



US007802685B2

(12) **United States Patent**
Allen et al.

(10) **Patent No.:** **US 7,802,685 B2**
(45) **Date of Patent:** **Sep. 28, 2010**

(54) **MULTISTEP SEPARATION OF PLASTICS**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1353 days.

(21) Appl. No.: **10/511,224**

(22) PCT Filed: **Apr. 14, 2003**

(86) PCT No.: **PCT/US03/11642**

§ 371 (c)(1),
(2), (4) Date: **Jun. 28, 2005**

(87) PCT Pub. No.: **WO03/086733**

PCT Pub. Date: **Oct. 23, 2003**

(65) **Prior Publication Data**

US 2006/0001187 A1 Jan. 5, 2006

Related U.S. Application Data

(60) Provisional application No. 60/372,001, filed on Apr. 12, 2002, provisional application No. 60/397,948, filed on Jul. 22, 2002, provisional application No. 60/397,808, filed on Jul. 22, 2002, provisional application No. 60/397,953, filed on Jul. 22, 2002, provisional application No. 60/397,980, filed on Jul. 22, 2002.

(51) **Int. Cl.**
B04B 5/10 (2006.01)
B07B 15/00 (2006.01)
B03C 7/00 (2006.01)

(52) **U.S. Cl.** **209/12.1; 209/127.1; 209/930**

(58) **Field of Classification Search** **209/12.1, 209/12.2, 127.1, 127.4, 128, 930**
See application file for complete search history.

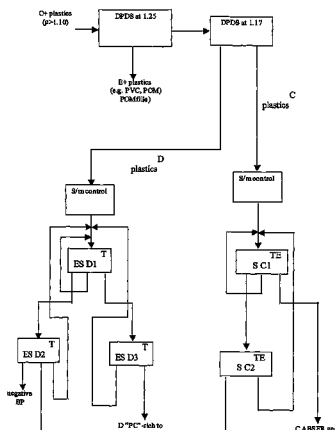
(56) **References Cited**

U.S. PATENT DOCUMENTS

5,131,212	A	7/1992	Grey et al.	
5,314,071	A *	5/1994	Christian et al.	209/4
5,895,790	A	4/1999	Good	
6,007,005	A *	12/1999	Gonzales et al.	241/20
6,090,862	A	7/2000	Tatsuda et al.	
6,114,401	A	9/2000	Doonan	
6,274,637	B1	8/2001	Schallenberg	
6,335,376	B1 *	1/2002	Allen et al.	521/40.5
6,452,126	B1 *	9/2002	Xiao et al.	209/127.1
6,460,788	B1 *	10/2002	de Feraudy	241/19
6,689,838	B1	2/2004	Fischer et al.	
7,014,132	B2 *	3/2006	Vandeputte	241/20
7,037,951	B2	5/2006	Inagaki	
2004/0004033	A1	1/2004	Vandeputte	
2004/0164005	A1	8/2004	Allen, III	
2004/0182753	A1	9/2004	Allen, III et al.	

FOREIGN PATENT DOCUMENTS

DE	40 20 417	A	1/1992
DE	44 24 143	A	11/1996
DE	0761 763	A	3/1997
DE	197 15 418	A	10/1998
DE	197 44 964	A	4/1999
EP	0 634 260	A2	1/1995
EP	0 696 618	A	2/1996
EP	0 756 238	A1	1/1997
EP	1 226 913	A1	7/2002
JP	07-024437		1/1995
JP	07-025943	A	5/1995
JP	07-334583		12/1995
JP	08-259747	A	2/1997
JP	10-225934		8/1998
JP	2001-323121		11/2001
JP	2002-088212		3/2002
JP	2002-292628		10/2002
WO	WO 98/03318		1/1998
WO	WO 99/25493	A	5/1999
WO	WO 01/81058	A	11/2001
WO	WO 03/087215		10/2003



WO WO 2004/009200 A1 1/2004
 WO WO 2004/009242 A1 1/2004
 WO WO 2005/123817 A1 12/2005

(57)

ABSTRACT**OTHER PUBLICATIONS**

D. E. Karvelas et al., "Separation and Recovery of Thermoplastics by Froth Floatation", Nov. 9-11, 1999, 6th Annual Recycling Conference Proceedings Book, Detroit, Michigan, pp. 233-237.
 European Search Report for Application No. EP 09 17 7754.0, dated Jan. 20, 2010, 4 pages.

