained how claim 1 of the auxiliary request I was "foreseeable" for the opponent, as it is stated there.

The decision lacks also a proper argumentation in what concerns the technical assessment of inventive step.

Reasons for the Decision

1. Main request - Article 100(c) EPC, Article 76(1) EPC

1.1 Feature "*for liquefying natural gas*"

1.1.1 The opponent argues that the claimed combination of features has been originally disclosed only for the purpose of liquefying natural gas, and not for any purpose as it is claimed in granted claim 1. Originally filed page 6 of the parent application discloses that the problem to be solved and the solution concern the liquefaction of natural gas (see lines 22 to 24). The fact that it is stated immediately afterwards that the invention "*may find application outside the area of natural gas liquefaction*" is a mere speculation, and no adapted technical features are disclosed for such hypothetical further uses.

1.1.2 This argument is not convincing.

The passage at originally filed page 1, lines 3 and 4, states that, "In another aspect, the invention concerns

an improved method and apparatus for facilitating indirect heat transfer between a refrigerant and a cooled fluid.".
The skilled person is thereby informed that the invention in general terms contemplates an apparatus and a method for such a general purpose, which is not limited to natural gas liquefaction.

The passage in originally filed page 6, lines 24 and 25, discloses that "*However, at least one embodiment of the present invention may find application outside the area of natural gas liquefaction*", and reveals in the following four lines that the heat exchangers depicted in figures 1 to 9 can be used in other applications requiring indirect heat transfer. The skilled person would consequently understand that the various apparatus disclosed in the particular embodiments of figures 1 to 9 correspond to the invention referred to on page 1, lines 3 and 4, and that the method claimed in originally filed claim 1 encompasses the use of such devices, since they are the only heat exchangers disclosed in the patent application.

Therefore, the absence of the feature "*for liquefying natural gas*" in claim 1 does not result in an unallowable intermediate generalisation.

1.2 Features e1 and e2

1.2.1 The combination of features e1 and e2 reads:

> *maintaining the level of liquid-phase refrigerant in said shell at an elevation such that the core is partially submerged,*
> *at least 50% of the height of the core being submerged in the liquid-phase refrigerant*

1.2.2 The combination of features e1 ("*partially submerged*") and e2 ("*at least 50%*") results in a range which can be defined as "**equal or more than 50% and less than 100%**" for what concerns the submersion of the core in the liquid-phase refrigerant contained within the shell.

1.2.3 The patent proprietor submits that the combination of features e1 and e2 is derivable from the parent application as a whole, and cites numerous passages of the originally filed description and claims in support of it: page 8, lines 21 to 23, bottom line of Table 1 on page 9, and claims 5 and 6.

The use of the term "majority" on page 8, lines 21 to 23, in conjunction with the parts of the description where it is stated that the core is "partially submerged" indicates to the skilled person that it is not the whole height of the core that must be submerged. The disclosure of originally filed claim 5 ("*at least 50%*"), taken with the ranges in Table 1 , teaches the skilled person the combination of features e1 and e2.

1.2.4 These arguments are not persuasive.

The passage on page 8, lines 21 to 23, discloses that "*in order to generate an optimum thermosiphon effect, a* ***majority*** *of the core 14 should be submerged*" (emphasis added). This corresponds to a range of "**more than 50% and less than 100%**", which differs from the claimed range since it excludes the value of 50% as a lower end point.

The technical effect of this range is exclusively associated with the generation of an "*optimum*"

thermosiphon effect. The passage at page 8, lines 23 to 31, describes various advantages which would be desirable for the invention. Immediately afterwards (lines 31 to 33) it is stated that "***The above mentioned advantages*** *may be realized by constructing heat exchanger 10 with the dimensions/ratios illustrated in FIG.1, and quantified in Table 1, below.*" (emphasis added).

The skilled person would understand from this passage that only by constructing a heat exchanger having **all** the parameters of Table 1 would **all** the desired advantages be achieved. No basis can be found for taking any single parameter from Table 1 in isolation.

Further, even if the skilled person did take the last parameter of Table 1 in isolation, the range of submersion of the core disclosed there is "***0.5-0.98***" (ratio of the height of the liquid in the core vs the height of the core). This corresponds to a range of **"equal or more than 50% until 98%"**, which is different from the claimed range (see point 1.2.2 above) since it excludes values between 98% and less than 100% as upper end points.

Finally, the range claimed in originally filed claim 5 was "***at least 50%*** *of the height of the core*" (emphasis added). This results in a range which can be defined as **"equal or more than 50% up to and including 100%"**. This range differs again from that of features e1 plus e2 (see point 1.2.2 above) since it comprises the value of 100% i.e. total submergence .

