(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
17 September 2015 (17.09.2015)

WIPO | PCT

(10) International Publication Number
WO 2015/136461 A3

(51) International Patent Classification:
B01D 53/94 (2006.01) *F01N 3/28* (2006.01)
B01J 37/02 (2006.01)

(21) International Application Number:
PCT/IB2015/051772

(22) International Filing Date:
11 March 2015 (11.03.2015)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/951,575 12 March 2014 (12.03.2014) US

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, 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,

[Continued on next page]

(54) Title: IMPROVED CATALYZED SOOT FILTER

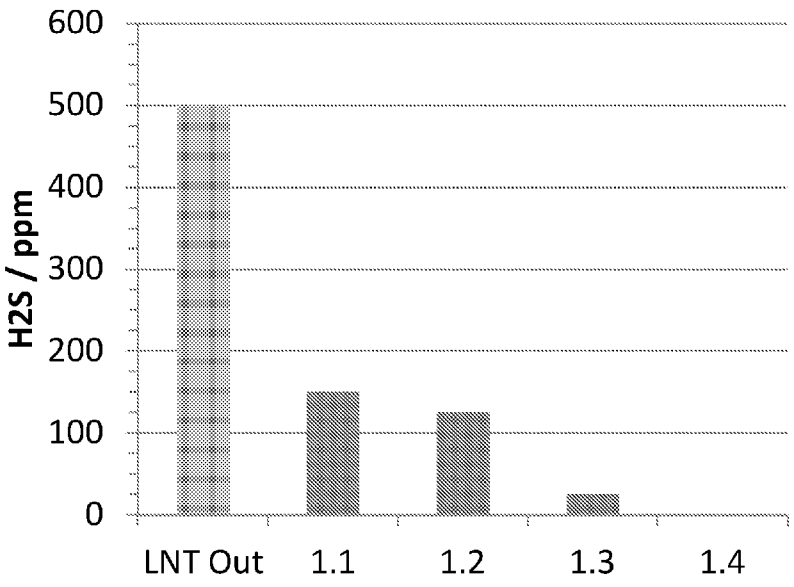


Fig. 1

[Continued on next page]

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GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, 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, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

(88) Date of publication of the international search report:
26 November 2015

(57) Abstract: The present disclosure relates to a catalyzed soot filter, in particular for the treatment of Diesel engine exhaust, with a coating design which ensures soot particulates filtration, assists the oxidation of carbon monoxide (CO), and produces low H_2S emissions during normal engine operations and regeneration events.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB15/51772

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - B01D 53/94; B01J 37/02; F01N 3/28 (2015.01)
CPC - B01D 53/945; B01J 37/02; F01N 3/2803
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 53/00, 53/34, 53/92, 53/94; B01J 23/00, 37/00, 37/02; F01N 3/00, 3/08, 3/10, 3/24, 3/28 (2015.01); CPC: B01D 53/00, 53/34, 53/92, 53/94, 53/9445, 53/945; B01J 23/00, 37/00, 37/02; F01N 3/00, 3/08, 3/10, 3/24, 3/28, 3/2803; Y02T 1/00, 10/20

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)
PatSeer (US, EP, WO, JP, DE, GB, CN, FR, KR, ES, AU, IN, CA, INPADOC Data); EBSCO; Google Scholar; ProQuest; IP.com; H2S, suppressing, oxidation, catalyst, soot, filter, coating, walls, plug, outlet

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2011/0014099 A1 (DORNHAUS, F et al.) 20 January 2011; figure 2; paragraphs [0023], [0036]-[0038]	1-3
A	US 2008/0141661 A1 (VOSS, K et al.) 19 June 2008; entire document	1-3
A	US 2011/0123421 A1 (GRUBERT, G) 26 May 2011; entire document	1-3
A	US 7,022,644 B2 (FOONG, JS et al.) 04 April 2006; entire document	1-3

☐ 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 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	Date of mailing of the international search report
09 June 2015 (09.06.2015)	26 AUG 2015
Name and mailing address of the ISA/ Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer Shane Thomas PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB15/51772

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.: 4-16
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 1-3 are directed toward a catalyzed soot filter with two different coatings on inlet and outlet surfaces.

Group II: Claim 17 is directed toward the use of CuO in the tenorite phase as an H2S suppressing material.

-***-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.:
1-3

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/IB15/51772

-***-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 feature of Group I include a catalyzed soot filter with a plurality of passages defined by internal walls of a wall flow filter substrate, wherein the inlet and outlets are coated with different materials, wherein the coating lengths define upstream and downstream zones of a catalyzed soot filter, and wherein the the total coating length is x + y, and x + y >= 100, which is not present in Group II; and the special technical feature of Group II of the use of CuO in the tenorite phase as an H2S suppressing material, preferably wherein the average crystallite size of the CuO is at least 30 nm, further preferably at least 40 nm, and more preferably at least 50 nm, which is not present in Group I.

The common technical feature of Groups I-II is an H2S suppressing material.

This special feature is disclosed by US 7,022,644 B2 to Foong, et al. (hereinafter 'Foong'). Foong discloses an H2S suppressing material (a TWC catalyst composition which has the capability of suppressing the release of hydrogen sulfide through the exhaust system; column 2, lines 10-25).

Additionally, US 4,939,113 A to Tauster et al. (hereinafter 'Tauster') discloses CuO as an H2S suppression material (hydrogen sulfide suppressing material is CuO; claim 13)

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