Notice for Reasons for Rejection for Application No. JP 2003-583720, dated Jun. 16, 2009, 11 pages.

First Examination Report for Application No. IN 2533/CHENP/2004, dated Aug. 21, 2009, 2 pages.

Notification of the First Office Action for Application No. CN 03813514.0, dated May 25, 2007, 4 pages.

Notification of the Second Office Action for Application No. CN 03813514.0, dated Aug. 15, 2008, 4 pages.

Communication pursuant to Article 96(2) EPC for Application No. EP 03 746 760.2, dated Dec. 20, 2004, 5 pages.

Communication pursuant to Article 96(2) EPC for Application No. EP 03 746 760.2, dated Jul. 14, 2005, 5 pages.

Communication pursuant to Article 96(2) EPC for Application No. EP 03 746 760.2, dated Nov. 25, 2005, 4 pages.

Communication pursuant to Article 96(2) EPC for Application No. EP 03 746 760.2, dated Jun. 1, 2006, 5 pages.

Communication pursuant to Article 96(2) EPC for Application No. EP 03 746 760.2, dated Oct. 12, 2006, 5 pages.

Communication pursuant to Article 96(2) EPC for Application No. EP 03 746 760.2, dated Dec. 27, 2006, 5 pages.

Communication pursuant to Article 96(2) EPC for Application No. EP 03 746 760.2, dated Jul. 20, 2007, 5 pages.

Communication pursuant to Article 9(3) EPC for Application No. EP 03 746 760.2, dated Mar. 10, 2008, 7 pages.

Communication pursuant to Article 94(3) EPC for Application No. EP 03 746 760.2, dated Jul. 16, 2008, 4 pages.

Communication pursuant to Article 94(3) EPC for Application No. EP 03 746 760.2, dated Mar. 16, 2009, 2 pages.

* cited by examiner

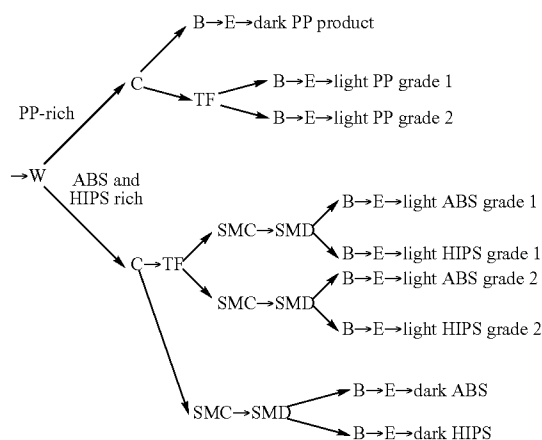
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Multistep recycling processes for preparing recycled plastic materials. The processes feature a sequence of operations selected from the group consisting of preprocessing operations, size reduction operations, gravity concentration operations, color sorting, sorting by thickness, friction, or differential terminal velocity or drag in air, surface to mass control operations, separation processes enhanced by narrow surface to mass distributions, blending operations, and extrusion and compounding operations. Plastic-rich mixtures are subjected to the process, and one or more recycled plastic materials are collected as outputs of the sequence of processes.