Thus, the end points of the claimed range are separately disclosed in different embodiments of the description. However, no basis can be found which could

hint at combining an end point of one out of the three ranges disclosed in the last line of Table 1 with another end point of the range disclosed on page 8, lines 21 to 23. In the absence of such a hint, the combination of the separately disclosed end points cannot be considered as being originally disclosed.

Therefore, the combination of the features e1 and e2 does not have a basis in the originally filed claims.

1.3 The subject-matter of claim 1 thus extends beyond the content of the originally filed parent application and offends Article 76(1) EPC. Consequently, the ground of opposition based on Article 100(c) EPC prejudices the maintenance of the European patent as granted.

2. Auxiliary request I - Article 76(1) EPC

2.1 Feature "square core"

2.1.1 The opponent argues that the third dimension of the core is not defined in claim 1, which merely defines its maximum height (Y1) and maximum width (X1). Figure 2 of the originally filed parent application discloses that the core must have a square shape along a horizontal cross section. However, claim 1 encompasses any horizontal cross section of the core, which results in an unallowable intermediate generalisation.

2.1.2 This argument is not persuasive.

Firstly, figure 2 is a schematic drawing from which no conclusions can be drawn concerning the precise dimensions of the core.

Secondly, the skilled person is aware that different horizontal cross-shapes are possible for a plate-fin core other than the one defined in the originally disclosed embodiment. Since no particular technical effect is linked to the horizontal cross-section of figure 2, the skilled person would not understand this shape as being limiting in view of their common general knowledge in the technical field of plate-fin heat exchangers.

2.1.3 The omission of the third dimension of the defined plate-fin core of claim 1 does thus not result in an unallowable intermediate generalisation.

2.2 Feature "LNG"

2.2.1 The opponent argues that, since claim 1 relies on Table 1, which concerns an embodiment for the production of liquefied natural gas (LNG), the dimensions of the heat exchanger would be understood by the skilled person as only referring to this application. The skilled person knows that the use of the embodiment in other applications would require adapted parameters. The absence of the intended use for LNG in claim 1 thus results in an unallowable intermediate generalisation.

2.2.2 The Board cannot identify such an inextricable link with the missing feature.

As it has been already stated (see point 1.1.2 above), the claimed embodiment is originally disclosed as being applicable for other purposes than the production of LNG: see page 6, lines 25 to 29, of the originally filed parent application, which makes explicit reference to the embodiment of figures 1 and 2 (forming the basis of claim 1 of auxiliary request I).

The argument concerning a necessary adaptation of the parameters for other application cannot be accepted, since the opponent has not proved that the relatively broad ranges defined in claim 1 would not be contemplated by the skilled person as allowing the use which is explicitly disclosed in page 6, lines 24 to 29.

2.2.3 The absence of the feature "LNG" in claim 1 does thus not result in an intermediate generalisation.

2.3 Feature "*in order to ensure proper disengagement..*"

2.3.1 The opponent argues that the functional feature "*in order to ensure proper disengagement of the entrained liquid-phase shell-side fluid in the gaseous shell-side fluid exiting the vapor outlet*" at the end of claim 1 results in an unallowable intermediate generalisation, since the original disclosure on page 8, lines 26 to 29, of the parent application refers to non-numerical parameters and does not form a basis for the defined Y4/Y1 range.

2.3.2 This argument is not persuasive.

Originally filed page 8 of the parent application discloses that "*In order to ensure proper disengagement of the entrained liquid-phase shell side fluid exiting vapor outlet 28, it is preferred for a substantial space to be provided between the top of the core 14 and the top of internal volume 24*" (see lines 26 to 29).

Later in the same paragraph it is disclosed that "*The above mentioned advantages may be realized by constructing heat exchanger 10 with the dimensions/*

ratios illustrated in FIG. 1, and quantified in Table 1, below" (lines 31 to 33).

Claim 1 defines this "substantial space" (Y4), which is originally disclosed in Table 1: "*the maximum space (Y4) measured parallel to the direction of extension of the central sidewall axis (22) between the top of the core (14) and the top of the internal volume (24) is greater than 2 ft. (0.6 m)*". Claim 1 also defines a ratio Y4/Y1 as disclosed in Table 1.

The technical effect defined at the end of claim 1 is thus originally disclosed in combination with the defined dimension Y4 and ratio Y4/Y1.

