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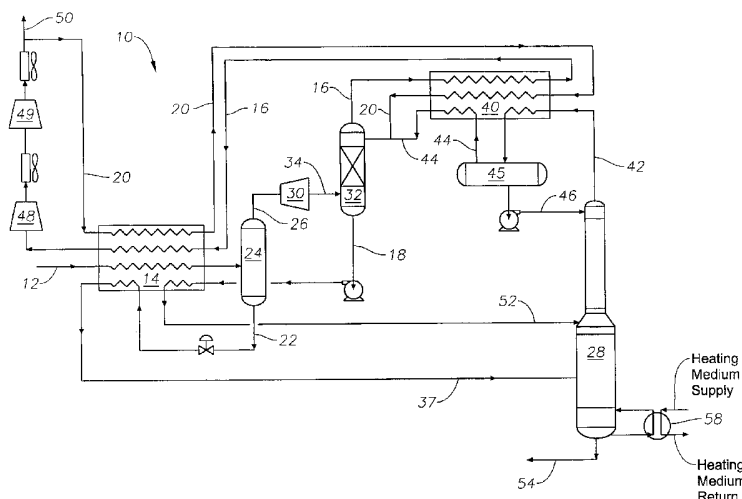
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ning of each regular issue of the PCT Gazette.*

(54) Title: LEAN REFLUX-HIGH HYDROCARBON RECOVERY PROCESS



(57) Abstract: A two-tower scheme process for the recovery of propane and heavier components from a hydrocarbon gas stream is provided. Feed gas (12) is cooled (14), partially condensed, and then separated (24) to give a first liquid stream (22) and a first vapor stream (26). First liquid stream is sent to a distillation tower (28) that recovers at the bottoms a major portion of propane and heavier components (54) and produces an overhead gas stream (42). First vapor stream (26) is expanded (30) and sent as bottom feed (34) to the absorber. Absorber produces an absorber overhead stream (16) containing essentially all the ethane and lighter components and an absorber bottoms stream (18). Absorber bottoms stream is heated (14) and sent to the distillation tower (28) as middle feed (52). Absorber overhead stream is warmed (40) and optionally compressed (48, 49). A part of the compressed stream (20) is substantially condensed and sent to absorber as top feed. The process and apparatus can be used to recover ethane and heavier hydrocarbons.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 03/40733

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 F25J3/02

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)

IPC 7 F25J C07C C10G

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	US 5 771 712 A (HUDSON HANK M ET AL) 30 June 1998 (1998-06-30) cited in the application figure 5	1-10, 41-45
Y	----- US 2002/157538 A1 (FOGLIETTA JORGE H ET AL) 31 October 2002 (2002-10-31) figures 2,6,7	1-10, 41-45
A	----- US 4 689 063 A (CASTEL JOELLE ET AL) 25 August 1987 (1987-08-25) figure 2	1-10, 41-45
A	----- US 6 401 486 B1 (CHEN JONG JUH ET AL) 11 June 2002 (2002-06-11) figure 1	1-10, 41-45
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in 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.

"&" document member of the same patent family

Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 03/40733

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,A	US 2003/221447 A1 (MEALEY W BRENT) 4 December 2003 (2003-12-04) figure 1 -----	1-10, 41-45

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 03/40733

Box I Observations where certain claims were found unsearchable (Continuation of item 1 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 II Observations where unity of invention is lacking (Continuation of item 2 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 fee, this Authority did not invite payment of any additional fee.
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.:
1-10, 41-45

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

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

1. claims: 1-10,41-45

A process and apparatus for the recovery of propane and heavier components from a hydrocarbon gas stream in a two-tower scheme including inter alia the steps of cooling and partially condensing the feed gas, separating the feed gas in a first vapor and first liquid stream, preheating the first liquid stream and feeding it to a distillation tower, expanding the first vapor stream into an absorber column, preheating the absorber bottom liquid and feeding it to the tower, feeding at least a portion of the tower overhead as first reflux to the absorber and recycling at least a portion of the absorber overhead after heating, compressing and condensing as second reflux to the absorber.

2. claims: 11-15

A process for the recovery of propane and heavier components from a hydrocarbon gas stream in a two-tower scheme including inter alia the steps of cooling and partially condensing the feed gas, separating the feed gas in a first vapor and first liquid stream, preheating the first liquid stream and feeding it to a distillation tower, expanding a first portion of the first vapor stream into an absorber column, preheating the absorber bottom liquid and feeding it to the tower, feeding at least a portion of the tower overhead as first reflux to the absorber and feeding a second portion of first vapor stream after cooling and partially condensing as second reflux to the absorber.

3. claims: 16-20

A process for the recovery of propane and heavier components from a hydrocarbon gas stream in a two-tower scheme including inter alia the steps of cooling and partially condensing the feed gas, separating the feed gas in a first vapor and first liquid stream, expanding the first liquid stream and feeding it to an absorber column, expanding the first vapor stream into the absorber, preheating the absorber bottom liquid and feeding it to a distillation tower, feeding at least a portion of the tower overhead as first reflux to the absorber and recycling at least a portion of the absorber overhead after heating, compressing and condensing as second reflux to the absorber.

4. claims: 21-25, 34-37

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

A process for the recovery of propane and heavier components from a hydrocarbon gas stream in a two-tower scheme including inter alia the steps of cooling and partially condensing the feed gas, separating the feed gas in a first vapor and first liquid stream, expanding the first liquid stream and feeding it to an absorber column, expanding a first portion of the first vapor stream into the absorber, preheating the absorber bottom liquid and feeding it to a distillation tower, feeding at least a portion of the tower overhead as first reflux to the absorber and feeding a second portion of first vapor stream after cooling and partially condensing as second reflux to the absorber.

5. claims: 26,27

A process for the recovery of propane and heavier components from a hydrocarbon gas stream in a two-tower scheme including inter alia the steps of cooling and partially condensing the feed gas, separating the feed gas in a first vapor and first liquid stream, preheating the first liquid stream and feeding it to a distillation tower, expanding the first vapor stream into an absorber column, preheating a first portion of the absorber bottom liquid and feeding it to the tower, feeding at least a portion of the tower overhead as reflux to the absorber and feeding a second portion of the absorber bottom liquid to the tower without preheating.

6. claims: 28-33

A process for the recovery of propane and heavier components from a hydrocarbon gas stream in a two-tower scheme including inter alia the steps of cooling and partially condensing the feed gas, separating the feed gas in a first vapor and first liquid stream, expanding the first liquid stream and feeding it to an absorber column, expanding the first vapor stream into the absorber, preheating a first portion of the absorber bottom liquid and feeding it to a distillation tower, feeding at least a portion of the tower overhead as reflux to the absorber and feeding a second portion of the absorber bottom liquid to the tower without preheating.

7. claims: 38-40

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

A process for the recovery of ethane and heavier components from a hydrocarbon gas stream in a two-tower scheme including inter alia the steps of cooling and partially condensing the feed gas, separating the feed gas in a first vapor and first liquid stream, feeding the first liquid stream to a distillation tower, expanding a first portion of the first vapor stream into an absorber column, feeding at least a portion of the tower overhead as reflux to the absorber and feeding a second portion of first vapor stream after cooling to the absorber.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 03/40733

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