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(54) **PERMEATE CARRIER FABRIC FOR MEMBRANE FILTERS**

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(58) **Field of Classification Search**

None

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,791,178	A *	2/1974	Meyer	66/196
4,454,176	A	6/1984	Buckfelder et al.	
4,613,436	A	9/1986	Wight et al.	
4,749,483	A	6/1988	Spet	
4,769,263	A	9/1988	Bitter	
4,855,058	A	8/1989	Holland et al.	
4,906,372	A	3/1990	Hopkins	
5,652,057	A	7/1997	Delker	
5,855,991	A	1/1999	McLarty, III	
5,948,020	A	9/1999	Yoon et al.	
6,277,282	B1 *	8/2001	Kihara et al.	210/652
6,454,942	B1	9/2002	Shintani et al.	
6,599,849	B1	7/2003	Vogt et al.	
6,638,284	B1	10/2003	Rousseau et al.	
6,767,498	B1	7/2004	Talley et al.	
7,048,855	B2	5/2006	de la Cruz	
7,083,644	B1	8/2006	Moroni	
2002/0127936	A1	9/2002	Wildeman	
2003/0034294	A1	2/2003	Dutton et al.	
2004/0214984	A1 *	10/2004	Keep et al.	528/359
2005/0123750	A1 *	6/2005	Hodge et al.	428/364
2008/0164208	A1	7/2008	Doyen et al.	
2009/0139650	A1	6/2009	Hardwicke et al.	
2009/0145838	A1	6/2009	Knappe et al.	
2010/0051132	A1 *	3/2010	Glenn	139/387 R

FOREIGN PATENT DOCUMENTS

CN	1270101		10/2000
EP	1775364	A1 *	4/2007
EP	1903134		3/2008
WO	2005070524		8/2005
WO	2010044971		4/2010

OTHER PUBLICATIONS

Official Action for U.S. Appl. No. 13/495,505, dated Apr. 10, 2013, 11 pgs.

Official Action for U.S. Appl. No. 13/495,505, dated Jul. 18, 2013, 21 pgs.

Membrane Support Fabrics: Issues and Un-Met Needs, Water Conditioning & Purification, by Edward C. Gregor, dated Feb. 2008, 2 pgs.

TriSep Engineering Manual, How a Spiral is Made, TriSep Corporation, date unknown, but admitted prior art, 2 pgs.

International Search Report and Written Opinion for PCT/US2013/042832, dated Jun. 27, 2013, 51 pgs.

Search Report and Written Opinion for PCT/US2013/068871, dated Feb. 28, 2014, 11 pgs.

Allowance Decision from the Intellectual Property Office for Taiwan App. No. 102141373, dated Mar. 31, 2016, with allowed claims, 10 pgs.

English abstract for EP1903134 (A1); downloaded from www.espacenet.com on Oct. 21, 2015; 2 pgs.

English abstract for EP 1041213(A1) corresponding to CN1270101(A); downloaded from www.espacenet.com on Oct. 21, 2015, 1 pg.

U.S. Appl. No. 13/495,505, filed Jun. 13, 2012.

* cited by examiner

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(57) **ABSTRACT**

A permeate carrier fabric includes at least some monofilament synthetic yarns to provide adequate stiffness and reduce blockage of permeate flow.

24 Claims, No Drawings