Therefore, no unallowable intermediate generalisation can be observed in connection with this feature.

2.4 Feature Y5/Y2

2.4.1 Auxiliary request I includes a number of parameters taken from the column "Preferred Range" of Table 1 in originally filed page 9 of the parent application.

2.4.2 All parameters and dimensions of Table 1 have been incorporated in claim 1 of the auxiliary request I except the ratio Y5/Y2, representing the height of the liquid fluid inlet on the sidewall of the shell from the bottom of the core (Y5) divided by the total height of the core (Y2). Figure 1 of the patent, disclosing Y2, Y5 and all other dimensions used in Table 1, is reproduced below.

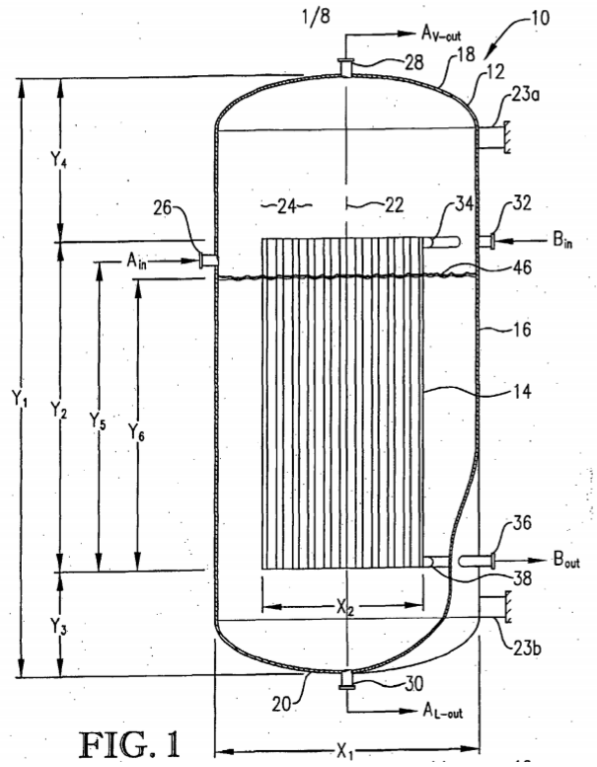

FIG. 1

2.4.3 The patent proprietor argues that there is a basis for excluding the parameter Y5/Y2 in claim 1 of the auxiliary request 1, since the originally disclosed embodiment does not discuss the effect of the dimension Y5 or that of the ratio Y5/Y2. The skilled person thus understands that this is not a critical parameter of the embodiment, and that its precise value can be excluded from the invention, since the invention is focused on providing a minimum space between the top of the core and the vapor outlet (28 in figure 1) "*in order to ensure proper disengagement of the entrained liquid-phase shell-side fluid in the gaseous shell-side fluid exiting the vapor outlet*" (see last lines of claim 1). As the skilled person would not identify a functional link between the missing feature (parameter Y5/Y2) and the intended technical effect, they would understand that this feature is not a critical parameter which is inextricably linked with the

embodiment. The skilled person knows that a shell-side fluid inlet must be provided in the heat exchanger used in the method, but would understand that the position of this fluid inlet does not contribute to achieve a technical effect.

2.4.4 These arguments cannot be accepted on the following grounds.

Originally filed page 8 of the parent application, lines 31 to 33, discloses that "*The above mentioned advantages may be realized by constructing heat exchanger 10 with the dimensions/ratios illustrated in FIG. 1, and quantified in Table 1, below*". The skilled person is thus informed that all dimensions/ratios of Table 1 (including Y5/Y2) must be adopted in order to obtain all the advantages which are previously recited in the paragraph, including the "*proper disengagement of the entrained liquid-phase shell side fluid in the gaseous shell-side fluid exiting vapor outlet 28*" (see page 8, lines 26 and 27).

The description thus indicates that there is an interaction between the specific parameters and dimensions of Table 1 which allows the simultaneous achievement of all the advantages. Consequently, the skilled person deduces that altering or omitting one of the parameters may have a negative effect on the desired advantages.

When looking at the technical nature of the dimensions Y2, Y5 and at the meaning of the ratio Y5/Y2 this indication is confirmed, since the role of the fluid inlet 26 in figure 1 is to provide the heat exchanger with shell-side fluid **in liquid phase**. This is so because the shell-side fluid must be in liquid phase

when entering the shell in order to evaporate in contact with the core 14 and to refrigerate in this way the core-side fluid.

