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[Continued on next page]

(54) Title: PROCESS FOR TREATING FLY ASH AND A ROTARY MILL THEREFOR

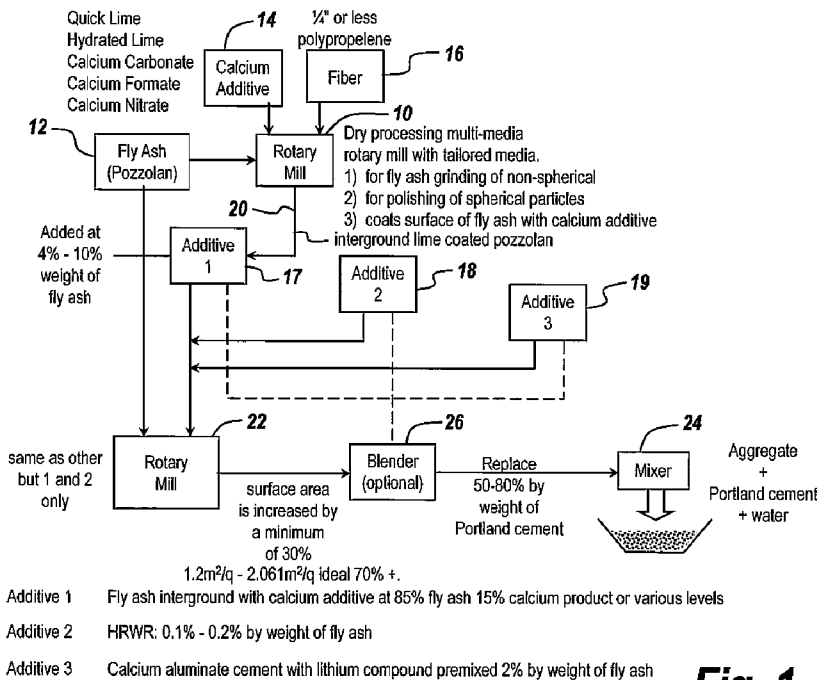


Fig. 1

(57) Abstract: A process for treating fly ash to activate the fly ash so that it may be used as a substitute for Portland cement, with the process including the use of a specialized rotary mill having variably sized and shaped media to increase the surface area of one fly ash component by grinding, avoiding milling a second fly ash component, while roughing up the surface of the second component to increase its surface area.

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— *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))*

**(88) Date of publication of the international search report:**  
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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2013/062543

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - C04B 20/02 (2014.01)

USPC - 106/709

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) - C04B 18/00, 18/04, 18/08, 20/00, 20/02, 28/00, 28/18, 28/22 (2014.01)

USPC - 106/400, 401, 405, 705, 709; 241/5

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

CPC - C04B 18/00, 18/04, 18/08, 20/00, 20/02, 20/026, 28/00, 28/18, 28/22 (2013.01)

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

Orbit, Google Patents, Google Scholar

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 6,802,898 B1 (LISKOWITZ et al) 12 October 2004 (12.10.2004) entire document	1-53
Y	US 2008/0308659 A1 (GRASSO JR et al) 18 December 2008 (18.12.2008) entire document	1-31
Y	US 5,988,396 A (MINKARA et al) 23 November 1999 (23.11.1999) entire document	3, 4, 9-11, 16-20, 22, 33-42
Y	US 4,018,619 A (WEBSTER et al) 19 April 1977 (19.04.1977) entire document	5-11, 16-31, 38-42, 49
Y	KOSMATKA et al. Design and Control of Concrete Mixtures. Portland Cement Association. 2003. [retrieved on 13 March 2014]. Retrieved from the Internet. <URL: <a href="http://www3.nd.edu/~ykurama/HIGH-SCHOOL/PCA%20CONCRETE%20MIX%20EB001s.pdf">http://www3.nd.edu/~ykurama/HIGH-SCHOOL/PCA%20CONCRETE%20MIX%20EB001s.pdf</a> >. Pgs. 21-70, 79-127	12-31, 39-41, 46, 48, 50-53
Y	US 2009/0188998 A1 (ANDERSON et al) 30 July 2009 (30.07.2009) entire document	32-42
Y	US 2004/0247846 A1 (UZAWA et al) 09 December 2004 (09.12.2004) entire document	43-53
A	US 2005/0005823 A1 (GOURLEY et al) 13 January 2005 (13.01.2005) entire document	1-53
A	US 4,679,736 A (ORLANDO) 14 July 1987 (14.07.1987) entire document	1-53

 Further documents are listed in the continuation of Box C.