P→R→



42 Claims, 25 Drawing Sheets

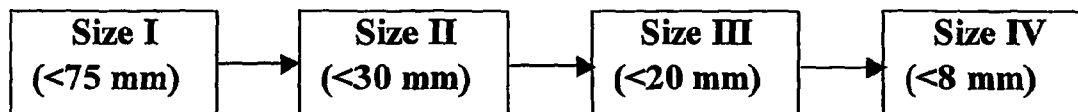


FIG._1

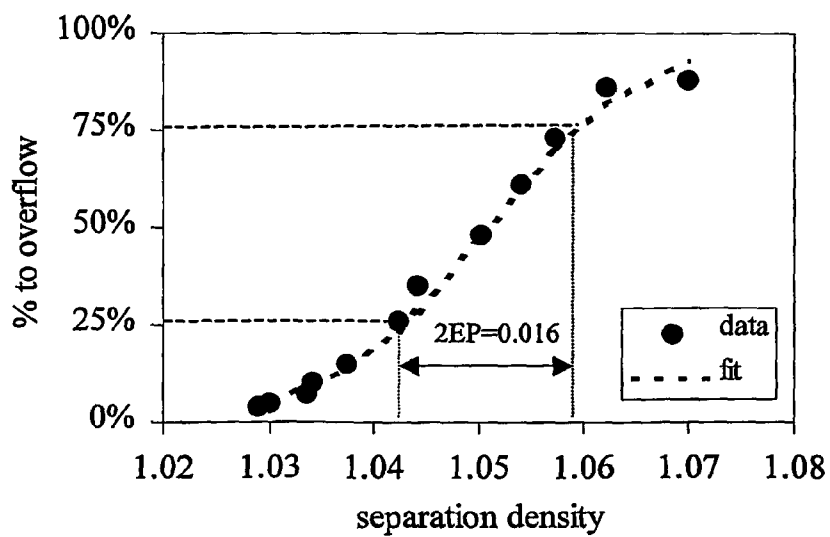


FIG._2

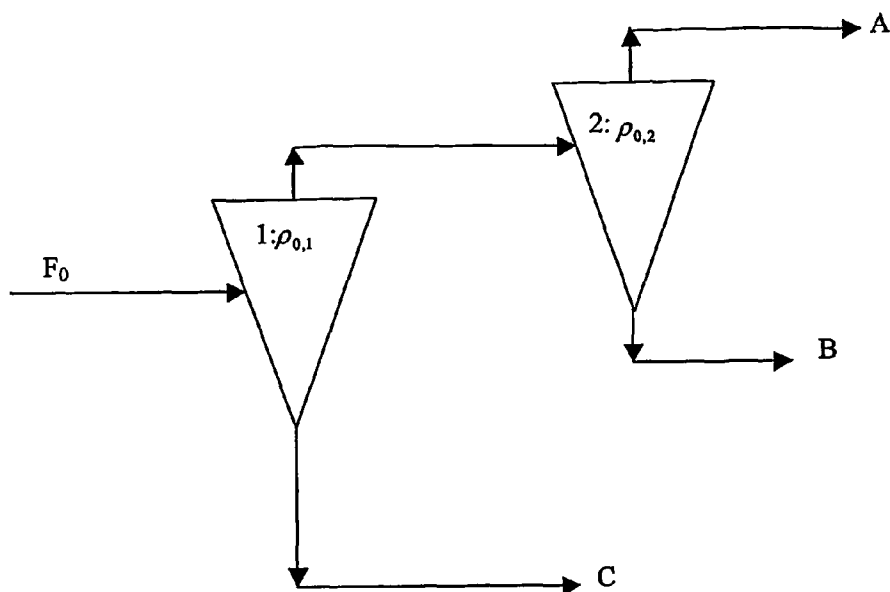


FIG._3

