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Canty et al.

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(54) **GRANULAR PRODUCT INSPECTION DEVICE**

2004/0151360 A1* 8/2004 Pirard et al. 382/141

FOREIGN PATENT DOCUMENTS

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DE	19832856	1/2000
JP	405045274 A *	2/1993
WO	WO 97/14950	4/1997
WO	WO 02/44692	6/2002

OTHER PUBLICATIONS

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“Particle Sizing Software”, Canty Process Technology; Reference Data Sheet 99A8035 A8356, www.jmcanty.com/overview/V.Vector/a8356.pdf, J.M. Canty Inc.

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 114 days.

“WipFrag System II—Online fragmentation analysis”, Maerz, N. H., and Palangio, T. C., FRAGBLAST 6, Sixth International Symposium For Rock Fragmentation By Blasting, Johannesburg, South Africa, Aug. 8-12, 1999, pp. 111-115.

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“Case studies using the WipFrag Image analysis system”, Palangio, T. C. and Maerz, N. H., 1999, FRAGBLAST 6, Sixth International Symposium For Rock Fragmentation By Blasting, Johannesburg, South Africa, Aug. 8-12, 1999, pp. 117-120.

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(52) **U.S. Cl.** **356/335**; 356/237.1

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(58) **Field of Classification Search** 356/335–343, 356/600–622, 356, 237.1; 382/110, 141; 250/573, 574

See application file for complete search history.

(57) **ABSTRACT**

A particle inspection device includes a feeder configured to drop a particle through an image area, a reflector configured to provide a reflected view of the particle in the image area, and an image capturing device configured to capture an image of the particle in the image area such that the image includes at least a direct view of the particle and the reflected view of the particle. In addition, a method for inspecting a particle includes dropping the particle through an image area, providing a reflected view of the particle in the image area using a reflector, and capturing an image of the particle in the image area using an image capturing device so that the image includes a direct view of the particle and the reflected view of the particle.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,121,294 A	10/1978	Galanis et al.	364/571
4,288,162 A *	9/1981	Sakamoto et al.	356/335
4,377,340 A	3/1983	Green et al.	356/237
4,514,758 A	4/1985	Berthel et al.	358/93
5,011,285 A *	4/1991	Jorgensen et al.	356/335
5,023,714 A	6/1991	Lemelson	358/107
5,519,793 A *	5/1996	Grannes	382/266
5,721,433 A *	2/1998	Kosaka	250/573
5,936,725 A *	8/1999	Pike et al.	356/237.1
6,049,381 A *	4/2000	Reintjes et al.	356/335
6,061,130 A *	5/2000	Plate et al.	356/335
6,629,010 B1 *	9/2003	Lieber et al.	700/109

30 Claims, 4 Drawing Sheets

