

The  
United  
States  
of  
America



**The Director of the United States  
Patent and Trademark Office**

*Has received an application for a patent for a new and useful invention. The title and description of the invention are enclosed. The requirements of law have been complied with, and it has been determined that a patent on the invention shall be granted under the law.*

*Therefore, this*

**United States Patent**

*Grants to the person(s) having title to this patent the right to exclude others from making, using, offering for sale, or selling the invention throughout the United States of America or importing the invention into the United States of America, and if the invention is a process, of the right to exclude others from using, offering for sale or selling throughout the United States of America, or importing into the United States of America, products made by that process, for the term set forth in 35 U.S.C. 154(a)(2) or (c)(1), subject to the payment of maintenance fees as provided by 35 U.S.C. 41(b). See the Maintenance Fee Notice on the inside of the cover.*

*Michelle K. Lee*

*Deputy Director of the United States Patent and Trademark Office*

(12) **United States Patent  
Maruya**(10) **Patent No.:** **US 8,721,916 B2**  
(45) **Date of Patent:** **May 13, 2014**(54) **REFRIGERANT COMPOSITION**(75) Inventor: **Richard H. Maruya**, Kancohe, HI (US)(73) Assignee: **A.S. Trust & Holdings Inc.**, Saipan (AE)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 381 days.

(21) Appl. No.: **13/106,701**(22) Filed: **May 12, 2011**(65) **Prior Publication Data**

US 2012/0286193 A1 Nov. 15, 2012

(51) **Int. Cl.****C09K 5/04** (2006.01)**C11D 7/24** (2006.01)(52) **U.S. Cl.**USPC ..... **252/67**; 510/407(58) **Field of Classification Search**USPC ..... **252/67**; 510/407

See application file for complete search history.

(56) **References Cited**

## U.S. PATENT DOCUMENTS

1,497,615	A	6/1924	Thompson	
1,976,204	A	10/1934	Vanderveer et al.	
4,336,046	A	6/1982	Schorre et al.	
5,287,703	A *	2/1994	Bernhard et al.	62/627
5,360,566	A *	11/1994	Stevenson	252/67
5,705,471	A *	1/1998	Minor et al.	510/408
6,248,256	B1 *	6/2001	Nagao et al.	252/68
6,327,866	B1 *	12/2001	Novak et al.	62/114
6,336,333	B1	1/2002	Lindgren	
6,846,792	B2 *	1/2005	Minor et al.	510/408
6,863,840	B2 *	3/2005	Goble	252/67
6,902,686	B2 *	6/2005	Maruya	252/67
7,413,675	B2 *	8/2008	Minor	252/68

2005/0051756	A1 *	3/2005	Maruya	252/73
2007/0275865	A1 *	11/2007	Tagawa et al.	508/438
2008/0178617	A1	7/2008	Jones et al.	
2010/0147024	A1	6/2010	Roberts et al.	
2010/0320413	A1	12/2010	Maruya	

## FOREIGN PATENT DOCUMENTS

CN	101157849	A	4/2008
EP	1 094 100	A1	4/2001
GB	2 228 739	A	9/1990
JP	10205899	A *	8/1998
KR	2002070177	A *	9/2002

## OTHER PUBLICATIONS

Y. S. Chang et al., "Performance and heat transfer characteristics of hydrocarbon refrigerants in a heat pump system", *International Journal of Refrigeration*, 23 (2000), 232-242.\*Wu et al., "Study of using hydrocarbons, R152a and their mixtures as alternatives for R12", *Journal of Engineering Thermophysics*, 15, 3, Aug. 1994, 233-236.\*

English translation of KR2002-0070177, Sep. 5, 2002.\*

\* cited by examiner

*Primary Examiner* – Douglas Mc Ginty(74) *Attorney, Agent, or Firm* – Richard C. Litman(57) **ABSTRACT**

The refrigerant composition is a hydrocarbon-based composition that may be used as a refrigerant for air conditioners, refrigerators or the like, and further, which may be used as a detergent for cleaning precision components, such as semiconductor chips, motherboards or the like. The refrigerant composition preferably includes, by volume, between 50% and 65% propylene, between 30% and 45% propane, and between 5% and 10% isobutane. In a preferred embodiment, the refrigerant composition contains about 40% propane, about 55% propylene, and about 5% isobutane (methyl propane) by volume.

**1 Claim, No Drawings**