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C10G 35/14 (2006.01)

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[Continued on next page]

(54) Title: REDUCED FLUIDIZATION OF SOLID PARTICLES IN RADIAL FLOW FLUID/SOLID CONTACTING

(57) Abstract: Apparatuses and methods are disclosed for contacting radially flowing fluids with solid particles (e.g., catalyst) with reduced tendency for fluidization of the particles, and especially a sealing portion of the particles at the top of a particle retention zone disposed between screens at upstream and downstream positions relative to radial fluid flow. Fluidization is reduced or eliminated by offsetting openings of the screens in the axial direction, such that upstream openings in the upstream screen are above highest downstream openings in a downstream stream. The offset in openings imparts a downward flow component to radially flowing fluid, thereby reducing solid particle fluidization without the need to induce a specific pressure drop profile along the entire axial direction of the screens.

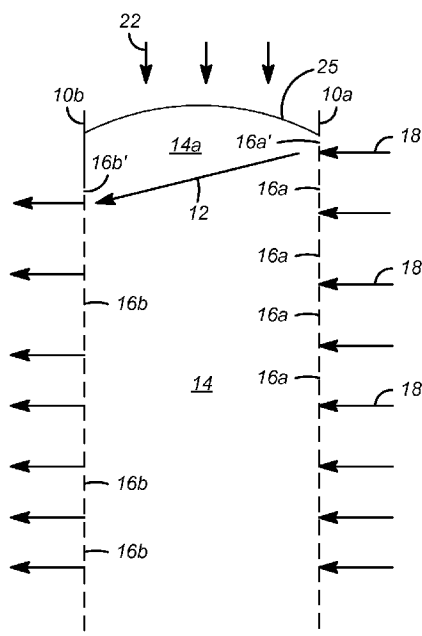


FIG. 1



TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

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A. CLASSIFICATION OF SUBJECT MATTER***B01J 8/36(2006.01)i, C10G 35/14(2006.01)i, C07C 5/32(2006.01)i***

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 8/36; B01J 8/02; B01J 8/12; B01J 9/04; C10G 35/12; B01J 9/08; B01J 35/02

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & Keywords: fluidization, solid particles, fluid, upstream openings, downstream openings

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 04040794 A (STONE; RICHARD D.) 09 August 1977 See abstract; column 9, line 33-column 13, line 29; figure 1	1-4,9-10
A	US 04141690 A (PERSICO; PAUL J. et al.) 27 February 1979 See abstract; column 9, line 15-column 11, line 13; figure 1	1-4,9-10
A	US 04374095 A (LEGG; DOUGLAS J. et al.) 15 February 1983 See abstract; column 5, line 4-column 7, line 57; figure 1	1-4,9-10
A	US 03909208 A (BORET ROGER et al.) 30 September 1975 See abstract; column 2, line 16-column 6, line 25; figure 1	1-4,9-10



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

"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 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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17 FEBRUARY 2012 (17.02.2012)

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2011/041219**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.: 6
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:
This claim is dependent on the claim which does not comply with PCT Rule 6.4(a), and thus this claim is not searchable.
3. ☒ Claims Nos.: 5, 7 and 8
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:

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.:

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.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2011/041219

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 04040794 A	09.08.1977	US 04102776 A	25.07.1978
US 04141690 A	27.02.1979	US 04167553 A	11.09.1979
US 04374095 A	15.02.1983	None	
US 03909208 A	30.09.1975	US 03909208 A	30.09.1975