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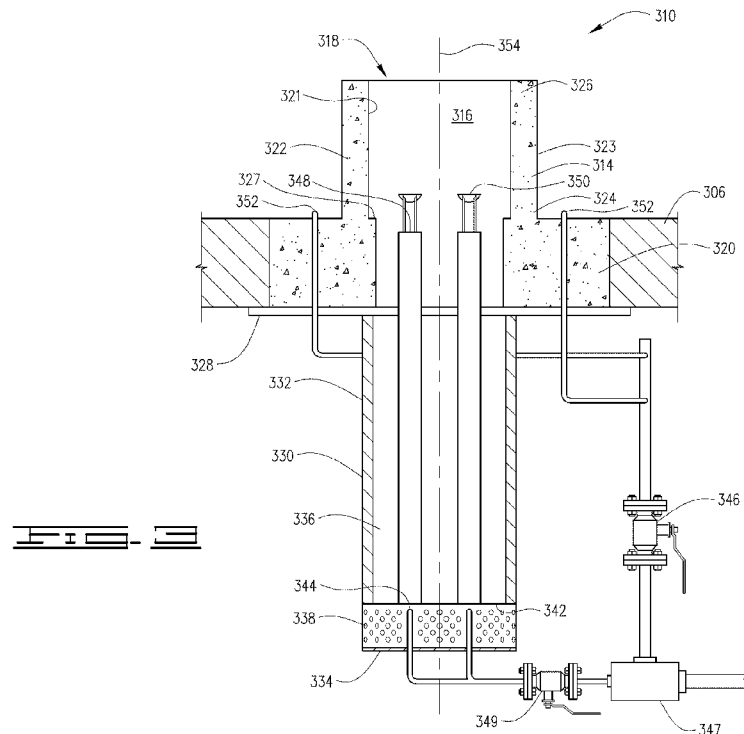
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(54) Title: LOW NOX AND CO COMBUSTION BURNER METHOD AND APPARATUS



(57) Abstract: Emissions of NO_x and/or CO are reduced at the stack by systems and methods wherein a primary fuel is thoroughly mixed with a specific range of excess combustion air. The primary fuel-air mixture is then discharged and anchored within a combustion chamber of a burner. Further, the systems and methods provide for dynamically controlling NO_x content in emissions from a furnace by adjusting the flow of primary fuel and of a secondary stage fuel, and in some cases controlling the amount or placement of combustion air into the furnace.



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))*
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- *in black and white; the international application as filed contained color or greyscale and is available for download from PATENTSCOPE*

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INTERNATIONAL SEARCH REPORT

International application No
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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

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INTERNATIONAL SEARCH REPORT

International application No
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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

International application No.
PCT/IB2018/056780

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.

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 NO_x 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 NO_x first combustion step

2. claims: 25-39

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

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/IB2018/056780
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