Since the shell-side fluid exits the fluid inlet 26 in liquid state, its distance to the "*normally-upper end cap (18) defining a vapor outlet (28) for discharging gas-phase shell-side fluid*" (see claim 1, towards the end of feature (a)) is a critical parameter. The skilled person realises that arranging the shell-side fluid inlet 26 above the core 14 in the embodiment of figure 1 would imply the presence of liquid-phase shell-side fluid in the vicinity of the vapor outlet 28, entailing a risk of droplets being carried by the vapor through the vapor outlet 28 which goes against the wished advantage (see page 8, lines 26 and 27). The ranges of values of parameter Y5/Y2 disclosed in Table 1 (0.5-1 in its broadest range) define a position of the fluid inlet 26 which is always aligned with or below the top of the core. The skilled person immediately understands that this limitation prevents the presence of liquid-phase shell-side fluid flowing from the outlet 26 in the vicinity of the vapor outlet 28.

The parameter Y5/Y2 disclosed in Table 1 is thus a feature which is disclosed as being inextricably linked to the intended technical effect of ensuring proper disengagement of the entrained liquid-phase shell-side fluid in the gaseous shell-side fluid exiting vapor outlet 28.

2.4.5 In view of the above, the omission of the parameter Y5/Y2 of Table 1 in claim 1 results in an unallowable intermediate generalisation.

2.5 Thus, auxiliary request I is not allowable as the subject-matter of claim 1 contravenes Article 76(1) EPC.

3. Auxiliary request II "new" - Article 13(1) RPBA 2007

3.1 The patent proprietor filed a new auxiliary request II during the oral proceedings before the Board.

3.2 As the summons for the originally scheduled oral proceedings was notified before the date of entry into force of the revised RPBA 2020, Article 13 RPBA 2007 applies instead of Article 13(2) RPBA 2020 (Article 25(3) RPBA 2020).

3.3 Under Article 13(1) RPBA 2007, any amendment to a party's case after it has filed its grounds of appeal or reply may be admitted and considered at the Board's discretion. The discretion shall be exercised in view of inter alia the complexity of the new subject-matter submitted, the current state of the proceedings and the need for procedural economy.

3.4 The objection under Article 123(2) EPC with regard to feature Y5/Y2 was already made in the opponent's statement of grounds of appeal (see point 8.4). The patent proprietor could and should have reacted to this objection by filing an auxiliary request already with their reply to the opponent's statement of grounds of appeal. Instead, auxiliary request II "new" was only filed during the oral proceedings before the Board, after the Board had informed the patent proprietor that the omission of the parameter Y5/Y2 of Table 1 in claim 1 of auxiliary request I contravened Article 123(2) EPC. Contrary to the patent proprietor's opinion, a party must give consideration to the

possibility that a Board will be convinced by a line of argument which has been put forward by another party, and act accordingly at the earliest opportunity.

3.5 In view of the above, admitting auxiliary request II "new" at such a late stage of the appeal proceedings would have been detrimental to procedural economy. Moreover, as put forward by the opponent, the presence of an additional feature may have given rise to new objections in the context of the analysis of novelty and inventive step. Therefore, the Board decided not to admit auxiliary request II "new" under Article 13(1) RPBA 2007.

4. Auxiliary request II "old" - Article 76(1) EPC

Claim 1 of the auxiliary request II "old" is identical to granted claim 1, except for the addition of the feature (in bold) "*A method of transferring heat from a cooled fluid to a refrigerant* ***in a process for liquefying a natural gas stream***".

The added feature has no limiting effect on the features e1 and e2 (according to the numbering of features of granted claim 1; see point VI. above).

Since the combination of features e1 and e2 of granted claim 1 incurs in an unallowable extension of subject-matter (see point 1.2 above), the same reasons are of application for claim 1 of auxiliary request II "old".

The subject-matter of claim 1 thus contravenes Article 76(1) EPC, and auxiliary request II "old" is not allowable.

5. Auxiliary request III - Article 111 EPC, Article 11 RPBA 2020

Auxiliary request III is neither discussed nor substantively evaluated in the contested decision, since auxiliary request I was found to be allowable by the opposition division.

Moreover, none of the parties provided arguments on this request in their written submissions, and none of the parties objected to the remittal of the case to the opposition division.

In view of these exceptional circumstances, the case is to be remitted to the opposition division for further prosecution (Article 111 EPC, Article 11 RPBA 2020).

