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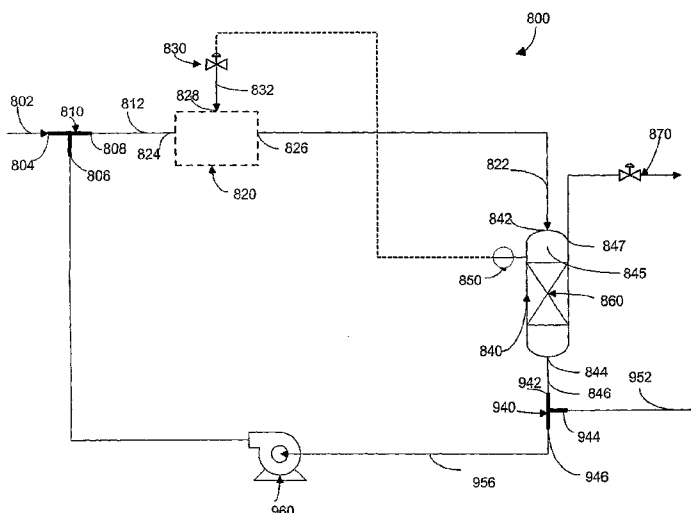
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Previous Correction:

see PCT Gazette No. 47/2007 of 22 November 2007

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: CONTROL SYSTEM METHOD AND APPARATUS FOR CONTINUOUS LIQUID PHASE HYDROPROCESSING



(57) Abstract: A continuous liquid phase hydroprocessing process, apparatus and process control systems, where the need to circulate hydrogen gas through the catalyst is eliminated. By mixing and/or flashing the hydrogen and the oil to be treated in the presence of a solvent or diluent in which the hydrogen solubility is high relative to the oil feed, all of the hydrogen required in the hydroprocessing reactions may be available in solution. The oil/diluent/hydrogen solution can then be fed to a plug flow reactor packed with catalyst where the oil and hydrogen react. No additional hydrogen is required; therefore, the large trickle bed reactors can be replaced by much smaller tubular reactors. The amount of hydrogen added to the reactor can be used to control the liquid level in the reactor or the pressure in the reactor.

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 06/10639

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - C10G 47/00 (2007.01)

USPC - 208/58

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)

USPC - 208/58

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

USPC -208/58, 59, 60, 79, 209, 213, 251H, 254H; 137/171, 202, 392 - see keywords below

Google Patent - see keywords below

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WEST (PGPB,USPT,USOC,EPAB,JPAB); Google

Search Terms: hydroprocessing, reactor, temperature, isothermal, pressure, sulfur, diluents, hydrogen, catalyst

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2005/0082202 A1 (ACKERSON et al.) 21 April 2005 (21.04.2005); figs. 4 and 5; para [0003]; [0019]-[0022]; [0051]-[0080]	1-4, 6-8, 10, 11, 13-15, 27, 28, 30-32, 34, 35, 37 and 38
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Y		5, 9, 12, 29, 33 and 36
Y	US 5,589,057 A (TRIMBLE et al.) 31 December 1996 (31.12.1996); fig. 8, Table I and II, col 5, ln 20-24	5, 9, 12, 29, 33 and 36

☐ Further documents are listed in the continuation of Box C.

* 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

Date of the actual completion of the international search

06 September 2007 (06.09.2007)

Date of mailing of the international search report

03 OCT 2007

Name and mailing address of the ISA/US

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 06/10639

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:

Group 1, claims 1-15 and 27-38, is directed to a continuous liquid phase hydroprocessing method.

Group 2, claims 16-23 and 39-46, is directed to a reactor for a continuous liquid phase hydroprocessing system.

Group 3, claims 24-26, is directed to a control system for the reactor.

The method of Group 1 does not require Group 2 elements (a)-(i) listed in claim 16. Additionally, Group 1 does not require Group 3 control elements (a)-(i) listed in claim 24.

The reactor of Group 2 does not require the Group 1 hydroprocessing elements of (a)-(f) listed in claim 1. Group 2 does not require the Group 3 control elements (a)-(i) listed in claim 24.

Finally, the control system of Group 3 does not require the Group 1 hydroprocessing elements (a)-(f) listed in claim 1. Group 3 does not require the Group 2 elements (a)-(i) listed in claim 16. Thus, unity is lacking between groups 1-3.

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.:
1-15 and 27-38

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.