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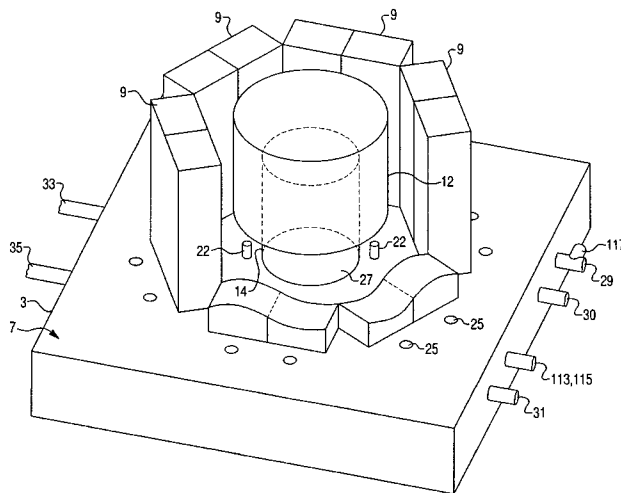
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(54) Title: HOT BOX DESIGN WITH A MULTI-STREAM HEAT EXCHANGER AND SINGLE AIR CONTROL

Fig. 1A



(57) Abstract: A fuel cell stack module includes a plurality of fuel cell stacks, an anode tail gas oxidizer (ATO) which is located in a heat transfer relationship with the plurality of fuel cell stacks, a base supporting the plurality of fuel cell stacks and the ATO, and at least one heat exchanger located in the base. An ATO exhaust stream and an anode exhaust stream from the fuel cell stacks heat the stack fuel and air inlet streams in a multi-stream heat exchanger.

WO 2009/017683 A3

**A. CLASSIFICATION OF SUBJECT MATTER*****H01M 8/04(2006.01)i, H01M 8/10(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)

IPC 9: H01M, B01J, F24H, F01K

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)

eKIPASS(KIPO internal) and keywords "fuel cell, anode tail gas oxidizer, ATO, heat exchanger, base, stack, and similar terms"

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2004-0163312 A1 ( Bloomfield et al. ) 26 August 2004 See abstract, Figures 1-2 and claims 1-27	1-25
A	US 7101175 B2 ( Deshpande et al. ) 05 September 2006 See abstract, Figures 1-2B and claims 1-13	1-25
A	US 6370878 B1 ( Dean et al. ) 16 April 2002 See abstract, Figures 1-3 and claims 1-30	1-25
A	US 6939635 B2 ( Ballantine et al. ) 06 September 2005 See abstract, Figures 1,3 and claims 1-4	1-25

 Further documents are listed in the continuation of Box C. See patent family annex.

\* Special categories of cited documents:

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2004-0163312 A1	26.08.2004	NONE	
US 7101175 B2	05.09.2006	AU 2004-227331 A1 CA 2521275 A1 EP 1611399 A2 US 2004-197718 A1 US 2006-257302 A1 WO 2004-090072 A2 WO 2004-090072 A3	21.10.2004 21.10.2004 04.01.2006 07.10.2004 16.11.2006 21.10.2004 06.05.2005
US 6370878 B1	16.04.2002	NONE	
US 6939635 B2	06.09.2005	US 2002-0182462 A1 US 2002-0182467 A1 US 2003-0008184 A1 US 2003-0064262 A1 US 6740437 B2 US 6835483 B2 US 7285346 B2	05.12.2002 05.12.2002 09.01.2003 03.04.2003 25.05.2004 28.12.2004 23.10.2007