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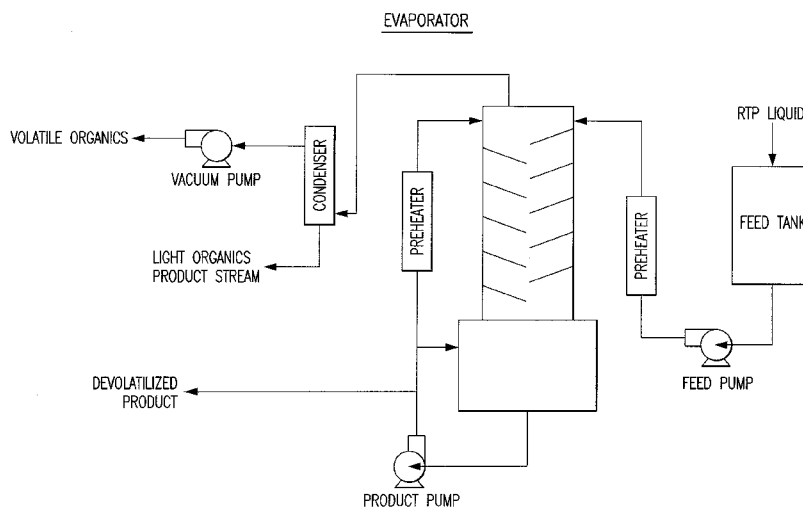
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(54) Title: DEVOLATILIZATION OF THERMALLY PRODUCED LIQUIDS



(57) Abstract: Methods and systems for the devolatilization of thermally produced liquids to raise the flash point are disclosed. Various methods and apparatus can be used to effectively reduce the volatile components, such as wiped film evaporator, falling film evaporator, flash column, packed column, devolatilization vessel or tank.



INTERNATIONAL SEARCH REPORT

International application No.

PCT/US13/56400

| A. CLASSIFICATION OF SUBJECT MATTER IPC(8) - B01D 3/06, 19/00 (2014.01) USPC - 203/88; 208/103, 184 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(8): B01D 3/06, 19/00; C10L 1/00 (2014.01) USPC: 203/88; 208/100, 103, 184; 210/180 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 practicable, search terms used) MicroPatent (US-G, US-A, EP-A, EP-B, WO, JP-bib, DE-C,B, DE-A, DE-T, DE-U, GB-A, FR-A); Google Scholar; ProQuest; IP.com; devolatilization, fluid, heating, flash point, temperature, pressure, filter, FCC | | |
| C. DOCUMENTS CONSIDERED TO BE RELEVANT | | |
| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
| Y | US 2008/0282606 A1 (PLAZA, JP et al.) 20 November 2008; figures 1, 5; paragraph [0067]-[0070], [0073]-[0074], [0081]-[0091] | 1-19, 24-34 |
| Y | US 4,101,414 A (KIM, YJ et al.) 18 July 1978; figure 2; column 3, lines 3-41; column 10, lines 7-16 | 1, 6-8, 11-13 |
| Y | US 2012/0205289 A1 (JOSHI, R) 16 August 2012; paragraph [0022], [0035] | 1-5, 9-10, 14-19, 24-34 |
| Y | US 6,676,828 B1 (GALIASO, R et al.) 13 January 2004; figures 4-5; column 8, lines 52-63; column 9, lines 1-15 | 30-34 |
| A | US 2011/0123407 A1 (FREEL, B) 26 May 2011; entire document | 1-19, 24-34 |
| <input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> | | |
| * 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 application or patent 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 | | |
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| Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201 | | Authorized officer: Shane Thomas PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774 |

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US13/56400

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 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 No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I: Claims 1-19, 24-34 are directed to a method of devolatilization of the starting liquid, wherein the starting liquid is produced from thermal conversion.

Group II: Claims 20-23 are directed toward to a system for thermal conversion.

-Continued Within the Next Supplemental Box-

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 additional fees, this Authority did not invite payment of additional fees.
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.:
1-19, 24-34

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

-Continued from Box No. III: Observations where unity of invention is lacking-

The inventions listed as Groups I-II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: the special technical features of Group I include increasing the flash point of a starting liquid by devolatilization of the starting liquid, wherein the starting liquid is produced from thermal conversion, the method comprising: i) supplying the starting liquid to a first component; ii) heating the first component to a temperature in the range of 20 degree Celsius to 200 degree Celsius; iii) obtaining a processed liquid product, wherein the processed liquid has an increased flash point and a reduced concentration of volatile components as compared to the starting liquid; and iv) obtaining a volatile components product; and introducing a devolatilized liquid material into a fluidized catalytic cracker (FCC), wherein the devolatilized liquid material is produced, which are not present in Group II; the special technical features of Group II include i) a feed system; ii) a reactor; and iii) a plurality of condensing chambers, wherein the temperature of the one or more of the plurality of condensing chambers is adjusted to a temperature greater than 30 degree Celsius, which are not present in Group I.

The common technical features of Groups I and II are a thermal conversion to produce a liquid at a temperature greater than 30 degrees Celsius .

These common technical features are disclosed by US 2010/0251600 A1 to Marker, et al (hereinafter 'Marker'). Marker discloses a thermal conversion to produce a liquid (multi-stage process for thermochemically transforming biomass into gasoline plus diesel liquid product; paragraph [0014]) at a temperature greater than 30 degrees Celsius (temperatures for the hydrolysis and hydroconversion steps are in the range of about 650 degrees F to about 900 degrees F; paragraph [0011]).

Since the common technical features are previously disclosed by Marker, these common features are not special and so Groups I and II lack unity.