

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference JZ-17-P-4-WO	FOR FURTHER ACTION see Form PCT/ISA/220 as well as, where applicable, item 5 below.	
International application No. PCT/IB2018/056780	International filing date (<i>day/month/year</i>) 5 September 2018 (05-09-2018)	(Earliest) Priority Date (<i>day/month/year</i>) 5 September 2017 (05-09-2017)
Applicant JOHN ZINK COMPANY, LLC		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 6 sheets.

It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the **language**, the international search was carried out on the basis of:

- the international application in the language in which it was filed
 a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))

b. This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6*bis*(a)).

c. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. **Certain claims were found unsearchable** (See Box No. II)

3. **Unity of invention is lacking** (see Box No III)

4. With regard to the **title**,

- the text is approved as submitted by the applicant
 the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

- the text is approved as submitted by the applicant
 the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority

6. With regard to the **drawings**,

- a. the figure of the **drawings** to be published with the abstract is Figure No. 3
 as suggested by the applicant
 as selected by this Authority, because the applicant failed to suggest a figure
 as selected by this Authority, because this figure better characterizes the invention
- b. none of the figures is to be published with the abstract

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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 all searchable 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 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

International application No
PCT/IB2018/056780

A. CLASSIFICATION OF SUBJECT MATTER
INV. F23D14/02 F23D14/64 F23N5/18
ADD.
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)
F23D F23N

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)
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.
Y A	US 5 407 345 A (ROBERTSON THOMAS [US] ET AL) 18 April 1995 (1995-04-18) column 1, lines 5,6; figures 1-3, 4A-4C column 1, line 52 - column 2, line 13 column 2, line 20 - line 35 column 3, line 58 - column 4, line 13 column 4, line 25 - column 5, line 27 column 5, line 63 - column 7, line 14 column 7, line 42 - column 8, line 16 column 8, line 32 - line 42 ----- -/--	32 1-31, 33-39

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 26 February 2019	Date of mailing of the international search report 06/03/2019
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 Hauck, Gunther

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2018/056780

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5 605 452 A (ROBERTSON THOMAS F [US] ET AL) 25 February 1997 (1997-02-25)	32
A	column 1, line 6 - line 40; figures 2B, 5 column 2, line 62 - column 3, line 38 column 4, line 34 - line 39 column 4, line 43 - line 63 column 5, line 23 - column 6, line 18 column 7, line 18 - line 50 -----	1-31, 33-39
A	DE 34 19 891 A1 (STIEBEL ELTRON GMBH & CO KG [DE]) 28 November 1985 (1985-11-28) page 2, line 1 - line 3; claim 1; figure 1 page 3, line 13 - page 6, line 10 -----	25-39
A	EP 0 562 710 A2 (ZINK CO JOHN [US]) 29 September 1993 (1993-09-29) column 1, line 1 - line 4; figures 1-4 column 2, line 4 - line 25 column 2, line 44 - column 4, line 53 column 5, line 7 - line 45 -----	1-24
A	US 2005/175945 A1 (CHUNG I-PING [US] ET AL) 11 August 2005 (2005-08-11) paragraph [0003]; figures 1-4 paragraph [0021] - paragraph [0024] paragraph [0027] - paragraph [0032] -----	1,9
A	CN 201 903 058 U (LUOYANG RUICHANG PETROCHEMICAL EQUIPMENT CO LTD) 20 July 2011 (2011-07-20) the whole document -----	1,9

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2018/056780

Patent document cited in search report	Publication date	Patent family member(s)	Publication date	
US 5407345	A	18-04-1995	US 5407345 A US 5554021 A	18-04-1995 10-09-1996

US 5605452	A	25-02-1997	AU 5878496 A CA 2223394 A1 DE 69606640 D1 DE 69606640 T2 EP 0830545 A1 US 5605452 A WO 9639596 A1	24-12-1996 12-12-1996 16-03-2000 06-07-2000 25-03-1998 25-02-1997 12-12-1996

DE 3419891	A1	28-11-1985	NONE	

EP 0562710	A2	29-09-1993	CA 2076705 A1 EP 0562710 A2 JP 2633452 B2 JP H0618011 A TW 227037 B US 5195884 A	28-09-1993 29-09-1993 23-07-1997 25-01-1994 21-07-1994 23-03-1993

US 2005175945	A1	11-08-2005	NONE	

CN 201903058	U	20-07-2011	NONE	

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

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

1. claims: 1-24

Method of low NOx combustion and corresponding burner; a burner tile is surrounded by a furnace environment and a primary combustion zone is defined within the burner tile for a lean, low NOx first combustion step

2. claims: 25-39

Method of controlling low NOx combustion and corresponding burner system, e.g. within a furnace; a primary combustion zone is defined by a burner tile for a lean, low NOx first combustion step; flow rates are adjusted based on fuel composition and/or adiabatic flame temperature and/or measured NOx values in the furnace.