6. Right to be heard and reimbursement of the appeal fee

6.1 In essence, the opponent argued that three weeks between having been informed of the contents of auxiliary request I on 13 February 2018 and the oral proceedings on 7 March 2018 had not been a sufficient time to react to auxiliary request I, in particular in view of the complexity of the amendments contained therein. Therefore, the opposition division should have either not admitted auxiliary request I into the proceedings or postponed the oral proceedings. The failure to do neither constituted a violation of their right to be heard under Article 113(1) EPC.

6.2 Both the decision whether or not to admit a late-filed submission and the decision whether or not to postpone oral proceedings are discretionary decisions by the opposition division. According to established case law, the departments of first instance have a certain degree

of freedom in exercising their discretionary power. A board of appeal should only overrule the way in which a department of first instance has exercised its discretion when deciding on a particular case if the Board concludes that it has done so according to the wrong principles, or without taking into account the right principles, or in an unreasonable way, and has thus exceeded the proper limits of its discretion(G 7/93, point 2.6 of the reasons; see also Case Law of the Boards of Appeal, 9th edition, IV.C. 4.5.2)).

6.3 In the case at hand, auxiliary request I was filed before the expiry of the deadline the opposition division had set under Rule 116(1) EPC. It was therefore not filed late by the patent proprietor. Auxiliary request I also addressed deficiencies which had been identified by the opposition division, and the opposition division gave the opponent the opportunity to comment on the admittance of auxiliary request I (see point 7 of the minutes of the oral proceedings before the opposition division). Moreover, the opposition division considered the opponent's arguments in the decision under appeal to an extent which allows the Board to review that decision. Hence, no substantive procedural violation occurred in these regards. For the same reason, the opponent's request not to admit auxiliary request I - which is the request on which the decision under appeal is based - cannot be granted either.

6.4 In the Board's view, the main thrust of the opponent's allegation that a substantial procedural violation occurred, concerns the opposition division's decision not to grant the opponent's request to postpone the oral proceedings. In this context, the opposition

division referred to the possibility to inspect the online European Patent Register and to the availability of a register monitoring tool (see point 15.1 of the decision under appeal). Because of these possibilities, the opposition division indicated that the opponent had a full month before the oral proceedings to consider auxiliary request I after it had been filed on 6 February 2018.

6.5 This is not correct. For the purposes of Article 113(1) EPC, parties and their representatives have no duty to monitor the proceedings themselves by regularly inspecting the electronic file (cf. R 4/17, point 4 of the reasons). Hence, the opponent did not have a month, but three weeks to analyse and consider auxiliary request I before the oral proceedings in the opposition proceedings.

6.6 Contrary to the opponent's opinion it does, however, not per se constitute a substantive procedural violation that the opposition division notified the opponent only by registered letter of the submission containing auxiliary request I, instead of in addition by fax immediately after receipt of that submission. Neither is it a violation of the principle of equal treatment that the opposition division did not notify the opponent by fax of a submission of the patent proprietor which was filed *before* the final date set under Rule 116(1) EPC, but did notify the patent proprietor by fax of a submission of the opponent which was filed *after* that date.

6.7 The opposition division further stated in its written decision that three weeks were sufficient for the opponent to analyse the new request. In this context, it referred to the extent of the amendments carried out

and to the aid provided by the patent proprietor's comparison table (see points 15.1 and 16.1 of the decision under appeal), as well as to carrying out a search if deemed necessary by the opponent (see point 20.4 of the decision under appeal). Thereby, the opposition division applied the correct principles and addressed the opponent's main arguments. The Board thus concludes that the opposition division exercised its discretion with regard to the request for postponement neither according to the wrong principles nor in an unreasonable way which would have exceeded the proper limits of its discretion. In this context, it is not for the Board to say whether a longer period of preparation - which could have been achieved by setting an earlier final date for making written submissions under Rule 116(1) EPC - may have been more appropriate in the given circumstances.

6.8 In conclusion, no substantive procedural violation occurred which justifies the reimbursement of the appeal fee under Rule 103(1) (a) EPC.

7. Request for remittal to an opposition division in a different composition

The opponent requests that the case is remitted to an opposition division in a different composition.

In the absence of a substantial procedural violation (see point 6 above), there is no reasonable ground to suspect that the opponent would not receive a fair hearing if the case were re-heard before the same composition of opposition division (see Case Law of the Boards of Appeal, 9th edition, III.J.4.2).

For this reason, the case is not remitted to an opposition division in a different composition.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the opposition division for further prosecution.

3. The request that the case be remitted to the opposition division in a different composition is refused.

4. The request for reimbursement of the appeal fee is refused.

The Registrar: The Chairman:

C. Spira C. Donnelly

Decision electronically authenticated