

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
15 February 2007 (15.02.2007)

PCT

(10) International Publication Number
WO 2007/018992 A3

- (51) International Patent Classification:
F02M 27/02 (2006.01) *B01J 7/00* (2006.01)
- (21) International Application Number:
PCT/US2006/028027
- (22) International Filing Date: 19 July 2006 (19.07.2006)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
11/199,349 8 August 2005 (08.08.2005) US
- (71) Applicant (for all designated States except US): **UTILIZATION TECHNOLOGY DEVELOPMENT, NFP** [US/US]; 1700 South Mount Prospect Road, Des Plaines, IL 60018 (US).
- (72) Inventor; and
- (75) Inventor/Applicant (for US only): **HEMSATH, Klaus, Heinrich** [US/US]; 5120 Beacon Road, Palmetto, FL 34221 (US).
- (74) Agent: **FEJER, Mark, E.**; Gas Technology Institute, 1700 South Mount Prospect Road, Des Plaines, IL 60018 (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, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, 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:
12 July 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: RECUPERATIVE REFORMING REACTOR

(57) Abstract: A method and apparatus for fuel reforming using the exhaust gases from internal combustion engines and high temperature combustion processes in which a fuel for reforming and steam mixture is introduced into a tube bundle having a plurality of heat exchange tubes and heat from the exhaust gases is transferred into the heat exchange tubes, thereby increasing the temperature of the mixture. The heated mixture is reformed by contact with a reforming catalyst external to, but proximate to the exit of, the tube bundle, forming a reformed fuel. To remove substantially all of the heat from the exhaust gases, a plurality of tube bundles and associated reforming catalyst arranged in series are provided.



WO 2007/018992 A3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US06/28027

A. CLASSIFICATION OF SUBJECT MATTER

IPC: **F02M 27/02(2006.01);B01J 7/00(2006.01)**

USPC: 123/3

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)
U.S. : 123/3; 48/61, 197R

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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6,508,209 B1 (COLLIER, JR.) 21 January 2003(21.01.2003), see entire document.	1-4 and 11-18
---		-----
A		5-10

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	"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
"E" earlier application or patent published on or after the international filing date	"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
"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)	"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
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

31 March 2007 (31.03.2007)

Date of mailing of the international search report

4 MAY 2007

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

Marianne Seidel
Marianne Seidel

Telephone No. (571) 272.1600