



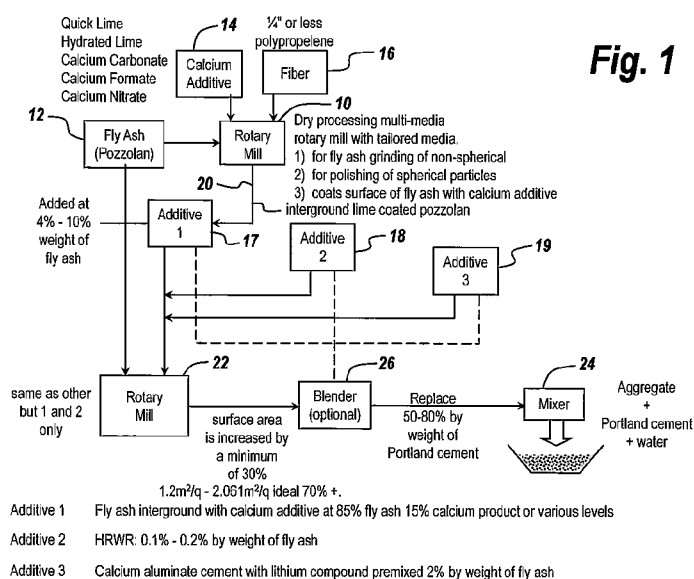
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(54) Title: PROCESS FOR TREATING FLY ASH AND A ROTARY MILL THEREFOR



(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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AMENDED CLAIMS
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WHAT IS CLAIMED IS:

1. 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.

2. The method of Claim 1, wherein a first component of the fly ash includes non-spherical particles and wherein a second component of the fly ash includes spherical components.

3. The method of Claim 2, wherein the variably sized and shaped media reduces the size of the non-spherical components of the fly ash while polishing the surface of the spherical components of the fly ash, thus to increase the surface area of both components.

4. The method of Claim 3, wherein the total surface area of the milled processed fly ash is increased by at least 30% thus to make the fly ash more reactive.

5. The method of Claim 1, wherein the rotary mill intergrinds a calcium with the fly ash components.

6. The method of Claim 5, wherein the calcium includes at least one of quick lime, hydrated lime, calcium carbonate, calcium formate and calcium nitrate or related calcium compound.
7. The method of Claim 5, wherein the output of the rotary mill includes calcium interground with fly ash to produce calcium-coated fly ash particles.
8. The method of Claim 7, wherein the interground calcium-coated fly ash particles are interground with fly ash in a subsequent intergrinding step wherein the interground calcium-coated fly ash is added at 4% - 10% by weight of fly ash.
9. The method of Claim 8, wherein the output of the subsequent intergrinding step results in an interground product having a surface area increased by a minimum of 30% to form activated fly ash.
10. The method of Claim 9, and further including the step of replacing 50-80% by weight of Portland cement with the activated fly ash in the manufacture of concrete.
11. The method of Claim 10, wherein the concrete is made by mixing the activated fly ash with aggregate, Portland cement and water.

12. The method of Claim 1, and further including the step of mixing the output of the rotary mill with an additive including a high range water reducer.

13. The method of Claim 12, wherein the high range water reducer is in powder form.

14. The method of Claim 13, and further including the step of mixing the output of the rotary mill with calcium aluminate cement.

15. The method of Claim 14, and further including mixing a lithium compound with the calcium aluminate cement.

16. The method of Claim 1, wherein the fly ash in the rotary mill is interground with calcium, such that the surface area of the activated fly ash from the rotary mill is increased by a minimum of 30% to achieve slag grade 100 or better performance.

17. The method of Claim 16, and further including the step of intergrinding additives that further activate the activated fly ash output of the rotary mill.

18. The method of Claim 17, wherein the interground additives activate the interground fly ash so as to produce slag grade 120 performance.

19. The method of Claim 18, wherein the interground additives include one of a high range water reducer, calcium aluminate cement or calcium aluminate cement mixed with a lithium compound.

20. The method of Claim 19, wherein the high range water reducer is in powder form.

21. 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 multi-media rotary mill with tailored media.

22. The method of Claim 21, wherein the fly ash includes non-spherical fly ash particles and spherical fly ash particles and wherein the dry processing multi-media rotary mill operates to grind the non-spherical fly ash particles while at the same time polishing the spherical fly ash particles, thus to produce calcium-coated activated particles.

23. The method of Claim 21, and further including the intergrinding the fly ash with fiber in the dry processing multi-media rotary mill.

24. The method of Claim 21, wherein the dry processing of the rotary mill is accomplished in a batch process mode.

25. The method of Claim 24, wherein the rotary mill includes a drum and wherein the drum is rotated at between 20-40 RPM.
26. The method of Claim 25, wherein the batch processing time for the production of activated fly ash is more than 15 minutes and as long as one hour.
27. The method of Claim 21, wherein the multi-media includes ceramic media that is cylindrically shaped.
28. The method of Claim 27, wherein the ceramic media includes cone shaped ceramic media.
29. The method of Claim 28, wherein the media includes spherical beads.
30. The method of Claim 21, wherein the media includes ceramic media and wherein the ceramic media includes a mixture of 5/8" cylinders with 3/4" cones and 1/8" cylinders.
31. The method of Claim 21, wherein the media includes ceramic media and wherein the ceramic media includes 1/2" cylindrical ceramic media, 1/4" cylindrical ceramic media, 3/4" cone shaped ceramic media and 8 millimeter beads.

32. 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 non-spherical component to reduce the size thereof while avoiding milling a second spherical component.

33. The apparatus of Claim 32, wherein the media in said mill are designed to polish the surface of said second component.

34. The apparatus of Claim 33, wherein said components include fly ash particles and wherein the total surface area of the fly ash particles is increased by at least 30% due to the action of said media with said components.

35. The apparatus of Claim 34, wherein the output of said first rotary mill includes activated fly ash particles.

36. The apparatus of Claim 35, and further including a mixer for mixing said activated fly ash particles with aggregate, Portland cement and water to produce concrete.

37. The apparatus of Claim 36, wherein said activated particles replace 50-80% by weight of Portland cement in the production of said concrete.

38. The apparatus of Claim 32, and further including a second rotary mill having said tailored media for intergrinding the output of said first rotary mill with fly ash to produce activated fly ash particles having a surface area increased by a minimum of 30%, said first rotary mill producing calcium-coated fly ash particles and wherein said calcium-coated fly ash particles are interground in said second rotary mill with fly ash particles.

39. The apparatus of Claim 38, wherein the output of said second rotary mill is mixed with a high range water reducer.

40. The apparatus of Claim 39, wherein said high range water reducer is in powder form.

41. The apparatus of Claim 40, wherein the output of said second rotary mill is mixed with calcium aluminate cement pre-mixed with a lithium compound.

42. The apparatus of Claim 38, wherein said first and second rotary mills are the same rotary mill.

43. Particulate fly ash having a total surface area between 0.9 m²/g and 4.0 m²/g.

44. The fly ash of Claim 43, wherein said fly ash powder is used in manufacturing of concrete.

45. The fly ash of Claim 43, wherein said fly ash is used to manufacture cement.