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(54) **IMPROVED SEPARATION OF HEAVY HYDROCARBONS AND NGLS FROM NATURAL GAS IN INTEGRATION WITH LIQUEFACTION OF NATURAL GAS**

(57) Described herein is a method of and system for fractionating and liquefying a natural gas feed stream. The natural gas is first fractionated in a scrub column. The overhead vapor from the scrub column is cooled, condensed and divided to form a first, a second and at least one further stream of liquefied first overhead. The

first stream of liquefied first overhead is returned to the scrub column as a reflux stream. The second stream of liquefied first overhead forms an LNG product. The further stream of liquefied first overhead is used to provide or generate reflux for a de-methanizer column used to fractionate the bottoms liquid from the scrub column.

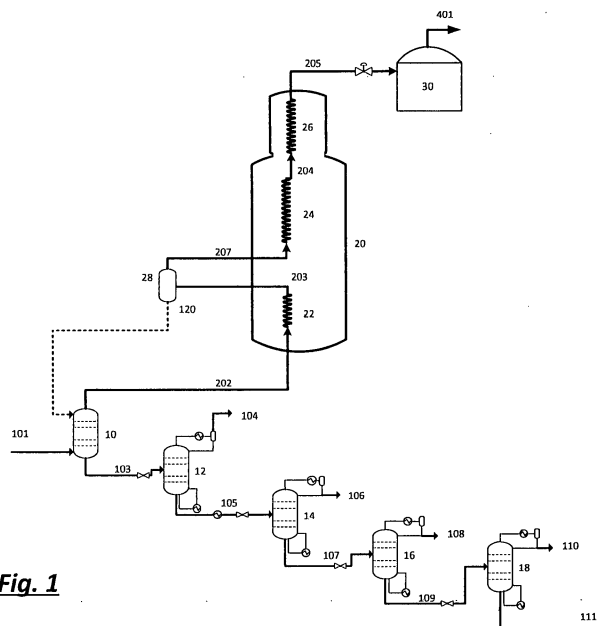


Fig. 1

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EUROPEAN SEARCH REPORT

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 17 October 2016	Examiner Göritz, Dirk
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	

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
Place of search Munich		Date of completion of the search 17 October 2016	Examiner Göritz, Dirk
<p>CATEGORY OF CITED DOCUMENTS</p> <p>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</p> <p>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</p>			

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CLAIMS INCURRING FEES

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

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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):

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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.

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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:

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see sheet B

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All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

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As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

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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:

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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:

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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).

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**LACK OF UNITY OF INVENTION
SHEET B**Application Number
EP 16 00 0122

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: 1-16(partially)

A method of fractionating and liquefying a natural gas feed stream, the method comprising:

(a) introducing the natural gas feed stream into a scrub column in which the natural gas feed stream is separated into a methane-rich vapor fraction collected as a first overhead vapor at the top of the scrub column, and a liquid fraction, enriched in hydrocarbons heavier than methane, collected as a first bottoms liquid at the bottom of the scrub column;

(b) withdrawing a stream of first overhead vapor from the top of the scrub column, and cooling, condensing and dividing said stream to form a first stream of liquefied first overhead, second stream of liquefied first overhead, and at least one further stream of liquefied first overhead;

(c) returning the first stream of liquefied first overhead to the scrub column as a reflux stream introduced into the top of the scrub column, thereby providing reflux for the scrub column;

(d) forming a liquefied natural gas (LNG) product stream from the second stream of liquefied first overhead;

(e) withdrawing a stream of first bottoms liquid from the bottom of the scrub column, and introducing said stream into a de-methanizer column in which the stream of first bottoms liquid is separated into a methane-rich vapor fraction collected as a second overhead vapor at the top of the de-methanizer column, and a liquid fraction, enriched in hydrocarbons heavier than methane, collected as a second bottoms liquid at the bottom of the de-methanizer column;

and

(f) providing reflux to the de-methanizer column by introducing one of said further streams of liquefied first overhead as a reflux stream into the top of the de-methanizer column.

2. claims: 1-16(partially)

A method of fractionating and liquefying a natural gas feed stream, the method comprising:

(a) introducing the natural gas feed stream into a scrub column in which the natural gas feed stream is separated into a methane-rich vapor fraction collected as a first overhead vapor at the top of the scrub column, and a liquid fraction, enriched in hydrocarbons heavier than methane, collected as a first bottoms liquid at the bottom of the scrub column;

(b) withdrawing a stream of first overhead vapor from the top of the scrub column, and cooling, condensing and dividing said stream to form a first stream of liquefied



LACK OF UNITY OF INVENTION
SHEET B

Application Number
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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:

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first overhead, second stream of liquefied first overhead, and at least one further stream of liquefied first overhead;
(c) returning the first stream of liquefied first overhead to the scrub column as a reflux stream introduced into the top the scrub column, thereby providing reflux for the scrub column;

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(d) forming a liquefied natural gas (LNG) product stream from the second stream of liquefied first overhead;
(e) withdrawing a stream of first bottoms liquid from the bottom of the scrub column, and introducing said stream into a de-methanizer column in which the stream of first bottoms liquid is separated into a methane-rich vapor fraction collected as a second overhead vapor at the top of the de-methanizer column, and a liquid fraction, enriched in hydrocarbons heavier than methane, collected as a second bottoms liquid at the bottom of the de-methanizer column;
and

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(f) providing reflux to the de-methanizer column by:
(1) introducing one of said further streams of liquefied first overhead as a reflux stream into the top of the de-methanizer column and condensing, by indirect heat exchange with one of said further streams of liquefied first overhead, a portion of the second overhead vapor to form a stream of liquefied second overhead that is reintroduced as a reflux stream into the top the de-methanizer column; or
(2) condensing, by indirect heat exchange with one of said further streams of liquefied first overhead, a portion of the second overhead vapor to form a stream of liquefied second overhead that is reintroduced as a reflux stream into the top the de-methanizer column

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

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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.

17-10-2016

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