

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
9 March 2006 (09.03.2006)

PCT

(10) International Publication Number
WO 2006/026224 A3

(51) International Patent Classification:

B01J 19/00 (2006.01) **B01J 19/24** (2006.01)

B01J 19/18 (2006.01)

(21) International Application Number:

PCT/US2005/029784

(22) International Filing Date: 23 August 2005 (23.08.2005)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

10/928,047 27 August 2004 (27.08.2004) US

(71) Applicant: **CHEVRON PHILLIPS CHEMICAL COMPANY LP** [US/US]; 10001 Six Pines Drive, The Woodlands, TX 77380 (US).

(72) Inventors: **SHAW, Benjamin, M.**; 2928 16th Street Northeast, Calgary, AB T2E7K7 (CA). **HOTTOVY, John, D.**; 2347 Summit Way Court, Kingwood, TX 77339 (US). **ZELLERS, Dale, A.** (deceased).

(74) Agent: **FLETCHER, Michael, G.**; Fletcher Yoder, P.O. Box 692289, Houston, TX 77269-2289 (US).

(81) Designated States (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW.

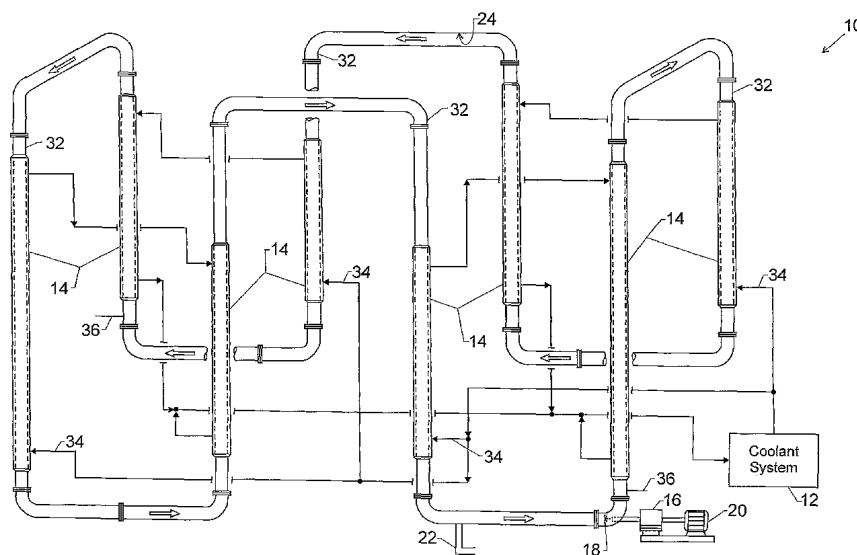
(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

(88) Date of publication of the international search report:
2 July 2009

(54) Title: METHOD AND SYSTEM TO REDUCE POLYMERIZATION REACTOR FOULING



(57) Abstract: Techniques are provided for the prevention of reactor fouls in polymerization reactors. A technique is provided for limiting polymer particle size to prevent or limit the occurrence of reactor fouls associated with large polymer particles. A technique is also provided for measuring reactor temperature at one or more local hot spots of the reactor and for controlling the polymerization reaction based upon these temperature measurements. In particular, control of the reaction may be based on the hottest temperature, such that the hottest temperature in the reactor is maintained within the reactor fouling curve. A technique is also discussed for predicting reactor fouls by using statistical analyses, such as periodogram analysis, to identify leading indicators of impending fouls. Preventative measures may be performed upon identification of such a leading indicator. In addition, the statistical analyses may be used to identify catalysts having less propensity to foul.

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2005/029784

A. CLASSIFICATION OF SUBJECT MATTER

INV. B01J19/00 B01J19/18 B01J19/24

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)

B01J

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, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 124 333 A (THE BABCOCK & WILCOX COMPANY) 7 November 1984 (1984-11-07) page 1, line 1 - line 4 page 2, line 16 - line 17 page 2, line 26 - line 30 page 3, line 23 - line 29 page 8, line 25 - page 9, line 5 page 12, line 14 - page 13, line 5 figure 1	1, 3, 10, 17-19, 21-31, 35-39
X	US 2004/037752 A1 (HERZOG MARC JACQUES) 26 February 2004 (2004-02-26) paragraph [0005]; claims 12-15 ----- -/-	1, 2, 4, 10, 13, 14

☒ Further documents are listed in the continuation of Box C.☒ See patent family 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.

Z document member of the same patent family

Date of the actual completion of the international search

30 November 2005

Date of mailing of the international search report

25/05/2009

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2

NL - 2280 HV Rijswijk

Tel. (+31-70) 340-2040,

Fax: (+31-70) 340-3016

Authorized officer

Veronesi, Sergio

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2005/029784

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P, X	EP 1 563 903 A (TOTAL PETROCHEMICALS RESEARCH FELUY) 17 August 2005 (2005-08-17) the whole document -----	1, 2, 7, 9, 10, 13, 15
E	WO 2005/077994 A (TOTAL PETROCHEMICALS RESEARCH FELUY; DAMME, ERIC) 25 August 2005 (2005-08-25) page 2, paragraph 1 page 9; table 4 -----	1, 10, 27
A	EP 0 432 555 A (PHILLIPS PETROLEUM COMPANY) 19 June 1991 (1991-06-19) -----	

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2005/029784

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:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International search report covers allsearchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an 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 reportcovers 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, 21 - 42

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.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

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

1. claims: 1-19, 21-42

Method of operating a polymerisation reactor, process and reactor for manufacturing a polyolefin, machine-readable media and control system, based on analyzing a set of operation data acquired over time for the presence of a predictive indicator of a reactor foul

2. claim: 20

Method for selecting a catalyst

3. claims: 43-52

Method for avoiding a reactor foul, based on control of particle size

4. claims: 53-58

Method for avoiding a reactor foul, based on temperature control

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2005/029784

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 0124333	A	07-11-1984	AU 565167 B2	10-09-1987
			AU 2722484 A	01-11-1984
			BR 8401765 A	04-12-1984
			CA 1222863 A1	16-06-1987
			DE 3476637 D1	16-03-1989
			ES 8600078 A1	01-01-1986
			ES 8603289 A1	16-04-1986
			ES 8603290 A1	16-04-1986
			HK 46289 A	16-06-1989
			IN 160886 A1	15-08-1987
			JP 59206414 A	22-11-1984
			JP 62075039 U	14-05-1987
			SG 16089 G	07-07-1989
US 2004037752	A1	26-02-2004	AU 5653701 A	17-12-2001
			EP 1287322 A1	05-03-2003
			FR 2809810 A1	07-12-2001
			WO 0194900 A1	13-12-2001
EP 1563903	A	17-08-2005	AT 417664 T	15-01-2009
			CN 1925909 A	07-03-2007
			DK 1660230 T3	06-04-2009
			WO 2005082518 A2	09-09-2005
			ES 2315847 T3	01-04-2009
			JP 2007522302 T	09-08-2007
			US 2007032613 A1	08-02-2007
WO 2005077994	A	25-08-2005	CN 1922219 A	28-02-2007
			JP 2007522317 T	09-08-2007
			KR 20070004694 A	09-01-2007
			US 2007037937 A1	15-02-2007
EP 0432555	A	19-06-1991	CA 2023745 A1	28-05-1991
			JP 3181501 A	07-08-1991
			NO 905133 A	28-05-1991