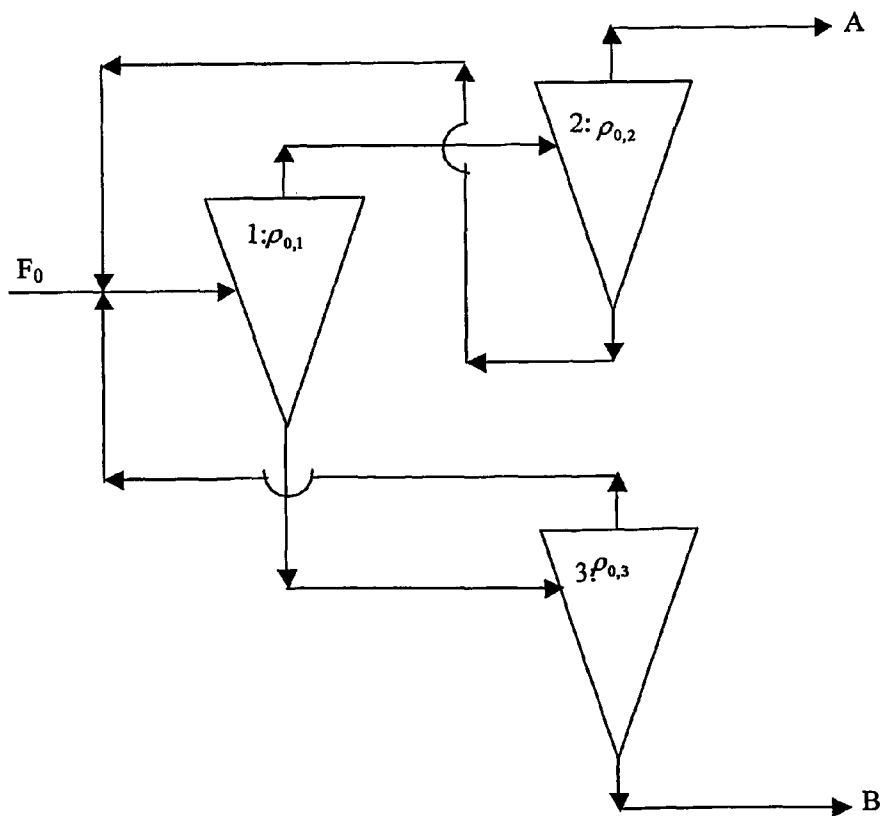


FIG._4

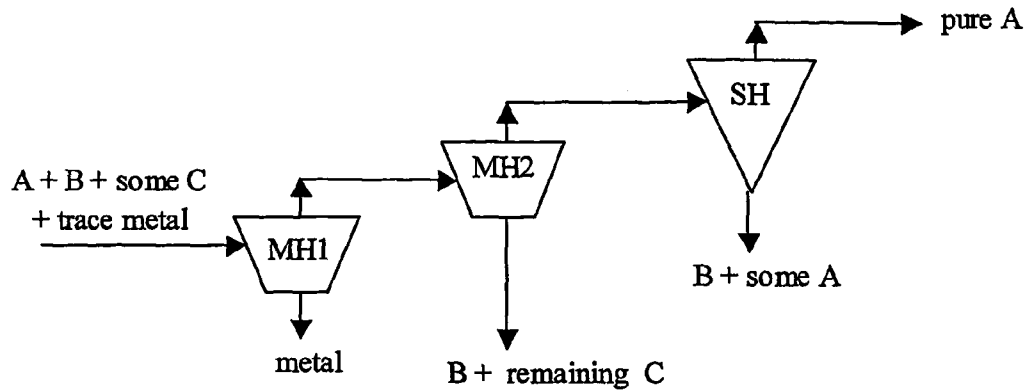


FIG._5

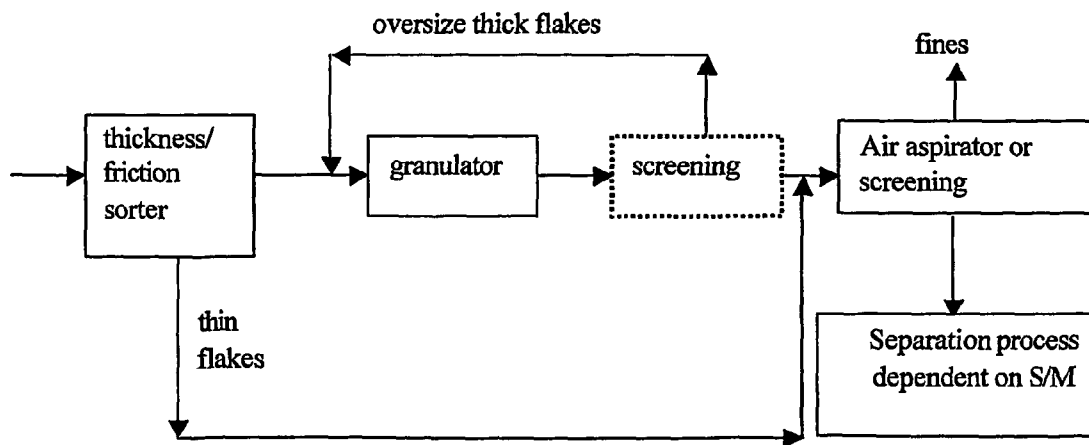


FIG._6

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