\* 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

"&amp;" document member of the same patent family

Date of the actual completion of the international search

14 March 2014

Date of mailing of the international search report

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## INTERNATIONAL SEARCH REPORT

PCT/US2013/062543  
International application No.

PCT/US2013/062543

**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 Extra 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 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/US2013/062543

<Continued from Box III: Observations where unity of invention is lacking>

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 need to be paid.

Group I: Claims 1-20 are drawn to a method for treating fly ash so that it is usable as a substitute for Portland cement in the manufacture of concrete

Group II: Claims 21-31 are drawn to a process for treating fly ash to activate the fly ash to provide slag grade 100 or better performance

Group III: Claims 32-42 are drawn to an apparatus for the processing of multi-component particulate material

Group IV: Claims 43-53 are drawn to a particulate fly ash having a total surface area exceeding 0.9 m<sup>2</sup>/g.

The inventions listed as Groups I through IV 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 features of Group I, a method for treating fly ash so that it is usable as a substitute for Portland cement in the manufacture of concrete, comprising the step of: grinding fly ash having at least two components in a rotary mill having variably sized and shaped media such that the mill increases the surface area of the two different components of the fly ash to provide activated fly ash, are not found in Groups II through IV; the special technical features of Group II, a process for treating fly ash to activate the fly ash to provide slag grade 100 or better performance, comprising the step of: intergrinding fly ash with a calcium compound in a dry processing multimedia rotary mill with tailored media, are not found in Groups I, III and IV; the special technical features of Group III, an apparatus for the processing of multi-component particulate material, comprising: a first rotary mill having a drum with internal mixing structures therein and a multi-media charge comprising ceramic media having sizes and shapes that preferentially grind one component to reduce the size thereof while avoiding milling a second component, are not found in Groups I, II and IV; and the special technical features Group IV, a particulate fly ash having a total surface area exceeding 0.9 m<sup>2</sup>/g, are not found in Groups I through III.

Groups I through IV share the technical features of a particulate fly ash comprising grinding fly ash having at least two components in a rotary mill having variably sized and shaped media such that the mill increases the surface area of the two different components of the fly ash. However, these technical features do not represent a contribution over the prior art.

Specifically, US 2005/0005823 A1 to Gourley et al. teaches particulate fly ash (Paras. [0054]-[0056], ...particulate composition...the carrier is a pozzolan or a plurality of pozzolans and the additive is prepared by cogrinding the carrier with the admixture in the form of a dry solid...during the milling process...the carrier is a plurality of pozzolans and consists of a majority of fly ash...) comprising grinding fly ash having at least two components in a rotary mill having variably sized media such that the mill increases the surface area of the two different components of the fly ash (Para. [0053], ...grinding media used...preferable have a diameter between 2 and 5 millimeters...; Paras. [0049];[0054]-[0056], ...milling process, in an attritor or ball mill...; Paras. [0073];[0075]; Tables 1 & 2).

Further, US 4,679,736 A to Orlando teaches particulate (Col. 1, Lines 30-47, ...ground down to a very fine size...) comprising grinding in a rotary mill having variably shaped media such that the mill increases the surface area (Col. 1, Lines 30-47, ...grinding increases the total surface area...; Col. 1, Line 9, ...rotary mill...; Col. 5, Lines 51-52, ...grinding media may be, for example, balls, pebbles, rods, or other appropriate devices...).

The inventions listed in Groups I through IV therefore lack unity under Rule 13 because they do not share a same or corresponding special technical feature.

<End Box III: Observations where unity of invention is lacking>