

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.

Andrei Iancu

Director of the United States Patent and Trademark Office



US009937464B2

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

(10) **Patent No.:** **US 9,937,464 B2**
(45) **Date of Patent:** **Apr. 10, 2018**

(54) **DEVICE FOR SEPARATING CARBON DIOXIDE USING SILICONE SEPARATION FILM AND METHOD FOR MANUFACTURING SAME**

(58) **Field of Classification Search**
CPC B01D 2256/245; B01D 69/12; B01D 2258/0283; B01D 2257/504;
(Continued)

(71) Applicant: **ARSTROMA Co., Ltd., Daegu (KR)**

(56) **References Cited**

(72) Inventors: **Gwan Shig Kim, Pohang-si (KR); Ky Yeong Shin, Daegu (KR)**

U.S. PATENT DOCUMENTS

(73) Assignee: **ARSTROMA CO., LTD. (KR)**

4,737,165 A * 4/1988 Kulprathipanja B01D 59/14
210/490
4,783,202 A * 11/1988 Kraus C08L 85/02
210/500.27

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 211 days.

(Continued)

(21) Appl. No.: **14/785,445**

FOREIGN PATENT DOCUMENTS

(22) PCT Filed: **Apr. 29, 2014**

CN 101293180 10/2008
EP 2995366 3/2016

(86) PCT No.: **PCT/KR2014/003757**

(Continued)

§ 371 (c)(1),
(2) Date: **Oct. 19, 2015**

OTHER PUBLICATIONS

(87) PCT Pub. No.: **WO2014/181994**

International Application Status Report generated Aug. 13, 2015 issued in International Application No. PCT/KR2014/003757.

PCT Pub. Date: **Nov. 13, 2014**

(Continued)

(65) **Prior Publication Data**

US 2016/0059181 A1 Mar. 3, 2016

Primary Examiner — Anthony Shumate

(74) *Attorney, Agent, or Firm* — Onello & Mello, LLP

(30) **Foreign Application Priority Data**

May 10, 2013 (KR) 10-2013-0053058
Oct. 7, 2013 (KR) 10-2013-0119091

(57) **ABSTRACT**

Provided are an apparatus for separating and collecting carbon dioxide and a method of separating carbon dioxide, and more particularly, an apparatus and method of selectively separating carbon dioxide from a byproduct gas using a difference in negative pressure and a difference in carbon dioxide concentration between the inside of a separator, which is made of a ceramic-coated porous silicone membrane and in which the byproduct gas flows, and the outside of the separator in which carbon dioxide is collected.

(51) **Int. Cl.**
B01D 53/22 (2006.01)
B01D 69/12 (2006.01)

(Continued)

(52) **U.S. Cl.**
CPC **B01D 53/228** (2013.01); **B01D 53/225** (2013.01); **B01D 69/12** (2013.01);

(Continued)

20 Claims, 8 Drawing Sheets

